July-September, 2011
Vol. LVIII • No. 3
ISSN 0537-2429

IPJ

The Indian Police Journal

Forensic Audit

BOARD OF REFEREES

IPJ
The Indian Police Journal
July-September, 2011 ● Vol. LVIII ● No. 3

Editorial Board

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Editorial

Forensic Auditing

THE discipline of forensic science and its tools & techniques must be factored in to deliver justice to the offended member of the society and punishing the criminals. This has become more imperative in the backdrop of criminals and terrorists using state-of-the-art technology and gadgets to execute their nefarious designs, which usually result into criminals getting away the noose of law and terrorist's trail going cold. This creates a sort of vicious circle: more offenders are let free without being punished and more terrorist's trails going cold, more crime and terrorist acts follow.

This can be checked by using state-of-the-art tools and techniques of forensic science and medicine. It is for this reason that policy makers and stakeholders of internal security world over in general and that of India in particular have turned their attention towards forensic science & medicine, and allocated substantial fund & manpower for upgrading the forensic science facilities.

In this issue of Indian police Journal (July-Sep, 2011), we have discussed various issues, problems and prospects of forensic science. The foremost issue befacing criminal justice system is that criminals and terrorists more often than not dodge the long arm of law due to omission and commission in following the thumb rules and practices of forensic science and forensic medicine discipline, and various pre-requisites & conditions as laid down by the Constitutional Courts and Subordinate ones for trial of the accused.

The lead paper titled as 'Analysis of Problems related to Forensic Examination in Offences Against Human body and Need for Auditing' by Shri A. Dutta, Shri R.C. Arora, IPS and Dr. P.C. Sarmah underlines the need for auditing in the cases where acquittal of the offenders or dismissal of cases result due to omission and commissions of thumb-rule of forensic sciences' medicine and constitutional courts' pre-requisites in this regard. "…..there is essential need to audit the role of police, forensic science and medical wings with an object to ascertaining their role in those cases where prosecution has failed to prove the guilt of the accused charge sheeted in the court. This audit process can be done by examining FIR Inquest Report, charge sheet, post mortem report, F.S.L. report, medico-legal reports, disposition of different witnesses during examination-in-chief and in cross examination with a perpendicular approach along with trial court judgement to find out basis for adverse comments."

Shri Swapnil R. Kamdar & Ms. Astha Pandey, in their paper, 'The Scope of Artificial Intelligence in Forensic Science', urge for the use of Artificial Intelligence in Forensic Science. "We can make a better

use of Artificial Intelligence in Blood Pattern Recognition & Analysis, Crime Scene Reconstruction, Digital Forensic, Image Processing, Satellite monitoring, Network & Router configuration, Narco-analysis and of course ballistics."

The paper 'Cyanide: A Versatile terrorist's Chemical Weapon and its counteract Preparedness' by Shri Amarpal Singh, Gungun Saxena, G.S. Bumbrah, Dr. Madhulika Sharma and Dr. V.K. Goyal discusses deadly potency of cyanide in a terrorist's hand and how to counteract it

Recently the economic terrorism involving money laundering, black money and circulation of counterfeit currency notes to cripple the economy has come to the fore. This has posed serious challenge for our policy makers. Ms. Seema Srivastava, Mohammad Idris and Asim Kumar Srivastava, in their paper, 'Source Identification of the Inks Used in Printing of Counterfeit Indian Bank notes' deliberates upon this problem of fake currency from point of forensic angle. They have put forward a ready-to-use blueprint for identifying the source through inks used in printing of counterfeit Indian bank notes.

Shri D.P. Gangwar, Shri Sanjeev Thakur & S.K. Choudhury, in their paper, 'Codec Impact on Voice Spectrographic Features: A Forensic study', seek to "find out whether there is any variation in their spectrographic features due to different recorders and different formats".

The other papers such as 'Nanoparticle–size Fingerprint dusting Compositions Based on Crystal violet Dye' by Ms. Daisy, Dr. D.J. Singh and Dr. G.S. Sodhi, "Differential-Pulse Anodic Stripping Voltammetry (DPASV) Determination of lead (pb) Heavy Metal in Blood" by Dr. A.K. Jaiswal and Others discus innovative methods of nanoparticle size finger print dusting composition which is based on crystal violet dye and DPASV determination of lead in blood respectively.

Dr. Asha Srivastava and Shri Aman Yadav, in their well-researched paper, 'Psycho-Physiological Basis of the Forensic Assessment' delve into the discipline of determining truth and detection of lies based on scientific principles. They underscore the need of "knowing the underlying processes that provide the framework for deceptive communication" based on better understanding of the nature of deception, its behavioural correlates, and its detestability.

(Gopal K.N. Chowdhary)
Editor

Analysis of Problems related to Forensic Examination in Offences against Human Body and Need for Auditing

A. Dutta*, R.C. Arora, IPS & Dr. P.C. Sarmah*****

Keywords

Crime
Investigation
Prosecution
Trial
Conviction Rate
Acquittal
Forensic Examination
Medico-legal Examination
Forensic Science/Medico-legal
Expert
Evidence
Witnesses
Courts
Crime Exhibits
Post-mortem
Ante-mortem Injuries
Medico-legal Tests
Forensic Science Laboratory
Medico-legal Jurisprudence
Examination and Cross-examination of Witnesses
Post-mortem/Autopsy Report
Audit

Abstract

Offence against human body is the biggest curse of our society, there is increase in crime rate and at the same time, acquittal of the accused is a painful phenomenon for us. As responsible members of the civilized society, it should always be our endeavour that only a guilty should be punished according to the Law of the Land.

The advances in Science and Technology have created opportunities for the Criminal Justice Delivery System to improve its quality with likelihood of enhanced level of satisfaction to the litigants. Forensic Science and Forensic Medicine disciplines have developed into robust and dependable tools in aid of criminal investigation to unravel the truth regarding nature of the criminal act respecting its causation and person responsible there for. In their statutory duty to adjudicate criminal liability of the accused courts have to assess the opinions rendered by the Forensic Experts with reference to the settled as well as evolving principles of attaching liability to the individuals charged with the criminal act(s).

To ensure full utility of the forensic opinion for the prosecution or even for the defence side, it is imperative that all tests carried out during forensic examination of clue lifted from the scene of crime pass the muster of reliability and validity for the results obtained therefrom. The Constitutional Courts (High Courts/Supreme Court) as well as the Subordinate Courts in our country have underlined various prerequisites, which must be satisfied before an expert opinion could be unquestionably used in the trial against the person affected by it adversely or otherwise.

While discussing different situations, involving application of Forensic Expert opinions as interpreted by the courts in this article, a suggestion has been mooted to introduce a system of audit about various aspects of forensic analysis.

Audit as a key tool will not only be helpful for pointing out of our default in criminal investigation, it will also be helpful to prevent unjust acquittal of criminals as it (audit) provides ample opportunity for timely rectification. Audit with reference to judgements of Courts can give the real picture for correction and as a result thereof our Criminal Justice Delivery System will be immensely benefited.

Author Intro. :

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OFFENCE against human body is the biggest problem of our society, especially the distress of the victims and the relatives, which can be further explained by the comments of Krishna Iyer, J. in **Rattan Singh** v. **State of Pubjab** [(1979)4 Section 719]—

> *"It is a weakness of our jurisprudence that victims of crime and the distress of the dependents of the victim do not attract the attention of law, in fact, victim reparation is still the vanishing point of our criminal law. This is the deficiency in the system, which must be rectified by the Legislature."*

Components like rape, murder, abduction and kidnapping, etc. constitute offences against human body. Hon'ble Gujarat High Court in **Santokben Sharmanbhai Jadeja** v. **State of Gujarat** on 13-8-2007, **Equivalent citations:** 2008 Cri.L.J. 68 (2008) 1 GLR 497, 2008 (2) KLT 398 at para 12 held—

> *"...The investigation of the crime on the scientific lines is to help the Investigating Agency, so as to enable collection of evidence to prove the guilt or innocence of the person accused of committing crime as the modern community requires modern scientific methods of crime detection, lest the public go unprotected."*

Even **The 39th All India Police Science Congress** held at Guwahati from 19th to 21st January, 2009 laid stress on:

(i) Specialization in investigating skills.

(ii) Successful investigation.

(iii) Improvement in quality of investigation, etc.

A Comparative Chart depicting occurrence of different types of IPC (Indian Penal Code, 1860) crimes for the years 2008 & 1953 is presented below:

Crime Head	No. of IPC offences reported in the year 1953	No. of IPC offences reported in the year 2008	Growth Rate (%) (1953 to 2008)
1. Murder	9,802	32,766	334.3%
2. Kidnapping and abduction	5,261	30,261	575.2%
3. Riots	20,529	66,018	321.6%
4. Rape*	9,802	21,467	219.0%
5. Total IPC Crimes	6,01,964	20,93,379	347.8%

Source: Crime in India, 2008, NCRB.
***NCRB collected data on rape since 1971 only.**

On the other hand, if we consider yearwise IPC case conviction rate (nationwide), it is not indicating good performance, because some States have failed to achieve conviction rate of even 30%. The All India conviction figures had reached the 42% and more because of the States like Madhya Pradesh, Rajasthan, Gujarat, etc., which have shown far above national average performance. A yearwise data of IPC crime conviction rate is given below:

Sl. No.	Year	Conviction Rate
1.	1998	38.2
2.	1999	37.4
3.	2000	39.6
4.	2001	40.8
5.	2002	40.6
6.	2003	40.1
7.	2004	42.5
8.	2005	42.5
9.	2006	42.9
10.	2007	42.3
11.	2008	42.6

But, at the same time, it is true that conviction rate in IPC offences in States like West Bengal, Tripura, Orissa, Maharashtra, Bihar, Assam, performance has been less than satisfactory.

Causes of Low Rates of Conviction

The low rate of conviction compared to the one prevailing in sixties and till mid-seventies has been caused by a number of factors. In this document, we have confined ourselves to such factors as are related to forensic/forensic medical examinations during investigation and court trials.

After carefully examining the important judgements of different **High Courts** and **Supreme Court**, some important factors have been identified as are primarily connected to Forensic Science and which contribute significantly to the woes of prosecution, while trying to establish guilt of the accused. The same are given as under:

A. Delay in Crime registration.

B. Conduct of investigation in haphazard manner.

C. Non-examination of important witnesses by prosecution.

D. Mismanagement of physical evidence to be lifted during investigation.

E. Non-production of X-ray Report and non-appearance of concerned Radiologist in the court.

F. Problems arising from scientific platforms.

G. When identity of recovered skeleton was not established.

H. Deficiencies in Post-mortem Examination and preparation of Post-mortem Report.

I. Problems in determining age of victims in Medico-legal cases.

J. Difference between Medico-legal Autopsy Report and Medical Expert opinion.

K. Conflict between Post-mortem Examination Report and FSL Report.

L. Miscellaneous Problems.

All the above-mentioned grounds along with sub-grounds as underlined by various High Courts and the Apex Court are discussed with appropriate case laws for appreciation of the issues involved in the succeeding para.

A. Delay in Crime Registration

Delayed crime registration is generally directly co-related to its successful investigation insofar as it could have drawn strength from forensic evidence timely lifted and got examined from the experts for gainful use of findings against the culprits of crime. The Apex Court and various High Courts have also viewed very seriously the tendency of the police to delay the filing of FIR on the basis of an information disclosing commission of a **cognizable offence**. The Hon'ble Supreme Court of India in **State of Haryana and others** v. **Ch. Bhajan Lal and Others** [JT 1990(4) S.C.650] has ruled that—

> *"At the stage of registration of a crime or a case on the basis of the information disclosing a cognizable offence in compliance with the mandate of the Section 154(1) of the Code, the concerned Police Officer cannot embark upon an enquiry as to whether the information, laid by the informant, is reliable and genuine or otherwise and refuse to register a case on the ground that the information is not reliable or credible.* ***On the other hand, the Officer-in-Charge of a Police Station is statutorily obliged to register a case and then proceed to suspect the commission of an offence, which he is empowered under Section 156 of the Code to investigate, subject to the proviso to Section 157****. In Section 154(1), Legislature in its collective wisdom, has carefully and cautiously used the expression* ***"information"*** *without qualifying the same as in Section 41(1)(a) or (g) of the Code, wherein the expressions* ***"reasonable complaint"*** *and* ***"credible information"*** *are used. Evidently, non-qualification of the word* ***"information"*** *in Section 154(1) unlike Section 41(1)(a) and (g) of the Code may be for the reason that the Police Officer should not refuse to record an information relating to the commission of a cognizable offence and to register a case thereon the ground that he is not satisfied with the reasonableness or credibility of the said information. The reasonableness is not a condition precedent for registration of a case... an overall reading of all the Code makes it clear that the condition which is* ***sine qua non*** *for recording a* ***First Information Report*** *is that there must be an information disclosing a* ***cognizable offence*** *is laid before an Officer-in-Charge of a Police Station under Section 154(1) of the Code, the said Police Officer has no other option except to enter the substance thereof in the prescribed form, that is to say, to register a case on the basis of such information."*

Regarding ***delay*** in registering the crime, Hon'ble Delhi High Court in **Court on its *Own Motion*** v. ***State (Delhi Admn.) & Ors***., 1994(3) Crimes 17(Del) at para 11 made the following observation:

> *"In fact, that is exactly my feeling in this case that the local police has not carried out the investigation in a fair manner and with due haste and promptitude. It did not register the case on 17-12-1992 immediately on receipt of complaint of Alphonsa. The statement put in the mouth of Alphonsa by the local police that she did not suspect foul play is prima facie not correct when she is shown to be running from pillar to post to seek justice and clearly spelling out her suspicion. Then, the local police did not make an attempt to*

lift fingerprints from the bed sheet, which could have shown whether the death was suicidal or homicidal. Then, the local police seems to have made up its mind without even registering the case at that time that it was a case of suicide (page 5, second line of affidavit of SHO dated 20-2-1992). It has also put wrong statements in the mouth of Alphonsa at a time when she was running from pillar to post for seeking justice."

According to the study of Jalpaiguri District of West Bengal discussed on 28th June, 2007 in a Crime Conference held at District H.Q., Jalpaiguri, it was shown that ensuring the recording of all cognizable offences at the P.S. strictly under the provision of Section 154(1) of Code of Criminal Procedure reduced the **complaint cases** u/s 156(3) of Cr.P.C. from 6.37% to 0.63%. The recourse to Section 156(3) of the Cr.P.C. by the aggrieved complainants is taken when they fail to get their complaints disclosing commission of cognizable cases registered u/s 154(1) of the Cr.P.C. The delay in registration of FIR, further delays lifting, preserving and sending for examination the evidence available on the scene of crime and this, in turn, affects the chances of successful detection and prosecution of the accused persons. And, this is what the Hon'ble Delhi High Court in their observation alluded to above, have underlined.

This matter of reluctance of the Officers-in-Charge of the Police Station towards registration of FIR on information laid before him disclosing commission of a cognizable offence has again come before the Supreme Court in **Lalita Kumari** v. **State of U.P. and Ors.** (WPC Cr 68/2008). Showing their anguish against the State for not filing reply to the notice issued by the court on 14-7-2008 as to why the failure to register should not lead to penal consequence for the Officer-in-Charge of the Police Station responsible therefor, their Lordships issued the following interim directions to ensure registration of an FIR on orders passed by the Magistrate under Section 156(3) of the **Criminal Procedure Code:**

"In view of the above, we feel that it is high time to give directions to Governments of all the States and Union Territories, besides their Director-Generals of Police/ Commissioners of Police, as the case may be to the effect that if steps are not taken for registration of FIRs immediately and copies thereof are not made over to the complainants, they may move the concerted Magistrates by filing contempt petitions to give direction to the police to register case immediately upon receipt/production of copy of the order and make over copy of the FIRs to the complainants, within twenty-four hours of receipt/production of copy of such orders. It may further give direction to take immediate steps for apprehending the accused persons and recovery of kidnapped/abducted persons and properties, which were subject-matter of theft or dacoity. In case FIRs are not registered within the aforementioned time, and/or aforementioned steps are not taken by the police, the concerned Magistrate would be justified in initiating contempt proceeding against such delinquent officers and punish them for violation of its orders, if no sufficient cause is shown and awarding stringent punishment like sentence of imprisonment against them inasmuch as the Disciplinary Authority would be quite justified in initiating departmental proceeding and suspending them in contemplation of the same."

B. Conduct of Investigation in Haphazard Manner

Systematic investigation is key to baring the plan and the ***modus operandi*** of a crime, which helps the court to appreciate the incriminating role of the accused and then to pass a judicious order meriting the facts and circumstances of the case taken in totality. On the other hand, investigation conducted in a haphazard manner leads to situation, which do not promote the cause of justice being done to the parties in general and the victims in particular.

In **Rajendra** v. **State**, 1993(3) Crimes 974(Mad), where his Lordship Thangumani, J. of Madras High Court at para 30 made the following observation in the context of **haphazard investigation:**

"We express our deep anguish that a crime of double murder like this goes unpunished. In a case of this type, we expect the Investigating Agency to spring into action not only to trace out and bring to book the real culprit involved in the crime, but also to place before the court convincing evidence

to connect the person arrested with the crime. The haphazard manner in which the investigation has been done in this case leaves much to be desired. The detention of the appellant in the Police Station long prior to his alleged date of arrest. The torture he was to undergo, the planting of the even silver tumbler at the scene of crime, so as to make it appear that the thumb impression of the culprit was available there and the coercion brought upon on PW-5 Selvi and the appellant to write Exts. P-4 and P-21 letters, so that they could serve to project a motive, are all instances which show that the investigation has not been done in a fair and straightforward manner."

The Investigating Agency has, therefore, to take all such measures as shall ensure the conduct of investigation in a most systematic manner.

Non-compliance of the ingredients of Section 27 of Evidence Act

The general bar against the admissibility of confession made before a Police Officer (Section 25 of Indian Evidence Act, 1872) is partially lifted by Section 27 of this Act to make use of material evidence collected consequent upon the disclosure made by the accused while in Police custody. To ensure credibility of the discoveries made pursuant to the admission made by the accused while in Police custody, the courts have laid down, from time to time, certain conditions precedent which should be satisfied.

Hon'ble Supreme Court of India in **Amitsingh Bhikamsing Thakur** v. **State of Maharashtra**, 2007 Cri.L.J. 1168, AIR 2007 SC 676 had explained the following requirements of Section 27 of Evidence Act:

"(1) The fact of which **evidence** is sought to be given must be **relevant** to the issue. It must be borne in mind that the provision has nothing to do with question of **relevancy**. The relevancy of the fact discovered must be established according to the prescriptions relating to relevancy of other evidence connecting it with the crime in order to make the fact discovered **admissible**.

(2) The **fact** must have been **discovered**.

(3) The discovery must have been in **consequence of some information** received from the accused and not by accused's own act.

(4) The persons giving the information must be **accused** of any offence.

(5) He must be in the **custody** of a Police Officer.

(6) The discovery of a fact in consequence of information received from an accused in custody must be deposed to.

(7) Thereupon, only that portion of the information, which relates distinctly or strictly to the **fact discovered,** can be proved. The rest is inadmissible."

Similarly, the consequences of non-compliance of any of the abovesaid ingredients of Section 27 of Indian Evidence Act can be inferred from the case of **Imamuddin** v. **State of U.P**, 2009 Cri.L.J. 4477, where his Lordship Rajesh Chandra, J. of Allahabad High Court at para 27 made the following observation:

"...In the present case, the Investigating Officer Pradyumna Singh (PW-6) has nowhere stated that after taking police remand of accused Imamuddin under the orders of a Magistrate, the accused Imamuddin made any disclosure statement. What PW-6 says is that the prayer for police remand of accused Imamuddin was accepted by the Chief Judicial Magistrate and at the instance of the accused, a pistol of 303 Bore, which was used in the commission of crime, was recovered and that the accused himself had procured the pistol after digging the earth from the place, which was about 100 metres from the house of accused Imamuddin. Thereafter, a memo (Ext. 3) was prepared. The Learned A.G.A. argued that in the recovery memo, it has specifically been mentioned that before the recovery of pistol, the accused Imamuddin in the presence of witnesses Mushtak Ahmad and Akik Ahmad had stated that the pistol with which he had opened fire upon Nabi Sarvar and about which he has already told he had concealed the same beneath the earth and is now giving to the Investigating Officer. Thereafter, digging the earth he took out

a pistol and gave it to the Investigating Officer. The Learned A.G.A. wants that this statement recorded in the recovery memo may be believed although the same has not been repeated in the statement of the Investigating Officer Pradyumna Singh. We feel that the argument is misplaced, because the statement as recorded in the recovery memo, cannot be taken into consideration until and unless the same would have been deposed to by Investigating Officer in his statement on oath. ***Since the recovery of the pistol has not been made pursuant to any disclosure statement, the same cannot be relied upon."***

This illustrates how a very valuable piece of evidence amenable to forensic examination to provide definite linkages between the accused and the crime allegedly committed by him can be lost to the serious detriment of prosecution case. Therefore, it is imperative that all the ingredients of **Section 27** of the Indian Evidence Act should be brought on record during documentation of investigation and may also be so deposed during trial of the case by the PWs. This alone shall ensure dividends to the prosecution for their painstaking efforts made during investigation to establish unambiguous connection between the crime and the accused facing prosecution therefor.

C. Non-examination of Important Witnesses by Prosecution

The witnesses examined by the Investigating Officer during investigation are scrutinized at the end of the investigation in order to shortlist those witnesses for prosecution, who may prove facts relevant for the prosecution version of the incident under investigation. Out of many witnesses for the same fact, the prosecution may drop rest of the witnesses if first 1-2 PWs have proved the fact before the court satisfactorily. The relied-upon PWs are required to be not only mentioned in the charge-sheet, but also summoned to adduce evidence attributed to them respecting some part or whole of the incident. Failure to examine such witnesses has very strong possibility of harming the cause of prosecution and to the corresponding undue benefits to the accused. Our courts have disapproved this practice, which leaves them with no option but to give benefit to the defence as per law and procedure.

In **Imamuddin** v. **State of U.P.**, 2009 Cri.L.J. 4477, **Rajesh Chandra,** J. of Allahabad High Court underlined the adverse impact of non-examination of important witness(es) by prosecution in the following way at para 34:

"Ram Chandra Bharti*, one of the Investigating Officers has stated on oath that by the time he reached the place of occurrence, the inquest had already been conducted by SI Chakrapani Datt Mishra and he, after preparing the Inquest Report and allied papers, had sent the dead body for post-mortem. This Chakrapani Datt Mishra has not been examined by the prosecution as a witness. He would have been the best person to state as to when the proceeding of inquest was started and when they were completed. He would have stated as to when the dead body of Nabi Sarvar was handed over to two Constables Parasnath Bharti and Ramnarayan for being taken to mortuary along with the copy of FIR, etc. He would have stated that the Inquest Report was prepared on the spot and the dead body was sealed. The prosecution has not examined either Constable Parasnath Bharti or Constable Ramnarayan to depose that after the dead body was handed over to them, they took it to Police Station or Police Line. A perusal of the Inquest Report (Ext.-12) shows that the Inquest Report was completed on 13-11-1997 at 8 p.m. The Police Form No. 13 (Ext.-14) shows that the dead body of Nabi Sarvar was brought to the Police Line, Azamgarh by the abovesaid two Constables, namely, Parasnath Bharti and Ramnarayan on 14-11-97 at 9.25 a.m. This document further shows that the distance between Police Station, Devegaon and headquarter is only three kilometres, whereas the distance between the place of incident and the headquarter is 48 kilometres. If Constable Parasnath Bharti or Constable Ramnarayan had been examined in the court, they would have told as to why the dead body did not reach the Police Line on 13-11-1997 itself and why the same was brought at the Police Line on 14-11-1997 at 9.25 a.m. In this connection, statement of PW-1 Zahir Ahmed is important. He stated at page 14 of his statement that the dead*

*body was brought to the Police Station at 7-8 p.m. He has further stated that at the Police Station, the signatures of Shahid Mushtak, Surender Singh, Harivansh Misra and one other were obtained by the police on a paper. He further stated that the dead body was sealed at the Police Station, but in second breath, he stated that the dead body had been sealed on the spot. Now, this is the evidence of the prosecution itself that from the spot, the dead body was brought to the Police Station. A perusal of the Inquest Report makes it evident that the abovenamed Shahid Mushtak, Surendar Singh and Harivansh Mishra are the "**Panch**" witnesses of the Inquest Report. The prosecution has not shown any other paper on which the signatures of those witnesses were taken at the Police Station. Hence, in the absence of any such document, it may be inferred that **Panchnama** is the paper on which signatures of these persons were taken at the Police Station as stated by PW-1 Zahir Ahmed. It comes out from the above evidence that the dead body on the spot was brought to Police Station, where Inquest Report was prepared and the signatures of the **'Panch'** witnesses were obtained. Anything contrary to above could have been proved by the Sub-Inspector Chakrapani Datt Mishra or by the Constables Parasnath Bharti and Ramnarayan, who have not been examined. In the light of these background facts, a suspicion is raised about the genuineness of First Information Report that the same was lodged at the time when it is being claimed to have been recorded. The prosecution has not examined even Head Muharir Surendra Pratap, who could have stated that the First Information Report was written by him on such and such date and at such and such time. Thus, FIR is also suspicious and appears to have been ante-timed."*

In **Shiva @Prashant** S/o **Vishwanath Sardar** v. **State of Maharashtra,** 2008 (1) Mh. L.J. (Cri) 58, where the husband of Vinanti Tayade (Prosecutrix) was not examined by prosecution, such act of prosecution was explained by the Hon'ble Judge at para 10 in the following way:

"...But, in this case, one has to bear in mind the conduct of prosecutrix and non-examination of the material witnesses, namely, husband of prosecutrix and the policeman. If these facts are taken into consideration, the fact of there being no injury assumes importance. Entire story as put up by the prosecution, therefore, appears to be absolutely false."

Therefore, it is imperative that prosecution does its homework thoroughly respecting its prosecution witnesses lest they should be excluded from examination in the court leading to undue benefit to the defence.

D. Mismanagement of Physical Evidence to be lifted during Investigation

The perpetrator of a crime, however well he may plan, shall certainly leave signature of his presence at the place of occurrence. It is the professional competence of the Investigating Officer as to the extent he is able to extract this evidence connecting the accused with the crime. The prosecution case, which largely depends on this evidence being lifted preserved and sent for examination in the Forensic Laboratory, for success of the investigation in their effort to connect the criminal with the crime. Therefore, the I.O. has to be very very careful and also skilled enough to detect the evidence available on the spot of occurrence and then to have the same lifted scientifically for onward despatch to the FSL for timely examination thereof. Any flaw in this exercise is bound to affect the success of investigation adversely, besides weakening the prosecution case at trial stage.

Mismanagement of physical evidence, including improper collection, preservation, non collection of clue evidence, non-maintenances of chain of custody, as well as delayed despatch of physical evidence for scientific analysis has been repeatedly commented upon by the courts. Some such judgements of the courts are given below:

- **Non-despatch** of the petticoat of a victim of rape to the Chemical Examiner to determine seminal stain was held as a **serious lapse** on the part of prosecution [1979 Cr. LR (Raj) 375].
- When concerned I.O. sent the **bloodstained mortal object** for chemical examination **without covering** the same by a wrapper immediately after seizure of the same, it was held that such omission is bound to

affect the result of the Chemical Examiner's Report, which cannot be accepted [1985 Cri.L.J. 1933 (Bom)].

- Regarding **non-lifting of fingerprints** by the I.O., Delhi High Court in the case of **Court on its Own Motion** v. **State (Delhi Admn.),** 1994(3) Crimes 13(Del) at para 8 made the following observation:

  "*It is not clear to me as to how the SHO came to the conclusion that all the symptoms of hanging were present. There are two possibilities in such cases. One is the victim herself did all the acts connected with the hanging or some other person did it after killing her. The second possibility was definitely to be ruled out. No attempts appear to have been made to lift the fingerprints from the bed sheet with which Bina was hanging. If it bore the fingerprints of some person, other than Bina herself,* ***prima facie****, the conclusion could be reached that somebody else was responsible for her hanging. During the course of investigation, the police did not lift any fingerprint, which* ***prima facie*** *is again an indication of the fact that the investigation in this case was not done in a fair manner***."**

- Long back in a remarkable judgement, Hon'ble Supreme Court of India held that for the sake of investigation, **police can send an object lying with the court for analysis in CFSL** or **State FSL and the court should grant permission for the same** (AIR1979 SC 1791).

- Regarding **delayed despatch** of physical evidence along with non-compliance of chain of custody:

  The Hon'ble Lahore High Court in its judgement referred in AIR 1944 Lah 206 held that maintenance of **chain of custody** is the duty of police. Similarly, His Lordship Rajesh Chandra, J. at para 32 of the judgement of **Imanuddin** v. **State of U.P.,** 2009. Cri.L.J. 4477 made the following observation:

  "*The pistol was allegedly recovered at the instance of the accused on 5-6-1998. There is no evidence on record to show as to where the pistol was kept after its recovery, i.e. either at the Police Station Malkhana or in the Sadar Malkhana. Again, no linking evidence has been produced to prove as to when this pistol was sent for Ballistic Expert examination. The Ballistic Expert's Report is (Ext. Kab) on the record, which shows that the pistol was recovered for Ballistic Expert examination on 24-12-1998 from the Serology Section of the Scientific Laboratory, Lucknow. However, there is no evidence as to when the pistol was sent from the Police Station or the Sadar Malkhana to the Scientific Laboratory. In any case, the pistol, after its alleged recovery on 5-6-1998, reached the Ballistic Expert on 24-12-1998 and* ***no reason for this delay*** *has been given. It is, therefore, apparent that the police had in its possession not only the bullet recovered from the dead body, but also the pistol, which was allegedly recovered at the instance of accused Imamuddin and there was ample opportunity with the Investigating Officer to tamper with the bullet during this period. The* ***inordinate delay*** *in sending the bullet and pistol for Scientific and Ballistic Expert or in its place, another bullet fired from the recovered pistol, was sent to the Ballistic Expert for comparison and there was ample opportunity for the police to have done so. In these circumstances, the report of the Ballistic Expert also loses its importance."*

Once again in **Kailash** v. **State of M.P.**, 2007 (4) MPLJ 324 at para 28, judicial observation was:–

"*It is also important to note from the report (Ext. P/10), it is clear that the seized articles were sent vide requisition memo on 10-8-1999 to FSL, Sagar and the packet was received on 13-8-1999. Thus, it is clear that after two months, packets were sent to FSL, Sagar. There is absolutely no evidence that after seizure where these articles were kept for two months and in what condition and in whose custody. This lacuna again casts doubt on the prosecution duty."*

- **Not sending an Accused for Medico-legal Examination**

  In **Ram Darash Rai** v. **State of U.P.** 1998 Cri.L.J. 4205 at para 14, S.K. Phaujdar, J. of Allahabad High Court interpreted the effect of not sending an accused of rape case for medical examination in the following way:

"...There was almost an immediate arrest of the accused and semen stains were allegedly found on the underwear suggesting that he did not have a wash after the alleged incident. Unfortunately, the accused was not sent for medical examination nor did the Investigating Officer look to his male organ..."

- **Absence of necessary precaution to eliminate the possibility of fabrication of physical evidence**

In Mahmood v. **State of U.P.**, AIR 1976 SC 69, 1976 Cri.L.J. 10 (1976) 1 SCC 542, His Lordship R.S. Sarkaria, J. at para 13 made the following observation:

"Further, the Investigator did not take all the necessary precaution, which could be taken to eliminate the possibility of fabrication of this evidence, or to dispel suspicion as to its genuineness. Admittedly, he sealed the box with his own seal which, thereafter, remained with him throughout. He did not take the signatures of the witnesses on the parcel containing the gandasa. He did not after sealing the parcel entrust his seal to the Sarpanch or any other respectable person of the village. According to the prosecution, the fingerprints found on the gandasa could possibly be blood-prints and that the blade of the gandasa was all smeared with human blood. But, this gandasa was never sent to the Chemical Examiner or the Serologist. No explanation of the same is forthcoming. This being the case, the contention of Mr. R.K. Garg at the Bar, that the gandasa (Ext. 1), or smear of the alleged blood on it was not sent to the Chemical Examiner for fear of the fabrication being detected and exposed, cannot be rejected outright."

Even in **Manoj Singh and Dharma Mahato @Dharam Nath Mahato and Ors.** v. **State of West Bengal**, 2007 (1) CHN 123, His Lordship P.N. Sinha, J. made the following observation at paras 28, 29, 30:

"The I.O. (PW-15) in his evidence disclosed that on 2-10-1998, while he was on duty at the Police Station, he received one telephonic message, from one Dhananjoy Singh (not examined as a witness) to the effect that Dharma and five others were hurling bombs in the Puja Pandal on T.G. Road and after murdering one person they were fleeing away. Receiving the telephonic message, he rushed to the spot with force and found a dead body lying in pool of blood near a Shiv Temple on T.G. Road. He informed the matter to his superior officer over R.T. message and the superior officer rushed to the spot. From local people he learnt that it was the dead body of one Dinanath Dubey, who was murdered by Dharma and five others. He sent the dead body to the M.R. Bangur Hospital for treatment and also for ascertainment whether the said person was dead or alive. His superior officer Swapan Bagchi (PW-12) recorded the statement of Aloke Pandit, which was treated as the written complaint and the complaint was sent to the Police Station for starting specific case and he was entrusted with the investigation. He prepared sketch map (Ext. 4) of the place of occurrence and also examined witnesses available at the place of occurrence. He seized bloodstained earth, dry earth, one subscription book of Belpukur Sarbojonin Durgotsav Committee containing bloodstain at page 47, one dot pen of deep blue colour, two used bullets bearing No. KF-94 and KF-95. The seizure list prepared by him at the place of occurrence in the presence of witnesses was marked Ext. 3. He also seized remnants of exploded bomb, including burnt jute having smell of explosive substance, some pieces of small sticks, some small nails having smell of explosive substance and two live bombs by preparing a seizure list (Ext. 4). During investigation he received one case docket from S.P.P.S. and he also started investigation of that case and during investigation, he could realize that the said incident also happened in the same transaction.

He did not examine the wife and the children of deceased Dinanath Dubey. He was not aware of whether PW-3, PW-7 and PW-8 were wanted in several murder cases and stated that those witnesses were not the pocket witnesses of the Police Department. He examined the eyewitnesses whose names he got at the time of investigation. After completing investigation, he submitted

charge-sheet against these accused persons under Section 302/34/364 of the IPC and Sections 25 and 27 of the Arms Act.

His cross-examination reveals that he did not verify the antecedents, profession of the witnesses examined by him during investigation. It did not transpire during investigation that the star witness Binod Rajbhar @Kalia (PW-7) is wanted in connection with Metiaburuz P.S. Case Nos. 379 dated 19-12-1996 and 388 dated 29-12-1996. He did not submit any prayer before the Learned Magistrate at Alipore for placing the accused persons in the T.I. parade in respect of the murder committed within the jurisdiction of S.P.P.S. He did not send the spent/used bullets to the Ballistic Expert for examination. He did not send the used bullet for comparison recovered from the body of deceased Dinanath Dubey to any expert. He did not take assistance of any Serologist to ascertain whether it was human blood or not. He did not meet Madan Singh, the local Councilor, who was a witness to the inquest in respect of dead body of Dinanath Dubey. He denied the defence suggestion that the accused persons were falsely implicated in this case."

The aforesaid gross omission by the Investigating Officer in conducting investigation into a heinous crime like murder is a sure recipe to kill chances of successful prosecution of accused persons, despite their obvious connection to the crime.

Conflicting Statement by PW

In **State (through CBI)** v. **Santosh Kumar Singh,** 2007 Cri.L.J. 964, His Lordship R.S. Sodhi, J. of Delhi High Court at para 23 made the following observation:

"However PW-38 Sunit Sharma, deposes that he had brought the said parcels from the doctors on 29-1-1996. There is no support to this claim. There is no memo prepared in this regard and the contemporary evidence shows that the articles were handed over on 25-1-1996. There is no explanation as to what happened or in whose possession the articles were from 25-1-1996 to 29-1-1996 and so the possibility of tampering with the articles could not be ruled out and the finding of the Trial Court to that effect is fully justified."

In **Manoj Singh** and **Dharma Mahato @Dharam Nath Mahato and Ors**. v. **State of West Bengal**, 2007 (1) CHN 123, His Lordship P.N. Sinha, J. made the following observation at para 7:

*"Out of the aforesaid 15 witnesses, PW-1 is the informant concerning murder of Dinanath Dubey and PW-5 is the informant concerning abduction and murder of Rajesh Rai. PW-2 and PW-4, in their evidence stated nothing concerning the incident and accordingly, their evidence is left out of our consideration. PW-1 according to FIR was an eyewitness of the incident of murder of Dinanath Dubey, but the said witness in his evidence did not state anything in support of the prosecution case. His evidence only reveals that Dinanath Dubey asked for **'prasad'** and this witness entered inside the temple for fetching **'prasad'** and at that time, he heard sound of bomb bursting, followed by hue and cry and out of fear, he did not come out of the temple and thereby exposed himself as a witness, who did not see murder of Dinanath Dubey. Surprisingly enough, the Public Prosecutor-in-Charge of the case did not declare this witness a **hostile** witness and did not confront him about his narration of incident in FIR and we are amazed at this conduct of the Public Prosecutor."*

It may be seen that some precaution at investigation stage to ensure proper documentation of the facts revealed by the witnesses and their reconciliation with similarly placed other witnesses could have saved the case for the prosecution during trial.

E. Non-production of X-ray Report and Non-appearance of concerned Radiologist in the court

In **P. Jhonson and Others** v. **State of Kerala**, 1998 Cri.L.J. 3651, S. Marimuthu, J. of Kerala High Court at para 44 made his observation relating to **non-production of X-ray Report** and the doctor concerned, who had done the radiological investigation by prosecution:

"Even regarding the conviction brought under Section 326, there is no legal evidence to fix the criminal liability. Section 320 IPC defines grievous hurt. Fracture comes under this Section. PW-7, the doctor, who examined PW-12 in the Medical College

Hospital, Calicut, issued Ext. P-6 certificate on the basis of ***X-ray Report and that report was not produced and the doctor, who took X-ray was not examined****. Non-production of X-ray Report and non-examination of doctor, who took the X-ray are sufficient to deduce that the criminal liability either under Section 325 or 326 IPC is not established. This flaw is also stronger one shaking the case of the prosecution."*

F. Problems arising from Scientific Platforms to establish the Crime

The preparation of examination report by the experts is an important area, which may provide big help either to the prosecution or by default to the defence. The findings in the expert's report may be suffering from certain infirmities by way of unintended or otherwise, omission. The same is applicable to the stage of examination of the expert, who prepared/authored the report. The courts have had many occasions to draw attention to these aspects lest it should harm the prosecution case. Some of the cases where the courts had occasion to make their critical observations on the very process of examination or exhibits in the laboratory, quality of the opinion report prepared and the conduct of the expert during examination in the court are narrated in the succeeding para:

(i) **Non-mention of Blood group in Serologist's report**

In **Kasha Behara** v. **State of Orissa**, AIR1987SC1507, where the Serologist's Report regarding examination of blood sample was produced without the information of **blood group**, the Hon'ble Supreme Court explained the lacuna in the following way:

"As regards the recovery of a shirt or a dhoti with bloodstains which, according to the Serologist's Report, were stained with human blood, but there is no evidence in the report of the Serologist about the group of the blood and, therefore, it could not be positively connected with the deceased."

(ii) In **State of U.P.** v. **Anthony**, AIR 1985 SC 48, the nail clippings of the accused were taken and kept in a sealed envelop and sent for chemical examination. But, it is interesting to inform that the **origin of the blood** was not informed in the report, which was held fatal for prosecution.

(iii) In **Kailash** v. **State of M.P.**, 2007(4) M.P.L.J. 324 - Absence of blood group and origin of blood in the Expert's Report was explained by the court in the following way of para 28:

"So far as FSL report (Ext. P/10) is concerned, the bloodstains were found on the Baniyan of the girl, towel, Sardoda seized from the spot, on the swab and the slides of the girl and the shirt, Baniyan, underwear and pant of the accused. But, in the report, it has not been made clear as to whether the stains of blood found on these articles were of ***human blood****? Also, no report of the Serologist has been produced to prove* ***blood group*** *on these articles. Thus, in the absence of the evidence regarding* ***human blood*** *and* ***blood group*** *on these articles, it cannot be concluded that the bloodstains found on the articles were of the same origin and on this ground also, the presence of bloodstains found on the seized articles could not connect the accused with the alleged crime."*

(iv) **When tests were not done meticulously**

In **Himangshu Pahari** v. **State** (1986) Cri.L.J. 622, the accused were charged for robbery and murder. Part of the evidence against the accused was that hairs found at the scene were morphologically similar to the sample hairs taken from the person of the accused. The accused was convicted and appealed. In the course of delivering the judgement of the High Court of Calcutta, Sankar Battacharyya, J. made the following observation:

"After the appellant was taken into police custody, the Investigating Officer took samples of his scalp hairs by combing and sent the hairs to the Forensic Science Laboratory for comparison with the hairs found in the deceased's palm and at other places inside the flat. On examination and comparison by the Senior Scientific Officer (PW-18), the hairs found adhering to the blade of the Rampuria knife seized from the deceased's flat were found morphologically to be similar to the sample hairs of the appellant (Report - Ext. 15). Though, the Learned Trial Judge accepted the report of the Senior Scientific

Officer, on scrutiny of his evidence, we consider it unsafe to act upon the report it has been elicited in his cross-examination that he did not measure the diameters of the shafts of the hairs or their length. He did not take impression of the cuticles of the hairs, did not note the shapes, appearance and the colours of the hairs or the directions of the pointing out of the hairs. ***The science of comparison of hairs has not yet reached perfection like the science of comparison of fingerprints. Where, therefore, all the tests were not meticulously carried out, it would be unsafe to rely upon the report.*** *We, therefore, leave out of our consideration the report of the Senior Scientific Officer (Ext. 15)."*

From the above-mentioned instances, which came under judicial scrutiny, it can be seen that how fatal or damaging the consequences could flow from the negligent and careless manner of conducting crime exhibits examination at laboratory. The Forensic Experts have to be, therefore, very careful in their examination of subjects covered by the Medico-legal examination.

Therefore, N.H.R.C. appointed core group on Forensic Science, who prepared their report under the title of this report *"State-of-the-art Forensic Sciences: For Better Criminal Justice"* at page 2, the following comment is made:

"Today, neither the impact of the Forensic Science is adequately felt at the national level nor the Forensic Scientists have a sense of pride in their profession, as they have not been able to make a big dent in the Criminal Justice Delivery System of the country."

(v) **When no supportive data were provided by the Expert along with report**

In **Mahmood** v. **State of U.P.**, AIR 1976 SC 69, 1976 Cri.L.J. 10 (1976), 1 SCC 542, His Lordship R.S. Sarkaria, J. at para 17 observed as under:

"Lastly, it may be observed that Inspector Daryao Singh, (PW-15), has not given any reasons in support of his opinion. Nor has it been shown that he has acquired special skill, knowledge and experience in the science of identification of fingerprints. It would be highly unsafe to convict one of capital charge without any independent corroboration, solely on the bald and dogmatic opinion of such a person, even if such opinion is assumed to be admissible under Section 45, Evidence Act".

In **Gopal Singh Gorkha** v. **State of U.P.** (1991) Cri.L.J. 1253, His Lordship P.P. Gupta. J. made the following observation, when the **Ballistics Expert's Report** was submitted without any supporting data at para 22:

"An ***expert opinion*** *in firearms identification case should produce* ***facts*** *not* ***opinion,*** *which cannot be checked. Being the Head of the Forensic Science Laboratory, the expert, should know his responsibility towards the administration of the criminal justice. He should give up the habit of producing his* ***bald opinion****. The expert should, if he expects his opinion to be accepted, put before the court all the materials, which induced him to come to his conclusion, so that the court, although not an expert, may form its own judgement on these materials.* ***Bald opinion*** *is of no use to the court and often leads to the breaking of very important links of prosecution evidence, which are led for the purpose of consideration."*

Similarly, in **Rajendran** v. **State**, 1993(3) Crimes 974 (Mad), which was a case of double murder, His Lordship Thangamani, J. made the following observation regarding **Fingerprint Expert's Report,** which was produced without sufficient data at para 25:

"And, above all, F.P. Expert's Report (Ext. P-23) is bereft of any details. In fact, contrary to the claim of PW-14 F.P. Expert, it is not a report at all. This only purports to be a communication dated 20-8-1985 from Single Digit Fingerprint Surgeon, Coimbatore Rural District addressed to the J.S. C.M., Palladam. This boldly reads that 'the Fingerprint Expert, who compared the photographed chance prints developed at the scene of crime concerned, reports that the chance print developed on silver tumbler are found identical with the right ring and left index print slips were received

by the Bureau. The chance print developed on the door of the inner locker of the steel bureau is also found identical with the left thumb fingerprint of the same accused. The F.P. slips of Rajendran are retained here'. This letter ***does not furnish any further data as to how the expert had arrived at his conclusion****. The report of the F.P. Expert without furnishing the reason for the conclusion is of* ***no value****."*

Therefore, Expert's Report submitted without sufficient data can easily harm the prosecution case. Such activity as Government expert cannot be expected as they are being paid from Government Exchequer.

(vi) **Delayed examination of exhibits at the laboratory**

Regarding delayed examination of physical exhibits, Hon'ble Delhi High Court in **Mahabir Singh @Mahavir Singh** v. **State**, Cri. Appeal No. 498/2007, decided on 22-5-2009 at para 21 made the following observation:

"Unfortunately, in Delhi, we have only two Forensic Science Laboratories. One is Central Forensic Science Laboratory at R.K. Puram. The other is the Forensic Science Laboratory at Rohini. The two laboratories are overworked. They do not receive suspected samples for forensic examination at random. The procedure being followed is that the Investigating Officer writes letters, which are entered in a register and as per priority position assigned to a request, the laboratory requisitions the samples, which have to be analyzed. This explains delay in all cases for having sent seized samples for Forensic Analyst after 2 months of the seizure."

But, such delay is very much effective regarding inconclusive results of biological, serological, toxicological tests, which can be cited from the view of Gaur & Bhalla (2008):

"The delayed reports on biological, serological and viscera exhibit in poisoning cases put a big question mark on the authenticity of evidence. The putrefaction of such exhibits can generate alcohol in the exhibits, on long standings, and may also not permit the detection of poisons and conclusive serological results, likewise, in the cases of drunkenness, the blood alcohol or urine alcohol negative samples may test positive for the presence of alcohol due to self-generation of alcohol on the putrefaction of samples."

Since Dr. Gaur is the current Director of State FSL, Himachal Pradesh and a leading Forensic Scientist of India, so the abovesaid comment is having scientific value. Therefore, in such situation, result of FSL cannot match with the post-mortem findings, which may sometime be fatal for the prosecution. Even delayed examination of viscera sometimes helped the suspect to get bail as because of absence of viscera examination report. Sometimes, it is not possible for the Autopsy Surgeon to clarify the mode of death. In this regard, one of the examples is ***Enamul Haque@Enamu Haque*** v. ***State of West Bengal,*** CRM 17348 of 2010 and AST 1114 of 2010, which is an application for bail under Section 439 of the Code of Criminal Procedure filed on 19th October, 2010, in connection with Sagardighi P.S. Case No.123 of 2010, dated 4th April, 2010 under Sections 498-A/304-B/34 of the Indian Penal Code Division Bench of J.N. Patel, CJ. and Ashim Kumar Roy, J. of Calcutta High Court on their interim order, dated 15th December, 2010 said that–

"...It is stated that the Autopsy Surgeon could not give the exact cause of death and preserved the viscera for chemical analysis, which was sent on 9th June, 2010 to FSL, Kolkata for Expert opinion.

For want of report of the Forensic Science Laboratory, Kolkata, charge-sheet could not be filed within ninety days, resulting in release of the principal accused in the case of dowry death..."

One of the important causes of delayed examination of crime exhibits is lack of human resource (i.e. staff strength) of the concerned laboratory. In this regard, ***Enamul Haque @Enamu Haque*** v. ***State***

of West Bengal, CRM 17348 of 2010 and AST 1114 of 2010, which is an application for bail under Section 439 of the Code of Criminal Procedure filed on 19th October, 2010 in connection with Sagardighi P.S. Case No.123 of 2010, dated 4th April, 2010 under Sections 498-A/304-B/34 of the Indian Penal Code Division Bench of J.N. Patel, C.J. and Ashim Kumar Roy, J. of Calcutta High Court on their interim order, dated 10th January, 2011 said–

"...From the affidavit we find that the Home Secretary is not in a position to make any comments to this court as to when all the vacancies in the Forensic Science Laboratory would be filled in. On the other hand, he has expressed his helplessness in the matter by attributing to various factors, which have not been spelt out.

We, therefore, direct the State Government, particularly the Principal Secretary (Home) to the Government of West Bengal, to take immediate and urgent steps to fill in all the existing vacancies in the Forensic Science Laboratory of all the categories and provide necessary infrastructure and equip laboratories for its effective and meaningful functioning within a period of six months from today..."

(vii) **When question arises regarding Expert evidence is partisan in nature**

- In **Baswantrao Bajirao** v. **Emperor,** 1949 Cri.L.J. 181, Division Bench of Bose, Hidayatullah, JJ. at para 22 made the following observation:

  "The first method of approach merely helps the court and it may be convenient to put a question in such general terms based upon medical science, but the second method of approach merely substitutes the judgement of the medical witness for that of the court on the most vital question in the case. It is for this reason that legal theory does not tolerate the encroachment of an Expert upon the province of the court and one good reason is that partisan evidence is easy to give."

- **Smt. Kamlesh and Anr.** v. **State of U.P.** and Ors., cited in 2002 (3) AWC 1792, 2002 Cri.L.J. 3680 Division Bench of S. Singh, R. Dash, JJ. at para 13 held–

  "...As has been well said, 'It is safe as a general rule to assume that a professional Expert witness is a partisan, willing and eager to serve the party, who requests his service. Indeed, all Experts whether professional or non-professional, are very apt to zealously espouse the cause of the party by whom they are called. There are to be sure exceptions to the general rule, but they are not numerous enough to more than prove the rule. The witnesses now in worst repute are called Expert witnesses that is, witnesses retained and paid to support by their evidence a certain view on a scientific or technical question. We have all heard the old jeer about the three kinds of liars - white liars, black liars and expert witnesses.' (Woodroffe and Amir Alis Evidence Act, 14th Edition, page 1293)."

- **Ezaz** (1996) citied a reference from 59 IC 220 and 1933 Cri.L.J. 735 regarding partisan attitude of Expert, which was referred from **Ryen on Criminal Evidence in India**, page 127:

  "It must be borne in mind that an Expert witness, however impartial he may wish to be, is likely to be unconsciously prejudiced in favour of the side which calls him. The mere fact of opposition on the part of the other side is apart to create a spirit of partisanship and rivalry, so that an Expert witness is unconsciously impelled to support the view taken by his own side. Beside it must be remembered that an Expert is often called by one side and solely because it has been ascertained that he holds views favourable to its interest."

- In **Vinod Kumar and Anr.** v. **State of Madhya Pradesh,** 1987 Cri.L.J. 1541, His Lordship G.G. Gupta, J. observed that–

  "...Possibility of an Expert being partisan is, by itself, sufficient to destroy the credibility of her evidence. In this view of the matter, it is not possible to

give any benefit to the appellants on the basis of the opinion given by Dr. (Mrs.) Khare."

- In **Ram Vishnu Gupta and 2 Ors.** v. **State of Madhya Pradesh** on 5-2-1999, II (1999) DMC 489, Division Bench of D. Dharmadhikari and R. Gupta, JJ. at para 18 observed:

  "The Learned Counsel for the accused very severely criticized the report and conduct of the so-called Scientific Expert Dr. S.P. Singh (PW-8). It is submitted that he went for the spot inspection after the inquest had already been done and the body was sent for post-mortem. The storeroom was not locked and sealed. He prepared his spot inspection report after the storeroom was cleaned and put in order. The observations made by him and noted in the report do not show the condition of the storeroom as it was found when, in the presence of ***Panchas,*** *the door was broken open to prepare the inquest memo. It is submitted that the witness in his report (Ext. P/5) has tried to overdo his job by stating in his deposition that the suicidal note was not in the handwriting of the deceased. By making such a statement contrary to the opinion of the Handwriting Expert, the above so-called Scientific Expert has shown his partisan attitude and has tried to oblige the complainant party."*

- In **Jagdish** v. **State,** AIR 1967 All 532, 1967 Cri.L.J. 1467, Division Bench of T. Ramabhadran and H. Tripathi, JJ. at para 17 held–

  "In the instant case, the evidence is of a highly partisan character, it does not find corroboration from the medical evidence and suffers from various blemishes. The Trial Judge for good reasons has disbelieved the major part of the prosecution story and has given a categorical finding that the acquitted persons did not participate in the incident and it was not difficult for the eyewitnesses and Kishen Dayal to implicate them falsely. In view of the categorical findings by the Learned Trial Judge, which are based on adequate reasons and in view of the various infirmities pointed out in the ocular testimony of the witnesses, we are of opinion that the conviction of the appellant is not sustainable on the facts and circumstances of the case."

Therefore, partisan attitude of an Expert not only harms his repute, but it may also destroy the value of Expert witness in a trial.

G. When Identity of the recovered Skeleton was not established

Calcutta High Court in **Sudhir Mandal** v. **State of West Bengal**, 1988(1) Crimes 729 at para 5 made the following observation:

"The prosecution case is that one evening, Hema Mondal, the wife of the accused alleged to have been murdered, was seen with the accused coming towards Debipur and that thereafter, her skeleton was recovered from the bank beside the river Marakashi. There is no evidence whatsoever to show that the said skeleton was that of Hema Mondal, wife of the accused. To establish the ***identity*** *of skeleton, the prosecution adduced evidence to show that a tuft of long hair, one twisted black tarsal, a piece of light yellow-coloured glass bangle and a beguni-coloured blouse were seized from beside the place where the skeleton was found. These articles were not found on the dead body, but were found according to the evidence of PW-15 near Debipur embankment. PW-6 says that the O.C. seized a yellow blouse. But the O.C. (PW-16) says that he seized a beguni-coloured blouse, PW-1, the father of the victim, identified one blue-coloured blouse as the one belonging to her daughter. The evidence of PW-1 that 'when my daughter went out with the accused, she was wearing a purple (beguni)-coloured blouse and used glass bangles, her hair were dressed with a tarsal' cannot be accepted, because he did not see his daughter coming with the accused. The evidence of PW-4 that the wife of the accused wore a blouse shown to her and yellow bangles and a tarsal when she was coming with the accused is shaky, because her evidence*

that she told the I.O. that she saw Sudhir and his wife coming out of their home in the evening and that on her asking Sudhir told her that he and his wife were going to attend a marriage feast is contradicted by her statement recorded by the I.O. (PW-16),even if it is assumed that PW-4 saw the accused and his wife were going out. The evidence of PW-3, the husband of PW-4 is also shaky. In view of the evidence on record, we are ***unable to hold that the identity of the skeleton has been established****. PW-16 states that he despatched the skeleton to D.M.O., Malda for post-mortem examination. PW-17, who submitted charge-sheet, said that the FSL Report and the Post-mortem Report were already in the Case Diary. In spite of several opportunities having been given to the prosecution for production of the Post-mortem Report, the said report was not produced. In the circumstances, we hold that the prosecution failed to prove that any murder was at all committed to hold the accused guilty of the charges framed."*

In the famous **Shibu Soren** Case, Cri. Appeal No. 64/2007 decided on 22-8-2007, the Hon'ble Delhi High Court at para 34 made the following observation:

"From the analysis of the above, it appears to be doubtful that the skeleton exhumed was that of Sashi Nath Jha. Since neither the family supports any of the wearing apparels found upon the skeleton as those belonging to Sashi Nath Jha nor does the post-mortem conducted by PW-17, Dr. Ajit Kumar Choudhurty, supports the prosecution's story of Sashi Nath Jha having been killed with two iron rod blows on his head by Nand Kishore Mehta as deposed to by PW-4, Charu Oraon, on the superimposition test, which only goes up to establishing that the skull could have belonged to the person whose photograph is sent for matching, it is not a ***positive test*** *but a* ***negative test****. Further to the above, is the result of the DNA Fingerprinting test got conducted at the instance of the Trial Court in its report dated 11-6-2001, suggested, in no uncertain terms, the skeleton in question was not that of Sashi Nath Jha. For further assurance, CBI got the DNA Fingerprinting test done from another laboratory exercising its power under Section 173(8) of the Code of Criminal Procedure. Even this report from CCMB, Hyderabad, does not support the prosecution's case. With this material on record to show that the body of Sashi Nath Jha, there is no evidence on record to show that the body of Sashi Nath Jha had initially been buried near the brick kiln and, thereafter, to the farmhouse of B.P. Sinha. There is no evidence as to who led the CBI to the skeleton exhumed on 13-8-1998."*

H. Deficiencies in Post-mortem Examination and Preparation of Post-mortem Report

When death of a subject occurred in a suspicious condition, post-mortem examination and its report is an important part of prosecution evidence (**Vidyainati** v. **State,** AIR 1951 HP 82). **Estimation of post-mortem interval** is the most important work of medico legist (AIR 1931 Oudh 119). It is important to produce the **cause of the death** (**State of Maharashtra** v. **Manglyn Dhav Kongil**, AIR 1972 SC 1797). Regarding the attitude of medical witness to supersede the Judge in **Majee Taha** v. **State,** 1973 Cri.L.J.. 526 at page 530, judicial observation was:

"It is not permissible to him (medical witness) to substitute his judgement for that of the court."

Since Post-mortem Report is a very important piece of evidence, the doctor should do the same with utmost care (**Thakur** v. **State**, AIR 1955 All 189). To destroy the viscera, doctor is completely dependent on the order of the administration (AIR 1972 SC 1797).

Some specific problems relating to post-mortem are given below:

(i) **Difference between inquest and Post-mortem Report**

In **Maula Bux** v. **State of Rajasthan**, 1983 SCC (Cri) 199, the Hon'ble Supreme Court of India made the following observation regarding difference between **Post-mortem Report** and **Inquest Report:**

"…The Learned Trial Judge held that the bruise marks on scapular region and waist of the dead body noted in the inquest

*Panchnama by the Investigating Police Officer, 'were nothing but the marks of **post-mortem staining'**. This view of evidence taken by the Trial Court could not be said to be palpably wrong. Nor was the High Court fair enough to the Medical Officer Dr. Sati Punjabi, inasmuch as it held that she had failed to note some **contusion marks** mentioned in the inquest Panchnama, through sheer inadvertence or by design.*

*The Police Officer, who prepared inquest Panchnama, was not an expert in medical jurisprudence. The possibility of his having mistaken the post-mortem staining marks on the waist and shoulder of the deceased, for ante-mortem bruise, could not be ruled out. In any case, in such a situation, as a matter of judicial caution**, the benefit of this discrepancy between medical evidence and the Inquest Report, on this point in issue, ought to have been given to the appellants...**"***

(ii) **Improper identification of weapon of offence**

In **Sethur Madhavan Nair** v. **State of Kerala**, 1974 SCC (Cri) 774, the Hon'ble Supreme Court held that bamboo sticks like blunt weapon cannot be able to cause incised wound on the person of the deceased. In another case, while the doctor stating about an injury by *Bhala* (a sharp cutting weapon) said the weapon was like lathi. Such evidence was rejected by the court (AIR 1985 SC 1688).

(iii) **Non-despatch of highly-decomposed dead body to an Anatomy Expert to ascertain strangulation**

In **State of Punjab** v. **Bhajan Singh**, 1975(I) SCR 747,1975 SCC (Cri) 584, where the doctor conducted Medico-legal autopsy of highly-decomposed dead bodies, but failed to refer the same to an Expert of Anatomy to examine **hyoid bone** and **cervical vertebra** in order to ascertain whether death was due to strangulation or not, the Hon'ble Supreme Court made the following observation:

*"We find that Dr. Saluja has deposed that he found **no marks of ligature** on either of the two dead bodies, which were in a decomposed state. In the face of the above evidence of the doctor, he could not find the **cause of death,** because the two dead bodies were in a decomposed state. In the face of the above evidence of the doctor, it is not possible to hold that the death of the two persons, whose bodies were recovered, was homicidal. The Learned Sessions Judge in the course of his judgement observed that **the doctor, who performed post-mortem examination, was careless inasmuch as he failed to send two dead bodies to the Professor of Anatomy, who might have been in a position to express opinion after examining hyoid bone and cervical vertebra as to whether the death of the two deceased persons was due to strangulation**. Although, it may be said that it would have been more appropriate on the part of the doctor, who did not do so, cannot be a ground for drawing an inference adverse to the accused. The accused cannot be made to suffer because of that omission of the doctor. It **would indeed be contrary to all accepted principles to give benefit of that omission to the prosecution."***

Similarly in **Sabhau** v. **State of M.P**., 1988 Cri.L.J. 39 34, where the prosecution failed to send the decomposed dead body to an **Anatomy Expert** to examine hyoid bone and cervical vertebra to rule out the possibility of strangulation, His Lordship S.K. Dubey, J. of M.P. High Court made the following observation:

*"In the present case, the prosecution has led evidence to prove three circumstances, which we will take up one by one. The first circumstance is of the **recovery** of dead body, which is not at the instance of the accused. On post-mortem examination performed by Ashok Khare (PW-18), the **cause of death** could not be known as the body was highly decomposed. He was not in a position to opine whether death was homicidal or natural, as he did not find any external or internal injuries. When the cause of death could not be known on post-mortem, the prosecution ought to have referred the dead body to **Anatomy Expert**, which was not done; that being a serious lacuna in the prosecution case in the absence of **ligature mark** on the body, it is difficult to hold that the death was homicidal.*

To prove an offence of murder, the death should be homicidal of which onus in a criminal trial is upon the prosecution. ***In the absence of legal proof of the death being homicidal, because of the serious lacuna of not obtaining the report of Anatomy Expert to prove homicidal death, the benefit will go to the accused*** *and not to the prosecution. The accused cannot be held to legal criminality of the offence under Section 302 of India Penal Code."*

Also, in the case of **Bhanwar Singh** v. **The State**, 1988 Cri.L.J. 1054, the Hon'ble Rajasthan High Court acquitted the appellant from the charge of murder, since the **prosecution failed to send the decomposed body to an Expert of Anatomy**.

The same type of judicial reference can be found in:

- **State Government of M.P.** v. **Ramkrishna Ganpat Rao**, AIR 1954 SC 20,
- **Megha** v. **State**, 1983 MPWN 250,
- **Bhagoban Kirsani** v. **The State,** 1985 Cri.L.J. 868.

(iv) **Conflicting Medico-legal Autopsy Report**

In **K.V. Chacko** v. **State of Kerala**, 2001 Cri.L.J. 713 (SC), it was held that–

"The ***benefit of doubt,*** *which arises out of the two* ***conflicting*** *post-mortem reports, must go to the accused. Where in the original post-mortem, no external injury to the head was noticed nor was any blood clot or external injuries were noticed in the inquest Panchnama of the bodies in the absence of any recorded injuries, the courts were held not justified in placing reliance on another post-mortem report indicating that the skulls had suffered fractures to hold that the weapon recovered was used by the accused in execution of crime."*

(v) **Non-adherence of Police Regulation/Police Manual by Doctor**

In **Manoranjan Das** v. **State**, 1994 (2) Crimes 128; A.K. Dutta, J. of Calcutta High Court in his judgement explained the above point in the following way:

"As already indicated above, the Learned Trial Judge by his impugned order had directed issue of process against the petitioner herein under Sections 201/120-B IPC, mainly on the ground that he had submitted charge-sheet in the relevant case against the four accused concerned under Sections 306/120-B IPC, ***without sending viscera of the victim****, which had been preserved in the hospital for chemical examination and without obtaining any report from the* ***Chemical Examiner****, suggesting "****deliberate action on his part to cause disappearance of evidence*** *under Section 302 IPC, against the accused persons concerned in a criminal conspiracy with them. As regards submission of charge-sheet by the petitioner without obtaining Chemical Examiner's report in the relevant case, he does not appear to have erred in doing so as he could do so in view of the clear instructions contained in Regulation 272(b) of the* ***Police Regulation Bengal****, 1943. As instructed therein, charge-sheet should be submitted by the quickest means to the Court Officer for submission to the Magistrate. When a prima facie case is made in a case in which articles have been sent for chemical analysis, the charge-sheet should not be delayed till receipt of the Chemical Examiner's Report."*

As regards the sending of viscera of the deceased preserved in the hospital for chemical examination, it is indeed not for the Investigating Officer to send the same for the aforesaid purpose. In terms of the instructions contained in the Police Regulations, Bengal, the packing and forwarding of all exhibits and articles for examination are to be carried out by the Police Officers except when the preservation of such articles has been done by a Medical Officer. **When there has been a post-mortem examination by Civil Surgeon or any duly qualified Medical Officer, the viscera and other articles (if any), connected with the case and found on or with the body at the time of examination are to be packed, sealed and despatched by the Medical Officer concerned**. Similarly, when stomach washings, vomited matters, stool, etc. are preserved by the Medical Officer, the same should be packed, sealed, despatched by him, if requested to do so by the Investigating Officer. If in

any case the Civil Surgeon considers for special reason that any matter or portion of a subject examined by him should be sent by special messenger, he shall apply to the Superintendent (vide P.R.B. in Criminal Investigation for Bengal, by Shyamal Kumar Sinha Roy, First Edition, at pages 65-66).

It would further clearly appear from **Modi's** Textbook of **Medical Jurisprudence and Toxicology**, 17th Edition, at page 478 that a Medical Officer, who has no experience at chemical analysis, should never undertake the analysis nor should he ever make any guess from the nature of stomach contents, etc. But, after obtaining necessary orders from the District Magistrate, he should forward the viscera to the Chemical Examiner or State Forensic Science Laboratory for analysis. The Magistrate conducting the proceeding should furnish the Chemical Examiner with a copy of Medical Officer's Post-mortem Report and with every fact and detail either from deponents or from police investigation, which may indicate the direction in which analytical inquiry may yield a positive result. **The Chemical Examiner or his assistant, who receives the articles for analysis from Medical Officers, should first verify the seal and compare the labels with the invoice list of materials sent, and then open the articles, etc**.

According to **Medico-legal Jurisprudence,** the Medical Officer conducting examination is required to send the following items for chemical examination:

"(1) The stomach and its contents;

(2) The contents of the intestines;

(3) At least one kidney;

(4) Lever - at least one pound;

(5) Urine, if found in the bladder;

(6) In cases of exhumed or decomposed bodies, hairs, nails, a sample of bones;

(7) A sample of preservative used during the transit of viscera; and

(8) In case of exhumed bodies, a sample of soil where the body was interred should also be sent for examination, because a plea is sometimes taken, in case arsenic is detected, that it was present in the soil."

In view of the above discussion, **there could be no mistake that it is not for the Investigating Officer but for the Medical Officer concerned holding post-mortem examination to forward viscera, etc. to the Chemical Examiner or the State Forensic Science Laboratory for analysis**. The Petitioner - Investigating Officer in the relevant case appears to have requested the District Medical Officer, Kishnanagar Sadar Hospital by his letter dated 13-6-1988 for arranging to send the viscera of relevant case for chemical examination for ascertaining the actual cause of death.

(vi) **No specific data submitted by doctor in support of his post-mortem examination finding in a case of infanticide and other cases**

In **Vidyamati** v. **State** (AIR 1952 HP 82), the Hon'ble Court held that it is the duty of the doctor, in a suspected case of infanticide to record in the Post-mortem Report**, the data for arriving at the two main conclusions germane to such a case,** i.e. **that the child was born alive and it met with a violent death later**.

In **Ganga Basnet** v. **State of Sikkim**, 1988(3) Crimes 588, where appellant Ganga Basnet was working as an A.N.M. (Auxiliary Nurse-cum-Midwife) within the territory of the State, following external injuries were noticed on the dead body:

"(1) **Abrasion** on the neck and injury on the left side of the head.

(2) **Bluish mark** on the back of the neck.

(3) **Haematoma** on the occipital region."

On **dissection** of the dead body, the following were found:

- Brain was congested.
- The larynx and trachea were congested.
- Both the lungs were congested.
- The mouth pharynx and oesophagus were full of blood.
- Stool was seen on the anus.

- There were fractures on 2nd, 3rd, 4th cervical vertebrae.

During his cross-examination at Sessions Court, PW-8, the doctor, stated the following:

— "I had not taken any **photographs** of the dead body.

— I had not given the **size** of lungs.

— It is also true that I have not given the **shape** of the lungs in my report.

— It is true that I have not done any **microscopic examination**.

— It is true that I had not done **hydrostatic test** of the lungs as there is no facility in the hospital. It is true that I have not done any test to ascertain whether the baby was **born alive or dead,** but I have already said in the instant case looking at the organs of the body during post-mortem examination that the child was born alive.

— It is true that there were no nail marks on the neck of the baby.

— It is true that I did not notice the colour of the eyes, eyelids and position of the eyeballs and the colour of the lips of the dead body.

— It is true that there were no blood foams in the mouth nor there was any blood foams in the nose and ears.

— It is true that I had not taken the **weight** of lungs.

— It is true that I had not mentioned the nature of strangulation that is how strangulation is caused."

From the above discussion, it is clear that the statement of the concerned doctor (PW-8) regarding absence of hydrostatic test facility is nothing but showing the **great negligence** from the side of doctor, since for hydrostatic test, a bucket of water is necessary in which lungs, heart and tongue, collected enemas to be placed if the same is floating, then lungs should be separated and cut into small pieces, once again if these cut pieces are floating, then the subject is born alive or otherwise still born.

While delivering the judgement regarding acquittal of Ganga Basnet, J.K. Mohonty, CJ made the following observation:

"In this case as has already been stated, a newly-born dead baby was found below the cot of the appellant. The evidence also shows that the appellant has tried to conceal that she has given birth to a child. There is no doubt that there are some circumstantial evidence on which prosecution wants to rely to show that the baby might have died after being born alive.

It is in the evidence that the appellant was married and evidently, she tried to conceal her pregnancy and also the fact that she has delivered a child. As already mentioned, the doctor's (PW-8) evidence on which the entire prosecution case depends, is not convincing as admitted by the doctor he has not done any **test** to find out **whether the baby was born alive or not**. Even in the Inquest Report (Ext. P-3), there is no mention that there were any marks of injury. It has only been mentioned that some blood has been found on the right side of the mouth. This is also evidence of all the witnesses, who entered it to the room of the appellant and saw the dead baby. **While examining a case of suspected case of infanticide, the doctor should find out data for arriving at the two main conclusions germane to such cases, that the child was born alive**, and it met with a **post-natal violent death**. In this case, the doctor has not directed his attention towards the necessity of doing of these tests and has admitted that he has not done any test as to whether the child was born alive or dead, as it is already indicated in Modi's Medical 'Jurisprudence an Toxicology' as to what are the duties of the doctor to find out at the time of post-mortem in case of infanticide. But, these thing not been done, it cannot be definitely said that in fact, the child was born alive and was not still born. The other evidence in this case only shows that the appellant gave birth to a child, which was found dead. The **circumstantial evidence, however strong, cannot take the place of legal proof**.

On a conspectus of the evidence adduced in this case, I am of the view that the prosecution has not been able to prove the case **beyond reasonable doubt** and the benefit of this should go to the appellant."

In **Court on its Own Motion** v. **The State of Jharkhand and Ors.**, 2007 (2) BLJR 1363, Division Bench of M.K. Vinayagam & P. Kohli, JJ. at para 22 (viii) made the following observation regarding complaint lodged by the father of the deceased Abhishek:

*"Dr. Mishra has got the Post-mortem Report examined through Dr. Gaurav Agarwal. He gave a report **indicating different opinion**. According to him, the post-mortem was hurriedly done and death could not have occurred due to **asphyxia due to drowning**. Dr. Agarwal has given a clear opinion that if death has occurred due to asphyxia due to drowning, then there would have been signs of asphyxia as well as the **presence of water, mud, etc. in the respiratory passage and the lungs**. Admittedly, there is no mention about presence of these things in the Post-mortem Report. According to him, body had no mark of drowning and the **body was not swelling** at all. From the injuries, as is apparent from photograph, some of the cut injuries on the face and head must be ante-mortem. The eyes and lips were totally smashed. Two teeth had broken. This cannot be possible by a fall into the deep water. The opinion of the post-mortem doctor that the injury could have been caused by aquatic lives is highly unlikely, as the body was taken out after 22 hours. **As per the medical jurisprudence in order to find out whether the death was due to drowning, the doctor has to conduct diatom test. This was not done**. Further, blood sample and sample of spleen was not preserved for examination. The injury on the right leg has been ignored in the post-mortem."*

In **Raju @Rajendra Prasad** v. **State of M.P.**, 2002 Cri.L.J. 2367, I (2002) DMC 655, His Lordship S. Kochar, J. at para 19 made the following observation **about incomplete documentation of post-mortem injuries** by the doctor, who conducted medico-legal autopsy in the following way:

*"It is a case of **100% burn** and the deceased has committed **suicide** within the four walls of the kitchen, but Autopsy Surgeon (PW-10) Dr. S.D. Garg, failed to mention **presence or absence of carbon particles in the mucus membrane of nose, nasopharynx, trachea, larynx and bronchi** and also so many other things which are normally available in a burn case by kerosene, because according to the prosecution case, deceased having poured kerosene oil on her person lit fire, must have produced lot of carbon dioxide and other gases and the same would have been inhaled by the deceased. Dr. Garg has also not mentioned in the Post-mortem Report **whether the burn injuries were post-mortem or ante-mortem** and no finding or data has been given in the Post-mortem Report, on the basis of which one can assess that the burn injuries were post mortem or ante-mortem. All these medico requirements are discussed in great detail in Division Bench judgement of this court in case of **Ashok Dubey (Dr.)** v. **State of M.P.**, 1980 JLJ 250."*

In **Ashok Dubey (Dr.)** v. **State of M.P.,** 1980 JLJ 250 at para 20, His Lordship Malik, J. made the following observation:

*"The questions put to Dr. K.S. Shrivastava by the Public Prosecutor would reveal how deliberately and suppressive the report had been made. The report does not mention **the degree of burns, the percentage of burns**, **the presence or absence of carbon particles in the mucus membrane of the nose**, **nasopharynx, larynx, trachea and bronchi**, whether the **colour** of the blood had changed into cherry red due to absorption of carbon monoxide showing reactions of carboxyl haemoglobin, whether the burns were **ante-mortem** or **post-mortem**, the nature of blister formations, the line of redness, vesication and reparative processes even though the blisters had peeled off, the presence or absence of petechial haemorrhage, the **stomach contents, whether digested** or **semi-digested** and above all, the reasons for non-preservation of the viscera. These were vital points on which the Autopsy Surgeon should have furnished data. **The tendency of an Expert witness, as we generally find is***

to substitute his judgement for that of the court**, forgetting that howsoever confidently he may speak, he is not infallible and the availability of authoritative treatises on the subject can be taken advantage of by the Judge in testing the correctness of his opinion. **The medical witness when called as an Expert is not a witness of fact. His evidence as an Expert is evidence of opinion, which the court may or may not accept, depending on the data he has collected and the reasons he has given for coming to certain conclusion. The Expert is a privileged person, no doubt, provided he discharges his duty intelligently, conscientiously and with a sense of responsibility. But, slightest deviation from an honest labour brings him a charge of incompetence and even sometimes of demonstrable corruption."

In **Husenera Begum** v. **State of West Bengal** (2004) 2 CALLT 410 HC, 2004 (1) CHN 215, at para 4 of the same judgement, court said-

"…First post-mortem examination carried by the Autopsy Surgeon Dr. S.K. Majumdar of Raigunj Hospital could not give any positive opinion and his opinion was that it might be a case of suicide and the injuries might have been caused by bullets fired from a revolver…"

Therefore, it is true that careless medico-legal examinations of the dead body can bring severe judicial criticism against the doctor and also the court may invite re-investigation by any other agency like CBI, if the court thinks so as in the case of **Court on its Own Motion** v. **The State of Jharkhand and Ors**., 2007 (2) BLJR 1363.

"Example of judicial stricture against the doctor can be referred from para 59 of **Ashok Dubey (Dr.)** v. **State of M.P**., 1980 JLJ 250—

"We must record here our strong condemnation for perfunctory, superficial and misguiding post-mortem examination conducted by Dr. A.K. Srivastava. A copy of judgement may, therefore, be sent to his Head of Department and one to Indian Medical Council to assess him for his professional ethics."

(vii) **When medico-legal examination of leaving was not at all carried out meticulously in heinous cases like child rape**

In **S. Krishna** v. **State of Karnataka,** 1998 Cri.L.J. 785, His Lordship M.F. Saldana, J. at para 4 made the following observation in this regard:

"…Again, we need to take note of the fact that in rape cases, even though the medical evidence and forensic evidence is of critical importance, that having regard to the manner in which delays occur particularly on the part of the investigating authorities and the worthy persons, who are incharge of public hospitals and the careless manner in which exhibits and clinical samples are taken and stored, that merely because the medical evidence is not positive or the forensic evidence is not positive…"

From the above-mentioned instances, which came under judicial scrutiny, it can be seen that how fatal or damaging the consequences could flow from the negligent and careless manner of conducting medico-legal examination of ante-mortem or post-mortem injuries. The Medico-legal Experts have to be, therefore, very careful in their examination of subjects covered by the medico-legal examination.

Medico-legal examination is done to unearth real cause of injury or death, despite stated history of the same by the Investigating Officer, as heard by him from the witnesses or relatives/friends. The meticulous examination of Medico-legal examination shall also help to arrive at a reasonable conclusion respecting **accidental** or **suicidal** or **homicidal** nature of death and injuries leading to death or otherwise. Documentation of medico-legal examination should, therefore, be prepared very carefully in order to arrive at scientific findings. This also includes taking care that injuries caused by the Medico-legal Expert for the purpose of his examination are carefully recorded and excluded from those sought to be examined for their linkage to the cause of injury or injuries leading to death or otherwise.

In cases of death apparently due to burning, overrunning by the train on Railway track, drowning, suicides, road accidents, etc., this care and caution earns rich dividends for the examination by Medico-legal Experts and it is for the Investigating Agency to see the truth behind the veneer of deceptive appearances contrived by the vested interests.

(viii) **Tampering of physical evidence collected during post-mortem examination**

It has come to our notice from different newspapers, Internet sources regarding Shopian Case as well as in Arushi Case, where DNA profiling of vaginal swab did not match with the other organs like viscera's. As per laboratory report when the samples reached to the same, there was no tampering of seal. It clearly indicates that but for the tampering at the despatch stage or prior to that, this anomaly could not have arisen.

(ix) **Delayed Post-mortem Examination Report**

Delayed Post-mortem Examination Report is a headache for the prosecution as because of such delay, it is not possible for prosecution to file charge-sheet within due course of time. Judicial stricture regarding delayed Post-mortem Examination Report can be referred from **(Smt.) Arati Ghorai and Anr.** v. **State of W.B.,** CRM 15447 of 2010, which is an application for bail under Section 439 of the Code of Criminal Procedure filed on 10th November, 2010 in connection with Chandipur P.S. Case No. 101 of 2010, dated 25th August, 2010 under Sections 302/34 of the Indian Penal Code, Interim order, dated 6-12-2010, Division Bench of J.N.Patel, CJ. and Ashim Kumar Roy, J. said the following regarding delayed Post-mortem Report:

"...This court can take judicial notice of the fact that the Post-mortem Reports are not forwarded with urgency to the Investigating Officer in case of unnatural death, resulting in delay in further investigation of the case, which are triable by Court of Sessions.

We, therefore, would like to know from the Director of Health Services, Government of West Bengal, as to what practice and procedure is adopted by the Health Department in such cases and whether there is any obligation on the part of the Medical Officer to forward the Post-mortem Report to the Investigating Officer, as early as possible immediately after the post-mortem is conducted. As we understand, as soon as the post-mortem is conducted, the Medical Officer, who conducts the post-mortem, is expected to take down the notes as contemporaneous record of the post-mortem examination and immediately thereafter, Post-mortem Report should be prepared and forwarded to the concerned authorities, in this case, the Investigating Officer.

Therefore, issue show cause notice to the Director of Health Services, Government of West Bengal, as to why this court should not take appropriate action in the matter. Court expects that on the returnable date, the Director of Health Services would file his affidavit and place on record the state of affairs and the rules and regulations, which govern the subject. Show cause notice be served through Collector/District Magistrate, Kolkata..."

In the same case, interim order, dated 14-12-2010, the same bench of Calcutta High Court directed the following to the Director of Health Services, Government of West Bengal:

"1. Post-mortem examination must be done within a few hours of receiving the dead body.

2. The Post-mortem Report must be sent to the Investigating Agency then and there.

3. Viscera must be handed over to the Investigating Agency immediately thereafter."

I. Problems in determining Age of Victims in Medico-legal Cases

In **Kamal Kishore** v. **State of H.P**. (2000) Cri.L.J. 229 (SC), where the **age of rape victim** was fixed by the doctor without conducting **ossification test** or other pathological test, just only relying on clinical examination, the Hon'ble Supreme Court held that assessment of age so made was on fragile premises. In **Hiralal** v. **State of**

Haryana, 1994 Cri.L.J. 2471 (P&H), **medical opinion without ossification test regarding age is of no consequence**. In **Chidder Ram** v. **State,** 1992 Cri.L.J. 4073 (Del), where the judicial observation regarding age determination by ossification test was to the effect that age may vary by two years on either side. In **Taimu Ali and Others** v. **the State of Assam**, 1977 Cri.L.J., NOC 243 Gau - Age can be ascertained from: (i) teeth, (ii) ossification of bones, (iii) height and weight, (iv) other misc. science.

However, little reliance can be attached on individual test. But taken together, they may offer a fairly reliable means of estimating the age of the person. Thus, if **all the epiphysis are found to be united**, that would mean that the person is above **25 years**.

Therefore, it is expected from the medical expert that teeth, ossification, height and length, etc. should be mentioned in Age Determination Report with limiting range.

J. Difference between Medico-legal Autopsy Report and Medical Expert's Opinion

In **Ajab Singh** v. **State of U.P**. AIR 2000 SC 3421, where the Medical Expert of Jail was of the opinion that the death was due to jaundice and liver failure in a case of death in Judicial custody, but the medico-legal autopsy conducted by a Panel of Doctors opined that the death was due to shock and haemorrhage on the basis of the following injuries found on the body:

- Multiple **contusions** in an area of 18 cm. × 7 cm. on back of right waist and hand.
- **Contusion** measuring 6 cm. × 4 cm. on medical aspect of right ankle joint.
- **Contusion** measuring 5 cm. × 3 cm. on medical aspect of left ankle joint.
- **Multiple contusions** in an area of 18 cm. × 7 cm. on back of left forearm extending up to left hand.
- Traumatic swelling measuring 25 cm. × 20 cm. on front abdomen.

All the above-mentioned injuries were opined to be in nature of ante-mortem.

Expressing their strong disapproved of the report of Medical Expert of the Jail, the Hon'ble Supreme Court ordered CBI investigation to unearth truth in this matter.

In **Tej Prakash** v. **State of Haryana,** 1996 SCC (Cri) 412, it was observed:

> *"A dead body was examined by a **Board of three Doctors**, two of whom opined death due to **strangulation** on account of fracture of hyoid bone in the process of lifting the body from the well. The court observed:*
>
> *"Dr. Bhutani (PW-9) stated that in this case, it is possible to rule out the possibility of death by drowning because of the presence of injuries on the person of the deceased as described. If the injuries as described on the deceased were absent, there was a rare possibility that it might not have been impossible to determine whether death was on account of drowning. In view of this categorical statement on observation made by the witness that possibility of hyoid bone fracturing in the process of dead body being taken out does not in any way weaken prosecution case. This was only his subjective opinion and does not run counter to the objective part of the Post-mortem Report, namely, that the death was caused due to fracture of hyoid bone and the said injury was ante-mortem in nature. None of the symptoms, which attached to death by drowning, e.g., water in lungs or in the stomach, were present and Dr. J.L. Bhutani (PW-9), in his Examination-in-Chief had categorically stated that the fracture of the hyoid bone was ante-mortem in nature and this corroborates the evidence of Dr. K.C. Jain (PW-1) as well as the Post-mortem Report."*

K. Conflict between Post-mortem Examination and Forensic Science Laboratory Report

In **Mangat Ram** v. **State (Delhi Admn.),** 1988 (I) Crimes 998 (Del) : During medico-legal autopsy of the deceased, the doctor, who conducted the same, found that vagina was torn along with symptoms of asphyxia, on the basis of which the doctor opined that deceased died due to strangulation after sexual intercourse. But in this case, according to the request of the SHO, during

autopsy necessary samples, including viscera was preserved and the laboratory examination of the same confirmed the presence of **cyanide**. However, it was not proved that the accused administered poison. **Benefit of doubt** was awarded to the appellant. It underlines the need to reconcile the observation of the Medico-legal Expert with the Expert Examination Report of the Forensic Scientist in order to deny undue benefit to the accused/suspects.

In case of **Smt. Karpai** v. **State (Delhi Admn.),** Cri. App. No. 72/1994 decided on 3-7-2009, where the doctor conducted post-mortem examination, Dr. R.K. Barua (PW-19) that the deceased Murugan died due to carbamet poisoning, but the report from CFSL indicated that the viscera and the blood sample tested positive for active constituents of **Kaner.**

In this case, where **Kaner** is a botanical poison, but carbonates are the salts and esters of carbonic acid.

This discrepancy led to the acquittal of Smt. Katpai by the Hon'ble Delhi High Court because of lack of positive and unambiguous evidence connecting the accused with the cause of death.

In the case of **Court on its Own Motion** v. **State (Delhi Admn.),** 1994(3) Crimes 13(Del) regarding **discrepancies** between post-mortem findings and FSL findings at para 9, Hon'ble Judge R.L. Gupta of Delhi High Court made the following observation:

> *"Now, it seems rather strange that the doctor conducting post-mortem examination found symptoms of recent sexual intercourse upon the dead body of Bina. While the report of CFSL says that no reaction was found regarding the presence of semen or crime ash material lifted from the clothes, buttock and thigh of Bina. It is very difficult to reconcile these two facts, viewed in the background of the manner in which the investigation has been carried out in this case by the local police right from day one, I am of the view that all these facts require a detailed investigation. My prima facie conclusion is that the conduct of the local police is not free from blame and the investigation has not been fair."*

In the said case, the Hon'ble Judge ordered reinvestigation of the case by D.C.P. (Crimes) or any officer not less than the rank of Addl. D.C.P. under the supervision of D.C.P. (Crimes). Furthermore, at para 13, the court expressed the following view:

> *"If necessary, the dead body of Bina can also be exhumed for taking the investigation to a logical end."*

Therefore, **differences** between Medico-legal Autopsy Report and Forensic Science Laboratory Report must be reconciled by further investigation and by consulting the Medico-legal and Forensic Expert. But for the same, the consequences are going to be fatal for the success of the prosecution case in the court. It may be seen that the irreconcilable findings of Medico-legal Expert and the Forensic Science Laboratory has not only led to acquittal of the case, but has also earned strictures of the court on police investigation.

L. Miscellaneous Problems

The success of detection of a criminal case during investigation and during trial also depends upon some other factors, besides those discussed in the preceding paras. Some such problems encountered by the police and prosecution are discussed in the succeeding para.

(i) **Hostile witness**

Importance of hostile witness has been highlighted by the Allahabad High Court in the case - **Jamuna Nishad** v. **State of U.P.** Criminal Misc. Bail application No. 21862 of 2008 decided on 9-9.2008, where the court was of the view that–

"The record of this bail application further indicates that the applicant had a criminal history. He was tried on many occasions and the judgements, which have been appended by the applicant himself, clearly indicate that all those cases landed up in acquittal, because either the witness turned hostile or the case was forced to compromise."

It can be seen that despite a series of cases, the accused could secure acquittal in all on the basis of witnesses turning hostile. This fact, the accused, has been using to his advantage in subsequent cases to get bail from the courts and acquittal as well.

According to Hon'ble Supreme Court of India in **Satpal** v. **State (Delhi Admn.**), AIR

1976 SC 303, a **hostile witness is one who is not desirous of telling the truth at the instance of party calling him**.

In **Sehja Ram & Anr**. v. **State of H.P.,** 1985(I) Crimes 77(HP) [Cri-App. No. 51 of 1981, decided on 13-8-1984] when all the eyewitness have refused to support the prosecution stand, the charge against the accused would certainly be not stated to have been established beyond doubt, so as to justify his conviction.

It has generally been observed that eyewitness turned hostile, but it is true that sometime **scientific or medical witnesses** may also turn hostile:

In **Mohd. Jahangir Patham** v. **State of Gujarat**, 1995 Cri.L.J. 671 (Guj) (DB)– The public witness did not support the prosecution case that **charas** was seized from the possession of the accused by the Investigating Police Officer. Though, the report of the public analyst disclosed that the sample analyzed was **charas,** but it was **not established that the article seized was sent to the Public Analyst.** Therefore, the conviction was set aside.

In **S. Krishna** v. **State**, 1998 Cri.L.J. 785 (Kar), where the doctor, who examined the prosecutrix, endorsed the certificate of commission of rape on the victim, but he tried to take side with the accused. The court, taking a serious view of this fact, particularly when the same was a Government Doctor, considered the act of the doctor as nothing short of **perjury**. But, this fact does not necessarily prove fatal to the prosecution. The court recommended **disciplinary action** against the concerned doctor observing that the court cannot take a lenient view, particularly of situations, where heinous offences involving sexual assaults on minor take place, and the very medical authorities, which should be instrumental in assisting the administration of criminal justice in bringing such persons to book, are found to join hands with the culprits and subvert due process of law. His Lordship Saldanha, J. of Karnataka High Court made the following observation at para 9:

*"...We need to observe here that the oral evidence of Dr. Rajarathnam (PW-3), is more than unsatisfactory and we have no hesitation in holding that he was certainly approached. Despite the fact that he has been treated as a **hostile witness** and cross-examined, he has tried to side with the accused and we take a serious view of this fact, particularly since the man was a Government Doctor. It is unfortunate that a professional, while dealing with a serious case of the present type, has attempted to give evidence, which is nothing short of **perjury**. But, this fact does not necessarily prove fatal to the prosecution. We do recommend that the concerned authorities take appropriate **disciplinary action** against the concerned doctor after affording him a reasonable opportunity to show cause, because this court cannot take a lenient view, particularly of situations, where heinous offences involving sexual assaults on minors take place, and the very medical authorities, which should be instrumental in assisting the administration of justice in bringing such persons to book, are found to join hands with the culprits and subvert the due process of law."*

In **The State** v. **B.K. Pal Choudhury**, 1959 Cri.L.J. 1147, His Lordship Deka, J. of Gauhati High Court at para 6 made the following observation:

"While dealing with the evidence in the case, it appeared to the court that there was a reasonable and probable cause to hold that **the Civil Surgeon** Mr. B.K. Pal Choudhury **had intentionally lied while deposing in the committing court** as to the marks and symptoms on the girl as to alleged violence on her. The court accordingly directed notice to be issued on him to show cause as to why a **complaint for commission of an offence under Section 193, IPC** should not be filed against him as provided under Section 476 or 476-A, Cr.P.C., for intentionally giving false evidence at a certain stage of a judicial proceeding This order was passed the day the two connected appeals were disposed of by this court."

(ii) **Incompetence of expert witness**

Slightest deviation from honest labour by an Expert may bring him the charge

of incompetence and even sometimes of demonstrable corruption, rendering him unworthy of credit (1980 Jab LJ 250). In the same way, Young, J. of **Allahabad High Court in Happu** v. **Emperor**, AIR 1933 All 837, held that made the following comments at para 10:

"…The Chemical Examiner and his Assistant, both being human, are liable to err, especially in such a delicate operation as the Marsh-Berzelius process. There is not in this case the slightest allegation against the Chemical Examiner, but it is equally possible that these privileged persons might be half blind, incompetent, or even corrupt. I take judicial notice of the fact that an enquiry is not taking place in India as to whether a Chemical Examiner has made a false report…"

Same comment may also be found in AIR 1949 Nag 66. It is very interesting to note that the case, AIR 1933 All 837 was cited in the **25th Report of Law Commission of India** at page 12, Appendix IV, September 1963.

(iii) **Recording of dying declaration without fitness certificate from doctor**

In **Vasanta** v. **State of Maharashtra**, 2008(I) Mh.L.J. (Cri), B.P. Dharmandhikari, J. made the following observation:

*"Thus, again this **dying declaration** shows that PW-4, the **Executive Magistrate**, has not obtained any **fitness certificate from the doctor**. He only states that doctor gave him permission for recording dying declaration. He himself does not say that he put any question to Seema to ascertain her fitness and to find out whether she was in a fit condition to give dying declaration. On the contrary, he has tried to state that doctor has made endorsement on said dying declaration as **'Seen'** but later on, he pointed out that it was by S.D.P.O. and corrected himself immediately. In cross-examination, he has stated that Seema was groaning, obviously due to pain though initially he denied it. He also stated that she was unconscious. This evidence along with the fact that there **is no verification of fitness of the deceased** Seema either by him or by doctor clearly casts a serious doubt about the entire process of recording of dying declaration. Stand of witness that doctor gave him permission to record dying declaration shows that he was very much aware of such condition and its importance. Ext. 23, which required this witness to record Seema's dying declaration mentions the fact to stove flaring up suddenly and Seema sustaining 100% burn injuries. If PW-4 had received Ext. 23, it was necessary for him to obtain fitness certificate from doctor before recording dying declaration. However, he has not done so. Ext. 23 is obviously prepared after receipt of Ext. 29, because it mentions the same fact. It was also prepared before alleged dying declaration recorded by PW-5-Bala otherwise the language of Ext. 23 would have been different and PW-5-Bala would have mentioned in it that Seema was burnt by her husband as per information gathered by him.*

*The information (Ext. 29) clearly mentions that Seema was **not fit for giving statement** and she had sustained **100% burn injuries**. In view of this position, it was obligatory on the part of PW-4 and PW-5 to obtain **fitness certificate of the deceased Seema before recording of her dying declaration**. They ought to have mentioned the said verification and satisfaction in the respective dying declarations recorded by them. The evidence of PW-4-Dhanraj shows totally unsatisfactory state of affair in this respect. Neither he himself has taken any trouble to find out whether Seema was fit to give her dying declaration nor did he obtain such certificate from doctor. His cross-examination shows that Seema was in pain, groaning and was also unconscious. **In view of this position** of **dying declaration recorded** by PW-4 at Ext. 24 **cannot be accepted.**"*

(iv) **When recovery of crime exhibits remains unproved**

In **Kailash** v. **State of M.P.,** 2007(4) M. P. L. J. 324, Sheela Sharma, J. made the following observation:

*"Another circumstance against the appellant as alleged by the prosecution and as relied upon by the Trial Court is that **recovery***

of bloodstained clothes *- shirt, baniyan and underwear from the accused, who was wearing these clothes at the time of incident. The seizure memo of these clothes is found along with the charge-sheet. But,* ***no witness has proved the seizure memo****. This seizure memo is alleged to have been prepared by the ASI M.S. Rawat and the two independent witnesses of the seizure memo are Phool Singh and Vijay Singh. But, all these witnesses have not been examined by the prosecution. ASI M.S. Rawat is said to be dead but S.D.O.P. Santosh Gaur (PW-11) has been examined, who could have proved at least the signature of M.S. Rawat in the seizure memo. But, even he has not stated anything about the recovery of these clothes from the accused. Thus, recovery of these clothes has remained unproved.*

It is pertinent to mention that at the time of examination of the witnesses before the Trial Court, the alleged seized clothes were neither produced before the witness nor exhibited by the prosecution. According to prosecution, when the accused was sent for medical examination, Dr. Ravindra Chaudhery (PW-7) has seized the pant of the accused and handed over it along with sealed packets of slides to the police. But, Dr. Ravindra Chaudhery (PW-7) has nowhere stated in his statement before the Trial Court that he got recovered the pant of the accused and handed over it to the police. Even the alleged seized pant has not been produced at the time of examination by the said doctor."

Note: Regarding identity of the signature of a person by another person, who is acquainted with the handwriting of the same, in **Rameshwar Prasad Srivastava** v. **State of U.P., 1984** Cri.L.J. 996 (All), a Pharmacist, who was acquitted with the handwriting of the doctor, proved the signature of the same doctor.

(v) **Delayed despatch of information to police regarding admission of medico-legal case in hospital**

In **Dr. (Smt.) K.K. Patnayak and others** v. **State of M.P**., 1999 Cri.L.J. 491 (M.P.), where the doctors informed the police about the admission of a burn case patient in a **abnormally delayed period,** i.e. 6 days after admission to hospital, the court held that **it may have been a statutory a moral duty or even a duty according to rules** for these doctors to inform the police about the admission of the burn patient, **but non-information will not amount to causing disappearance of offence**.

(vi) **Refusal to treat the victims of medico-legal cases**

In **Rajendra** v. **State** 1993 (3) Crimes 974, PW-4, who was by profession a doctor refused to treat Pappathi because of this being a medico-legal case. This incident was highly criticized by Thangamani, J. of Madras High Court at para 31:

"Before parting, we would like to place on record ***our disapproval of the conduct of PW-4 doctor who has expressed his inability to render any medical aid when he was called upon to do so for deceased Pappathi when she was lingering for life****. It is admissible in cross-examination that* ***because it was a medico-legal case****, he did not treat Pappathi."*

But, in **Paramanand Katara** v. **Union of India,** AIR 1989 SC 2039, the Hon'ble Supreme Court of India held that–

*"****Every injured citizen brought for medical treatment should instantaneously be given medical aid to preserve life and, thereafter, the procedural Criminal Law should be allowed to operate in order to avoid negligent death****. There is no legal impediment for a medical professional when he is called upon or requested to attend to an injured person needing his medical assistance immediately.* ***The effort to save the person should be the top priority not only of the medical professional, but even of the police or any other citizen, who happens to be connected with the*** **matter or who** ***happens to notice such an incident or a situation****... preservation of human life is of paramount importance. That is an account of the fact that once life is lost, the* ***status quo ante*** *cannot be restored as resurrection is beyond the capacity of man. The patient whether he be an innocent person or be a criminal liable to punishment under the laws of society, it is the obligation of those*

who are incharge of heath of community to preserve life, so that the innocent may be protected and the guilty may be punished."

(vii) **Language to be used by Expert while deposing at the Court of Law**

Core group on Forensic Science established by N.H.R.C. on their report–

"The State-of-the-art Forensic Sciences for Better Criminal Justice" at page 42 under para 4.2 under the heading 'Suggestion' for legal status to Forensic Sciences commented that–

"**The job of a Forensic Expert is only half done after the scientific tests have been completed and the written report is submitted. The other half is to present the results of the texts in a form that is admissible in the Courts of Law in a manner that is understandable by the Judiciary**."

Such comment clearly indicates the need for knowledge of Law, Criminology, legal drafting and convincing of the fact, are necessary during Expert work, whether Medico-legal Expert or Forensic Expert.

Core group on Forensic Science established by N.H.R.C. in their report–

"The State-of-the-art Forensic Sciences for Better Criminal Justice at page 2 mentioned, today, neither the impact of the Forensic Science is adequately felt at the national level nor the Forensic Scientists have a sense of pride in their profession, as they have not been able to make a big dent in the Criminal Justice Delivery System of the country."

The Nagpur High Court and also some other High Courts deprecated the attempt to cloud a simple issue in a deluge of scientific words, which no ordinary Juror would be able to understand - 50 Cri.L.J. 184; AIR 1948 Nag 66: 1952 Cri.L.J. 1012(Cal).

Therefore, it is expected from an Expert that he should use **simple language** as well as use of **referred cases** in support of his findings, because the persons, who will evaluate his findings, are not technical experts.

(viii) **Entering into the domain of Judiciary**

It has been observed from the case laws that sometimes, Expert had unnecessarily entered into the domain of Judiciary, which was highly criticized by the Judiciary. In this regard, example can be drawn from–

- In **Baswantrao Bajirao** v. **Emperor,** 1949 Cri.L.J. 181 at para 9, the court said:

  "That a medical witness, who considers it unnecessary to examine a person, however sane at the moment, for suspected lunacy is not of much value."

  In this case, Dr. Roy has attempted to substitute his judgement for that of the court and that of course is not permissible. The question whether in given circumstances, a man was sane or insane is for the court to decide. An Expert can only furnish a court with data from which insanity can be inferred. It is beside the point whether in the opinion of the doctor the man was medically insane. Even that would be a dangerous conclusion on the slender data on which Dr. Roy proceeded but, however, that may be what we have to decide is whether the man was legally insane and there, at bottom, the question is a simple and commonsense one, which ordinary Jurors can easily comprehend. I do not minimize the value of Expert evidence in these cases, but I deprecate the attempt to cloud a simple issue in a deluge of scientific words, which no ordinary Juror would be able to understand. Even though cases of this type are tried without a Jury in this Province, the law is grounded on the assumption that the issues are ones, which "twelve good men and true" can comprehend and answer.

- In **Anant Chintaman Lagu** v. **State of Bombay,** AIR 1960 SC 500, 1960 SCR (2) 460, the Apex Court said:

  "…To rely upon the findings of the medical man, who conducted the post-mortem and of the chemical analyzer as decisive of the matter, is to render the

other evidence entirely fruitless. While the circumstances often speak with unerring certainty, the autopsy and the chemical analysis taken by themselves may be most misleading…"

- In **Majee Taha** v. **State,** 1973 Cri.L.J., 526 at para 10, the court said-

  "…It is not permissible to him (medical witness) to substitute his judgement for that of the court."

  So, it is wise for an Expert to be within his own domain while attending court, otherwise his reputation will drop in front of Judiciary.

(ix) **When the Expert was unable to brief the court about his qualification**

Inability from expert to brief the court about his qualification is always fatal for the side, which called his service. In this regard, example can be referred from the following case law:

- **Raj Kishore Rabidas** v. **The State**, AIR 1969 Cal 321, 1969 Cri.L.J. 860 at para 52, the court observed as:

  "**52.** *Another feature in the deposition of PW-8, who held the post-mortem examination barely 13 hours after the death of the victim is that it mentions that rigor mortis was present all over. But, no information has been vouchsafed to enable the court to ascertain if there was any element of cadaveric rigidity or spasm present in what was being described as rigor mortis. It is well known that cadaveric spasm occurs in cases in which death was immediately preceded by a state of great nervous tension or excitement caused either by terror or struggle. Both struggle and terror and also excitement were implied in prosecution case itself, because PW-2 spoke of shouts Nepal saying, "Bachao, bachao' and he ran after the assailant even after receiving mortal injuries. Indeed,* ***we have no material in evidence if PW-8 Dr. Basak was qualified in medical science to distinguish cadaveric spasm, which is not*** **rigor mortis.** ***In his deposition, besides saying that he is M.O., Police Case Hospital, he does not even say that he is a medical graduate, far less does he mention his qualifications and experience in Anatomy, Physiology or Surgery. The Lawyer for prosecution was not elicited any fact that may show that he is an Expert whose opinion will be admissible in evidence under Section 45 of Evidence Act****. The Learned Trial Judge has completely neglected that absence of evidence on that provable fact. Both of them have assumed too much in favour of prosecution on that essential point of fact. Law does not permit any assumption without evidence on material point of competence of the witness, who offers opinion for consideration against an accused."*

(x) **Quality of Evidence**

Even Apex Court orders also stressed upon quality of evidences in this regard–

- In **Sheelam Ramesh and Another** v. **State of A.P.**, [(1999) 8 SCC], The Apex Court opined:

  "…Courts are concerned with quality and not with quantity of evidence and in a criminal trial, conviction can be based on the sole evidence of a witness if it inspires confidence."

- In **Ramjee Rai** v. **State of Bihar,** 2006 AIR SCW 4816 at para 25, the Supreme Court of India held that–

  "It is now well-setteled that what is necessary for proving the prosecution case is not the quantity but quality of evidence. The court cannot overlook the changes in the value system in the society…"

The illustrative sample of cases discussed in the preceding paras underlines the great importance

and positive use of the scientific aid to the investigation in arriving at truthful conclusion about different aspects of crime. Forensic analysis provides an important chain in establishing *corpus delicti* or the body in the cases of suspicious deaths, homicides and suicides. The Police investigation, the Forensic Scientist and the Medico-legal Experts have to play the main role in enquiring into the facts and circumstances leading to the death of a person under investigation. To fulfil their role effectively, all of them should have fair degree of understanding of the Criminal Law and Procedure as well the Forensic Science, whose application can help the cause of investigation spectacularly.

Improper scientific knowledge with the I.O., the first respondent to the crime coupled with improper handling of scene of crime, may either contaminate the samples required to be tested or destroy the evidentiary value, which could be obtained on proper lifting, sealing, forwarding to the Expert/Laboratory for examination. **Therefore, association of Forensic Expert with the police investigation right from the beginning and their effective liaisioning with the Medico-legal Expert can contribute very significantly and sometime decisively, to the solving of the crime.** The coordination and cooperation among the Police, Forensic Scientist and Medico-legal Expert in criminal investigation is the key to the qualitative and quantitative improvement in criminal investigation. Therefore, any strategy to improve quality of investigation must include this concept of effective cooperation and coordination among Forensic Scientists, Medico-legal Experts and Police as an essential element.

Need for Audit

After critically examining the above-stated grounds, it can be seen that there is essential need to **audit** the role of Police, Forensic Science and Medical wings with an object to ascertaining their role in those cases where prosecution has failed to prove the guilt of the accused chargesheeted in a court. This audit process can be done by examining FIR, Inquest Report, Charge-sheet, Post-mortem Report, FSL Report, Medico-legal Reports, deposition of different witnesses during Examination-in-Chief and in cross-examination with a perpendicular approach along with the Trial Court judgement to find out basis for adverse comments. The total process may be conducted on different points, which will help the audit to find out where the fault was found to exist and which damaged the cause of prosecution. This process will not only be helpful to find out the fault, it will also increase the conviction rate especially if such process continues in those States where conviction rate is relatively low.

The notable points, which may be relevant for this proposed process of audit for Police and Forensic Experts, are described below:

A. **Police:**

(i) Any complaint relating to **delay** in registration of crime

(ii) **Discrepancy** in chain of custody.

(iii) **Date** of collection of physical evidence, **date** of submission of the same to the laboratory.

(iv) If there is any **excessive delay**, the reason for the same.

(v) Whether the reference of AIR 1979 SC 1791 was cited in the Court of Law or not for speedy judicial permission or not?

(vi) **Condition** of the malkhana where physical exhibits were kept, including pest & rat control.

(vii) Any incident of **mismanagement** of physical evidence or not?

(viii) Any **discrepancy** in FIR or charge-sheet.

(ix) Total No. of **prosecution witnesses.**

(x) No. of prosecution witnesses **examined.**

(xi) If there is any difference between (ix) and (x), what are the reasons for the same?

(xii) Any evidence regarding **haphazard investigation**.

(xiii) **Identification** of crime exhibits by the PWs whether right or wrong?

(xiv) **Non-production** of important witnesses or report(s) during trial and reasons therefor.

(xv) Crime scene **photography** and application of **reference scale** for the same.

(xvi) Noting of all important **features** of a dead body for identification.

(xvii) Violation of provisions of Police Manual/Police Regulations.

(xviii) No. of witnesses turned **hostile**, and reason for the same.

(xix) **Annual grant** received for infrastructure development and extent of its utilization.

(xx) **Utilization** of annual grant and its impact on qualitative & quantitative development in investigation.

(xxi) Need of **scientific and legal assistance** versus **actual facility** availability thereof.

(xxii) **Course contents** of police training and their adequacy vis-à-vis present need.

(xxiii) Any previous record of **incompetence** or **corruption,** etc.

(xxiv) Conduct relating to obtaining fitness certificate to make statement of dying declaration.

(xxv) Whether **all necessary steps** were adopted to ensure the fair administration of criminal justice or not?

B. **Forensic Medicine:**

(i) Date and time of **receipt** of dead body, and date and time of **post-mortem examination.**

(ii) Any **preliminary** Post-mortem Report or medical report of living was handed over to the police or not.

(iii) It there is any excessive delay in **despatch** of Post-mortem Examination Report, reasons for the same.

(iv) Possibility of **contamination** of exhibits collected during post-mortem examination.

(v) **Difference** between Inquest and Post-mortem Report.

(vi) **Findings of any contradiction** in Post-mortem Report, if yes, how it affects prosecution case. Whether Post-mortem Report version supports the view of authoritative treatise on Forensic Medicine/Science.

(vii) Any **difference** between P.M. Examination Report and FSL Report, reasons for the same.

(viii) **Violation** of provisions of Police Manual/Regulations.

(ix) Nature of reasons shown in Post-mortem Report, whether sufficient or insufficient for prosecution version?

(x) Application of **photography** using **reference scale** during post-mortem

(xi) Any **contradiction** of statement between Examination-in-Chief and cross-examination.

(xii) Submission of necessary **data**.

(xiii) Annual **grant** received versus extent of **utilization.**

(xiv) **Utilization** amount of annual grant versus **Infrastructure** development.

(xv) Infrastructure development versus competency development.

(xvi) Whether facilities for **tests** essentially to be done for the Expert examination are available or not? It not, then is it within the financial limit of annual grant or not?

(xvii) Current forensic medicine **course content** of M.B.,B.S. versus actual Human Resource Development.

(xviii) Date and time of issuing **fitness certificate** for recording of dying declaration.

(xix) Whether **plan** for infrastructure development submitted to bridge the deficiency gap?

(xx) Any previous history of **corruption** or **professional incompetence**.

(xxi) Whether the dead body, when reached for post-mortem, was **sealed** or not?

(xxii) Any Government order regarding **speedy disposal** of Post-mortem Reports.

(xxiii) Any incident of improper explanation of wound and mortal object.

(xxiv) Whether **all necessary steps** were adopted to ensure the fair administration of criminal justice or not?

C. **Forensic Science**:

(i) Date of **receipt** of sample.

(ii) Whether the **seal** of the exhibits when received were intact or not? Submission of necessary papers?

(iii) Date of **examination** of sample.

(iv) If the examination of exhibits were **delayed**, whether there is any possibility of **false positive results** or not?

(v) Reasons for delayed examination.

(vi) Whether pendency of exhibits is increasing or decreasing?

(vii) If pendency of exhibits has been increasing, whether any **plan** was submitted to the Government for **speedy disposal** of the same or not?

(viii) Any plan for **modernization** of the lab. submitted or not.

(ix) Last five years' **allocation** of grant versus **utilization** (yearwise).

(x) **Utilization** of grant (yearwise) versus **actual infrastructure** development (yearwise).

(xi) **Infrastructure** development versus **output** efficiency & productivity.

(xii) **Age** of the important instruments. If the age is ranging between 5-10 years, whether the **efficiency** of such instruments has been decreasing or not?

(xiii) **In-service Training** versus **capacity-built-up** arrangements.

(xiv) Any incident of **incomplete report**. If yes, what are the reasons for the same?

(xv) Any **gross deficiency** of the experts while deposing in the court at Examination-in-Chief or Cross-examination stage.

(xvi) Difference between **Examination-in-Chief** and **Cross-examination.**

(xvii) Non-production of sufficient **data** with the report, whether it is a habit of the laboratory or not?

(xviii) Whether the Expert used maximum or minimum or optimum **scientific words** during deposition. Is it having any adverse effect on prosecution version?

(xix) Reference of **foreign judgement** or **Indian judgement** cited in support of Expert's test carried out in laboratory or not?

(xx) **Reproducibility** of the test report again and again.

(xxi) Any previous report of criminal activity, contempt of court, corruption or incompetence.

(xxii) Any Government **award** won.

(xxiii) **Qualifications** for recruitment versus type work to be performed.

(xxiv) Whether **all necessary steps** were adopted to ensure the fair administration of criminal justice or not?

The **audit process** proposed above is a suggestive model, which can be discussed at one or more workshops involving all stakeholders in Criminal Justice Delivery System like Police, Prosecutors, Judicial Officers, Correctional Prison Officers, Experts of Forensic Science and Medicine. An agreed to model once evolved can be further discussed for modalities of its application on an ongoing basis. Once it is worked out, it can be prescribed in the syllabus for various functionaries

of Criminal Justice System like Police, Prosecutors, Judicial Officers, Forensic Experts, etc. It can also be used gainfully for **accreditation** of forensic analysis facilities and Forensic Experts in order to **benchmark** the quality of Forensic Services and Forensic Experts. ■

REFERENCES

1. http://indiankanoon.org/doc/1561319/
2. The Indian Police Journal, Vol. LVI-No. 1, January - March, 2009, pp. 70-71
3. www.ncrb.nic.in
4. The Indian Police Journal, Vol. LVI-No. 3, July - September, 2009, pp. 15- 25.
5. www.indiankanoon.org/doc/392387/
6. http://indiankanoon.org/doc/1302451/
7. http://www.kehakiman.gov.my/Judgement/coa/latest/Crpp%2032%20Khairudin%20bin%20Mohd%20Yusuf%20v%20Public%20Prosecutor%20_W-09-54-2004_.pdf
8. Indian Kanoon - http://indiankanoon.org/doc/1578595/
9. http://delhicourts.nic.in/May09/MAHABIR%20SING@MAHAVIR%20SINGH%20VS.%20STATE.pdf
10. Gaur, J.R. & Bhalla v. (2008). "Forensic Anthropology in Crime Investigation & The Administration of Justice", SSBT, ISBN:978-81-903493-2-1, Hb-211.
11. Indian Kanoon - http://indiankanoon.org/doc/469607/
12. http://indiankanoon.org/doc/402230/
13. http://indiankanoon.org/doc/551697/
14. Indian Kanoon - http://indiankanoon.org/doc/1488744/
15. Indian Kanoon - http://indiankanoon.org/doc/812966/
16. http://indiankanoon.org/doc/812966/
17. http://delhicourts.nic.in/Aug07/Shibu%20Soren%20Vs.%20CBI.pdf
18. http://www.indiankanoon.org/doc/137717/
19. http://www.indiankanoon.org/doc/275312/
20. http://news.outlookindia.com/item.aspx?664247
21. http://www.hindu.com/2009/09/04/stories/2009090455901100.htm
22. http://www.wbhealth.gov.in/notice/dhs456.pdf
23. http://www.indiankanoon.org/doc/876617/
24. http://delhicourts.nic.in/Jul09/Karpai%20Vs.%20State.pdf
25. http://webcache.googleusercontent.com/search?q=cache:GDwVv.R5J_sJ:elegalix.allahabadhighcourt.in/elegalix/WebDownloadJudgementDocument.do?method%3DR%26JudgementID%3D152613+Jamuna+Nishad+V.+State+of+U.P.+Criminal+Misc.+Bail+application+No.+21862+of+2008&hl=en&gl=in
26. http://indiankanoon.org/doc/1938653/
27. http://www.indiankanoon.org/doc/1880969/
28. Report of Core Group on Forensic Science (1999). "State-of-the art Forensic Sciences: For Better Criminal Justice", N.H.R.C., New Delhi.
29. http://lawcommissionofindia.nic.in/1-50/Report25.pdf
30. Ezaz Ahmed (1996); "Medical Evidence & Gist on Non-Medical Evidence", Ashoka Law House; Delhi, Hb-24.
31. http://www.indiankanoon.org/doc/820224/
32. http://www.indiankanoon.org/doc/469607/
33. http://www.indiankanoon.org/doc/1813863/
34. http://www.indiankanoon.org/doc/1136935/
35. http://www.indiankanoon.org/doc/1468199/
36. http://www.indiankanoon.org/doc/1812871/

Cyanide: A Versatile Terrorist's Chemical Weapon and its Counteract Preparedness

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Keywords

Terrorism

Chemical Weapons

Hydrogen Cyanide

Cyanogen Chloride

Colour Tests and Head Space Gas Chromatography

Abstract

The terrorist's attack incidents have increased manifolds recently so as to create terror. Lives of innocent people have lost in 9/11 World Trade Center, New York City Attack, 26/11 Bombay Attack, Delhi Bomb Blast cases, Indian Parliament Attack, etc.

Terrorists are using all the latest techniques, equipments and dangerous chemical weapons to make their operation successful and kill large number of people. Domestic or international terrorism involving cyanide has, not diminished yet and it has increased in recent years. The United States has issued a warning that Al-Qaeda, a terrorist outfit, has designed simplest form of chemical dispersal devices fabricated from commonly available materials to asphyxiate victims by generating Hydrogen cyanide (HCN) and Cyanogen chloride (CNCl) gas.

Taking into consideration of warning of cyanide as a terrorist's weapon, this paper discusses various aspects regarding management of such type of disasters and subsequently, analyzing the physical evidences in Forensic Laboratory to link the perpetrator(s).

Introduction

TERRORISM is the systematic use of violence to generate fear for achieving political goals. Establishment of terrorism or State-sponsored terrorism is very common and employed by Governments – or more often, by factions within Governments against Foreign Governments by violent and high-profile attacks, by hijackings, hostage, kidnappings, bombings, suicide bombings and

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by other means, such as chemical weapons where direct Military victory is not possible. Chemical weapons are chemical substances or poisons, which are used intentionally to cause harm or kill a large number of people causing mass destruction as well as to spread panic and fear.

After 9/11 terrorist attack on World Trade Center, The United States issued a warning that Al-Qaeda, a terrorist outfit, has developed **Cyanogen Chloride and Hydrogen Cyanide** gases as chemical weapons which is capable of mass casualties.

After Mumbai 26/11 terrorist attack incident, India has taken stern step to curb the State-sponsored terrorism across the border. The level of preparedness is being increased to deal with the possible chemical terror threat to avert Bhopal gas-type disasters.

In August 2009, The National Disaster Management Authority released its Guidelines for the Management of Chemical (Terrorism) Disaster. NDMA in its guidelines indicated that terrorists may use agricultural chemicals, Chemical Warfare (CW) agents, dual use chemicals, Toxic Industrial Chemicals (TIC), Toxic Industrial Material (TIM), natural gases, petroleum products, other poisonous substances as the chemical agents, etc. to create terror.

The potential of domestic and international terrorism, involving hydrogen cyanide as a Chemical Weapon, has not diminished. Different agencies, i.e. Police, RAW, SPG and Hospitals are likely to prepare for the management of such type of disasters because of Commonwealth Games - 2010, in Delhi. In this scenario, Forensic Science will be the most helpful at crime scene to corroborate the evidence and subsequent laboratory examination for the confirmation of involvement of cyanides in the terrorist attack.

History

Cyanide has a long history of use as a murder weapon and has been used as homicidal, suicidal and genocidal agents. Its abuse goes back to ancient times. Death sentences were carried out by forcing the convicts to eat bitter almonds**.**

In 1815, Gay-hursac named hydrogen cyanide as prussic acid.

During World War II, Germans used hydrogen cyanide, under the name Zyklon B, as a genocidal agent in the extermination of Jews in camps.

In the 1980s, during the Iran-Iraq War, reports have indicated that hydrogen cyanide gas might have been used along with other chemical agents against the inhabitants of the Kurdish city of Halabja in Northern Iraq.

In 1982, Chicago, United States, seven people died after taking pain-relief Tylenol capsules laced with potassium cyanide.

In 1992, the German authorities foiled a neo-Nazi plot to pump hydrogen cyanide into a synagogue. There was also a neo-Nazi plot to use cyanide to murder children in a Jewish Daycare Centre in Dallas, Texas's USA.

On 26th February, 1993, a bomb was detonated at the World Trade Center and was alleged that the bomb contained an unknown amount of sodium cyanide packed with conventional explosives.

In 1994, on New Year eve, cyanide-laced champagne, killed at least nine Russian soldiers, six civilians and 53 were hospitalized in Dushanbe, Tajikistan.

In May 1995, Japan averted a cyanide attack at Tokyo's biggest station by seizing two plastic bags containing half a gallon of sodium cyanide and dil.Sulphuric acid.

In 1996 March, The PKK poisoned water tanks with lethal concentration of potassium cyanide at Turkish Air Force compound in Istanbul. However, these were discovered before any untoward happening.

In 1998-99, in Japan, people were poisoned by beverage containing cyanide.

Cyanides

Cyanide is a fast acting and deadly chemical at relatively low concentrations. It is of Military and terrorist interest hence, can be used as warfare chemical. Military designations for hydrogen cyanide and for cyanogen chloride are AN & CK respectively.

Cyanide exists either in gas form, such as Hydrogen Cyanide (HCN), Cyanogen Chloride

(CNCl), or in salt form, such as Sodium Cyanide (NaCN), Potassium Cyanide (KCN) and naturally occurring Cyanogentic glycosides. Cyanide gas gives "bitter almond" smell.

Hydrogen Cyanide (HCN)

Hydrogen Cyanide (HCN) is a systematic and a cardiac poison. It exists in the form of a colourless gas to yellowish-brown liquid over the temperature range of –14°C to 26°C at atmospheric pressure. It is soluble in water, alcohol and ether. HCN is a weak acid (pKa = 9.2). Aqueous solution of HCN is known as hydrocyanic acid or prussic acid. Cyanide gas is used as a fumigant to exterminate pests and vermin in ships and buildings.

HCN can be synthesized by the Andrussaw process and Degussa process. These processes involve high temperature reaction of ammonia, methane and air over a platinum catalyst and catalysts Pt-Al-Ru.

Andrussaw Process

$$2NH_3 + 2CH_4 + 3O_2 \xrightarrow{1100°C/Pt} 2HCN + 6H_2O$$

Degussa Process

$$CH_4 + NH_3 \xrightarrow{1200°C/Pt\text{-}Al\text{-}Ru} HCN + 3H_2$$

Potassium Cyanide (KCN)

Cyanogen Chloride (CK)

CK is a colourless liquid at atmospheric pressure over the temperature range –6°C to +14°C. It is produced by chlorinating a saturated solution of KCN at 0°C. Cyanogen chloride is heavier and less volatile than HCN. It is more effective at low concentrations. It irritates the eyes and lungs and it also has a delayed toxic effect similar to lung irritant-like phosgene and also has cumulative effect on its victims. It is also used as an insecticide.

Sodium Cyanide (NaCN)

Sodium Cyanide (NaCN) is a highly toxic salt and is produced by treating hydrogen cyanide with sodium hydroxide. It can also be produced by treating formamide with sodium hydroxide.

$$HCN + NaOH \longrightarrow NaCN + H_2O$$

$$HCONH_2 + NaOH \longrightarrow NaCN + 2H_2O$$

The moist NaCN emits small amounts of hydrogen cyanide, which smells like bitter almonds. Sodium cyanide reacts rapidly with strong acids to release hydrogen cyanide. It is soluble in water and gives alkaline reaction and is highly poisonous.

KCN is a highly toxic white crystalline compound. It is highly soluble in water and gives strongly alkaline reaction. It has a corrosive action on mouth, throat and stomach. Due to hydrolysis, the moist solid emits small amounts of hydrogen cyanide, which smells like bitter almonds. KCN is produced by treating hydrogen cyanide with potassium hydroxide, or by treating formamide with potassium hydroxide.

$$HCN + KOH \longrightarrow KCN + H_2O$$

$$HCONH_2 + KOH \longrightarrow KCN + 2H_2O$$

Organic Compounds

Acrylonitrile, acetonitrile and propionitrile are organic compounds having a cyanide (CN) functional group bonded to an alkyl residue and known as aliphatic nitriles.

Cyanohydrins compounds contain a hydroxyl and cyanide functional groups on the same carbon, and release hydrogen cyanide and a carbonyl compound (ketone or aldehyde) on hydrolysis. These compounds are more toxic in comparison to nitriles.

Natural Cyanide (Cyanogentic Glycosides)

Amygdalin, prusasin, dhurrin and linamarin are naturally-occurring cyanogenetic glycosides, which give HCN on hydrolysis.

Amygdalin is found in bitter almonds, apricot seeds, apple seeds, peach, plum pear and apple pits. Emulsion enzyme hydrolyses Amygdalin into glucose, benzaldehyde and HCN.

$$\underset{\text{Amygdalin}}{C_{20}H_{27}NO_{11}} + 2H_2O \xrightarrow{\text{Enzyme emulsion}} \underset{\text{Glucose}}{2C_6H_{12}O_6} + \underset{\text{Benzaldehyde}}{C_6H_5CHO} + \underset{\text{Cyanide}}{HCN}$$

5 to 10 bitter almonds consumption by children and 60 by adults can be deadly to them.

Prunsin is found in cherry laurel and is the primary metabolite of orally administered Amygdalin. Dhurrin is found in sorghum, whereas linamarin is found in Cassava and certain Lima beans. Onset of symptoms after ingestion of Cyanogentic glycoside may be delayed up to 12 hours.

Cyanide Characteristics

- Cyanide can cause physical, psychological and mass casualties.
- It is readily available and can be procured easily from the market.
- It is versatile with respect to how it can be delivered.
- It does not require specialized skills or knowledge for effective use.
- Only 25-50% of population has apparent genetic trait to smell hydrogen cyanide.
- Finally, effective management of moderate-to-severe cyanide poisoning requires specific antidotes that are available typically in short supply. Therefore, the chances of responding effectively to an attack are generally low.

Mechanism

Acute cyanide poisoning reflects cellular hypoxia and its toxicity is due to complex formation with ferric (Fe^{3+}) of "Cytochrome oxidase a-a3" complex of Electron Transport System of the Mitochondrion resulting in stoppage of aerobic respiration, halting ATP production and prevents the cells of body from using oxygen properly consequently, asphyxial death. Cyanide is also reported to alter calcium metabolism and also inhibits multiple enzyme systems.

Possible Terrorist Chemical Device

The terrorist's chemical device may consist of a pierced container or canister, such as large milk container or paint can. The holes in the container would allow the toxic gas to escape. The acidic materials are likely to be in glass bottles or vials. The bottom of the container, around the bottles, would be partially filled with a crystalline solid. The device can be used with or without a detonator. Detonator can be used to break the inner container(s) for releasing the acid and HCN gas will be generated with action of acid on cyanide salt. The device can be placed near air intakes or ventilation systems, in crowded open spaces, or in enclosed spaces. Cyanide gas is most dangerous in enclosed places where the gas is trapped.

Prevention

- First, get fresh air by leaving the area where the cyanide was released. Moving to an area with fresh air is a good way to reduce the possibility of death from exposure to cyanide gas.
- If leaving the cyanide exposed area is not an option, then stay as low to the ground as possible.
- Remove any clothing that has liquid cyanide on it. If possible, keep the clothing in a plastic bag, and seal it and keep this bag inside a second plastic bag.
- Rinse the eyes with clean water for 10 to 15 minutes if they are burning, irritating or vision is blurred.
- Wash any liquid cyanide from the skin thoroughly with soap and water.
- Stay calm. Dial for police help.
- Wait for emergency personnel to arrive.

First-Aid

First-aid treatment should be started immediately.

- A cyanide antidote kit (amyl nitrite, sodium nitrite and sodium thiosulfate) should always be available.
- Oxygen and amyl nitrite can be given by a first responder before medical help arrives.
- Allow victim to inhale amyl nitrite for 15-30 seconds per minute until sodium nitrite and sodium thiosulphate can be administered intravenously.
- In case of conscious person, a new amyl nitrite ampoule should be used every 3 minutes and give oxygen in case of nausea, difficult breathing, dizziness, etc.
- Give oxygen and amyl nitrite by means of a respirator in case of consciousness is impaired by non-responsiveness, slurred speech, confusion, drowsiness or the patient is unconscious, but breathing.
- In case of not breathing, give oxygen and amyl nitrite immediately by means of an artificial respiration.
- Patient should be kept warm and given artificial respiration.
- Patient should be given O_2 inhalation.

Handling

- HCN and its salts have been recognized as a hazardous toxic gas that can be generated by the action of HCL.
- Ventilation equipments and protective clothing must be used. Gas masks with filters containing silver oxide offer effective protection.

  Note: Filters should be changed immediately after exposure.
- Persons working with this hazardous gas should be made aware that skin absorption, ingestion and inhalation are route of entry.
- Person should be trained to recognize the odour of HCN and evacuate the area immediately.
- The residual solutions containing alkali cyanides should be rendered harmless by addition of an excess of sodium hypochlorite.
- Pretreatment antidote should be taken in case of possible cyanide exposure.

Signs & Symptoms

Hydrogen cyanide is a very rapidly acting poison and onset of symptoms depends on dose, route, and duration of exposure. Inhalation of vapours of hydrocyanic acid causes constriction of throat and chest, insensibility and death from respiratory failure. Death is likely within a minute, if concentration is between 2,500-5000mg*min/m^3.

Cyanogen chloride produces the symptoms of cyanide poisoning and lung irritants, hence its toxicity resembles that of $COCl_2$ and HCN. It rapidly acts on the respiratory system's nerve centre after inhalation and produces irritation of

the nose and throat, lacrimation, cough, dyspnea, chest tightness, and ultimately pulmonary oedema. Exposure to 400mg*min/m^3 for 10 min is fatal.

Analysis of Cyanide

Various types of tests, i.e. spot tests, paper tests, chemical tests and Gas Chromatography-head space/GC-Mass-Spectrometry are available for the detection of cyanide. These tests/techniques can be used for qualitative and quantitative estimation of cyanide.

Ferric Thiocyante Test

This test is very simple, rapid and sensitive. The spot test technique is as follows:

- Stir a drop of the test solution with a drop of yellow ammonium sulphide on a watch glass.
- Warm it until a rim of sulphur is formed around the liquid (evaporate to dryness on water bath).
- Add 1-2 drops of dilute hydrochloric acid, and allow it to cool.
- Add 1-2 drops of ferric chloride solution to it.
- Appearance of red colour indicates the presence of cyanide.
- Sensitivity of test is 1μg of cyanide.

Sodium Picrate Test

- Mix the test sample with a small amount of manganese dioxide in a test tube.
- Heat the mixture to dull redness, whilst holding a piece of sodium picrate paper (prepared by dipping the Whatman paper in reagent of 1g picric acid in 10% sodium carbonate solution).
- The yellow colour of the filter paper changes from orange to brown-orange and then to orange red or red in the presence of cyanide.

Ferrous Hydroxide Test

- A piece of filter paper is impregnated with saturated solution of ferrous hydroxide solution and dried.
- The impregnated paper is suspended in the jar containing the suspected material.
- After 30 minutes, the paper is taken out and kept in a porcelain basin containing 5ml of dil.H_2SO_4.
- Appearance of blue colour on test paper indicates the presence of cyanide.

Copper Sulphide Test

- Place a drop of a freshly-prepared copper sulphide suspension on a filter paper or on a spot plate.
- Add a drop of the test solution.
- Brown colour of copper sulphide disappears, which indicates the presence of cyanide. Solution of cyanide readily dissolve copper sulfide forming the colourless tetracyanocuperate (I^-) ions.

$$2CuS\downarrow + 10CN^- \rightarrow 2[Cu(CN)_4]^{3-} + 2S^{2-} + (CN)_2\downarrow$$

- Sensitivity is 2.5 μg of cyanide.

Prussian Blue Test

This is a delicate test and is carried out in the following manner:

- A solution of the cyanide is rendered strongly alkaline with sodium hydroxide solution in a test tube.
- A few millilitres of a freshly-prepared solution of iron (II) sulphate are added [if only traces of cyanide are present, it is better to use a saturated solution of iron (II) sulfate] and the mixture is boiled. Hexacyanoferrate (II) ions are thus formed.
- Acidify with hydrochloric acid in order to neutralize any free alkali, which may be present. A clear solution is obtained.
- Small amount of iron (III) chloride solution is added to it.
- Prussian blue precipitation is obtained.

$$6CN^- + Fe^{2+} \longrightarrow [Fe(CN)_6]^{4-}$$

Hexacyanoferrate (II)

$$3[Fe(CN)_6]^{4-} + 4Fe^{3+} \longrightarrow Fe_4[Fe(CN)_6]_3\downarrow$$

Ferriferrocyanide (Prussian blue)

Crystal Test

Crystal test is simple, rapid and specific for screening purposes. The test is as follows:

- Distillate is taken into a conical flask and a few drops of dil.H_2SO_4 are added to it.
- A drop of silver nitrate solution is placed on a microscopic slide and is inverted immediately over the mouth of flask just after adding the acid into flask.
- The flask is then gently heated on a boiling water bath.
- The drop of silver nitrate solution assumes a white turbidity and appearance of needle-shaped crystals of silver cyanide are observed under a microscope indicates the presence of cyanide.

Gas Chromatography coupled with Head Space

Gas chromatography coupled with head space is a very sensitive method for qualitative and quantitative determination of cyanide in human blood previously stored in refrigerator with 0.1% sodium fluoride as preservative. The method involves the transformation of cyanide into cyanogen chloride by reacting it with Chloramine-T on a filter paper in the space above blood in head space vial. The formed cyanogen chloride is then analyzed by head space gas chromatography with electron-capture detector.

Conditions

Instrument (GC)	GC-HS with Auto system equipped with an electron capture detector
Column	50-metre long CPSIL-19CB, with internal diameter of 0.32mm, film thickness of 1.2um
GC oven temperature	80°C
Carrier gas	Nitrogen, 20psi
Detector	350°C
Head space oven temp	60°C
Needle and transfer line temperature	100°C
Heating time	30 min with shaking of head space vial
Injection time	0.2 min

Conclusion and Discussion

Cyanide is easily accessible in the form of inorganic cyanides, i.e. sodium, potassium, calcium and magnesium salts of cyanide. These compounds are mainly used in photography, electroplating, metal cleaning, removing gold and silver from its ores, jewellery, organic synthesis, paper manufacturing, textiles, insecticides and plastics.

Past records, also make it as a favourable chemical as chemical weapon to create terror among the innocent inhabitants where straight Military action is not possible. Hence, cyanide containing salts can be misused by the terrorists.

Cyanide terrorism attack is a very perilous situation though it can be averted. Police personnel, Doctors, Nurses and Forensic Experts should be made well trained. National Disaster Management Authority of India should strongly deal with such types of chemical attack.

At last, the entire humankind should stand against such dreadful substances, which are a threat to the entire civilization. ■

ACKNOWLEDGEMENT

We would like to thank for the typing work done by Shri Satya Prakash Gupta & Shri V.V. Srinivasu (Chemistry Division).

REFERENCES

1. WHO's "Monographs on International Programme on Chemical Safety".
2. H. Brandenberger & R.A.A. Maes, "Analytical Toxicology for Clinical, Forensic and Pharmaceutical Chemists", Berlin: New York: Degruyter, 1997.
3. Irving Sunshine, "Methodology for Analytical Toxicology".
4. Modi's "Medical Jurisprudence and Toxicology".
5. Clarke's "Analysis of Drugs and Poisons" (3rd Edition), edited by Anthony C. Moffat, M. David Osselton and Brian Widdop, 3rd Edition, Vol. 1.
6. C.K. Pariek's "Medical Jurisprudence and Toxicology".
7. Vogel's "Qualitative Inorganic Analysis", 7th Edition.
8. India, National Disaster Management Guidelines for Management of Chemical (Terrorism) Disaster, August 2009.
9. Nadine Gurr & Benjamin Cole, "The New Face of Terrorism Threat From Weapon of Mass Destruction". (http://books.google.co.in/books)
10. Felby, Soren, "Determination of Cyanide in Blood by Reaction Head-Space Gas Chromatography", Forensic Sci. Med. Pathol., 2009, Vol. 5, pp. 39-43.
11. Chemical terrorism fact sheet (www.bioterrorism.slu.edu)
12. file://localhost/E:/terrorismi/Cyanide%20Wikipedia
13. file://localhost/E:/terrorismi/Articles%20%232706%20,%20Chemical%20Warfare%20Agents%
14. file://localhost/E:/terrorismi/
15. file://localhost/E:/terrorismi/terrorism%20%20Britannica%20Online%20Encyclopedia.mht
16. file://localhost/E:/terrorismi/Scientific
17. file://localhost/E:/terrorismi/Scientific%20Support%20to%20Terrorism%20Investigations%20(Forensic%20Science%20Communications,%20July%201999).mht
18. file://localhost/E:/terrorismi/Weapons%20of%20Mass%20Destruction,%20Science%20&%20Technology
19. file://localhost/E:/terrorismi/Scientific
20. file://localhost/E:/terrorismi/Articles
21. file://localhost/E:/Chemical
22. http://india.foreignpolicyblogs.com/tag/terrorism/by
23. http://www.taxindiaonline.com
24. file://localhost/E:/books/
25. http://news.google.com/newspapers.com
26. http://en.wikipedia.org/wiki/1982_Chicago_Tylenol_murders
27. http://en.wikipedia.org/wiki/File:Birkenau25August1944.jpg
28. file://localhost/E:/hcn/Terrorism%20Information%20-%20Atlantic%20County%20Government.mht
29. www.medicinescomplete.com/mc/clarke
30. http://www.nizkor.org/ftp.cgi/camps/auschwitz/cyanide/cyanide.001
31. http://www.ruf.rice.edu/~bioslabs/studies/mitochondria/mitogradient.html

The Scope of Artificial Intelligence in Forensic Science

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Keywords

Artificial Intelligence (AI)
Crime Scene Reconstruction
Artificial Neural Networks (ANN)
Router Configuration
Remote Sensing
Central Database
Data Recovery
Narco-Analysis

Abstract

The aim of the work is to find better and extensible way to Enhance, Enlarge and Empower (EEE) Forensic Sciences capabilities in each and every field of life not only with the help of present sciences & technologies, but also with the upcoming technologies. One such technology is ARTIFICIAL INTELLIGENCE. As criminals are advancing in their usage of technologies so should we, to keep pace with time and help the society in having timely and accurate judgements for them. Artificial Intelligence is one of the most talked-about subjects among researchers, students and of course non-scientific and non-technical people. Though Artificial Intelligence is always seen as the field of upcoming future but why not Forensic Experts should use it for solving their problems. Artificial Intelligence has a very promising future in every field and aspects of life. Some of these are still to be achieved more or less in some of the countries. The paper discusses about the present and future possible applications of Artificial Intelligence in Forensic Sciences. For example, we can make a better use of Artificial Intelligence in Blood Pattern Recognition & Analysis, Crime Scene Reconstruction, Digital Forensics, Image-processing, Satellite Monitoring, Network & Router Configuration, Narco-Analysis and, of course, Ballistics. Artificial Intelligence has got a vast variety of applications. Starting from the Crime Scene Investigation to the Day of Judgement, this field promises accuracy of result.

> Today's Science fiction is often tomorrow's science fact.
> –*Stephen Hawking*

Introduction

THE word ***'forensic'*** comes from the Latin adjective *forensis*, meaning "of or before the forum". In Roman times, a criminal charge meant presenting the case before a group of public individuals in the forum. That group/forum was responsible for delivering the final judgement, according to the hearing of each suspected or accused person.

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The "*Eureka*" legend of *Archimedes* (287-212 B.C.) can be considered an early use of Forensic Science. He determined that a crown was not completely made up of gold (as it was fraudulently claimed). This conclusion was reached by evaluating the density of the object using measurements of its displacement and its weight, as he was not allowed to damage the crown. *Sherlock Holmes*, the fictional character created by Sir Arthur Conan Doyle in works produced from 1887 to 1915, used Forensic Science as one of his investigating methods.

A normative definition views ***crime*** as deviant behaviour that violates prevailing norms - cultural standards prescribing how humans ought to behave normally. This approach considers the complex realities surrounding the concept of crime and seeks to understand how changing social, political, psychological and economic conditions may affect changing definitions of crime and the form of the legal, law enforcement, and penal responses made by society. While, **Criminology** (from Latin *crīmen*, "accusation"; and Greek *-logia*, "study") is the scientific study of the nature, extent, causes and control of criminal behaviour. Criminological research areas include the incidence and forms of crime as well as its causes and consequences.

Artificial Intelligence (AI) is the intelligence of machines and the branch of computer science, which aims to create it. A system is said to be intelligent that perceives its environment and takes actions, which maximize its chances of success. John McCarthy, who coined the term in 1956, defines it as "the science and engineering of making intelligent machines".

Artificial Neural Networks are those machines capable of recognizing a particular pattern and will take decision that maximizes its chances of success in producing the result.

Definition

The term *neural* network is derived from human brain that is capable of learning from the past experiences. Artificial Neural Network is similar to that functioning of human brain, which has got neuron for its functioning. The first artificial neuron was produced in 1943 by the Neurophysiologist Warren McCulloch and the Logician Walter Pits. But, the technology available at that time, did not allow them to do too much. Unlike conventional computers, Neural Networks take a different approach to problem-solving. Computer follows a set of instructions in order to solve a problem. Unless the specific steps that the computer needs to follow are known, the computer cannot solve the problem. That restricts the problem-solving capability of conventional computers to problems that we already understand and know how to solve. But, computers would be so much more useful if they could do things that we do not exactly know how to do.

Description: Principles & Other Relevant Subjects

An artificial neuron is a device with many inputs and one output. The neuron has two modes of operation: the training mode and the using mode. In the training mode, the neuron can be trained to fire (or not), for particular input patterns. In the using mode, when a taught input pattern is detected at the input, its associated output becomes the current output. If the input pattern does not belong to the taught list of input patterns, the firing rule is used to determine whether to fire or not. A *firing rule* states:

> *"Take a collection of training patterns for a node, some of which cause it to fire (the 1-taught set of patterns) and others, which prevent it from doing so (the 0-taught set). Then, the patterns not in the collection, cause the node to fire if, on comparison, they have more input elements in common with the 'nearest' pattern in the 1-taught set than with the 'nearest' pattern in the 0-taught set. If there is a tie, then the pattern remains in the undefined State."*

For example, a 3-input neuron is taught to output 1 when the input (X1, X2 and X3) is 111 or 101 and to output 0 when the input is 000 or 001. Then, before applying the firing rule, the truth Table is:

X1:		0	0	0	0	1	1	1	1
X2:		0	0	1	1	0	0	1	1
X3:		0	1	0	1	0	1	0	1
OUT:		0	0	0/1	0/1	0/1	1	0/1	1

As an example of the way the firing rule is applied, take the pattern 010. It differs from 000 in 1 element, from 001 in 2 elements, from 101 in 3 elements and from 111 in 2 elements. Therefore, the 'nearest' pattern is 000, which belongs in the 0-taught set. Thus, the firing rule requires that the neuron should not fire when the input is 001. On the other hand, 011 is equally distant from two taught patterns that have different outputs and thus, the output stays undefined (0/1).

Neural networks make use of *memristors* to take decisions on its own.

At the same time, Forensic Science in itself has got six principles:

- Law of Individuality.
- Principle of Exchange.
- Principle of Comparison.
- Principle of Analysis.
- Principle of Probability.
- Law of Progressive Change.

One of the fundamental principles of Forensic Science is "Every Contact Leaves a Trace" as *Principle of Exchange*. This principle not only forms the basis of Forensic Science & Investigation, but also for *AI* in the sense that even a pattern will be enough to identify the suspect and will help us to perform our proceedings from Crime Scene to Courtrooms.

Artificial Neural Network Applications in Forensic Science

ANN and AI will be of great help, if implemented properly in Forensic Science Fields.

Some of its applications will be able to define its vast extent in Forensic World.

- **Crime Scene Reconstruction**

  This system will require some inputs like presence of any object at the crime scene, say dead body or any object like glass piece. After extracting and analyzing each and every aspect of input, it will try to figure out 3 to 4 animated videos on its own and that will be of great help to Forensic Experts as compared to now, which involve manual construction of animated crime scenes.

- **Data Acquisition & Recovery Purposes**

  Generally, Cyber Forensic Experts come across a major problem in analyzing a file, i.e. which file is important, can be decided only after accessing/opening that file. Another problem is that even if the suspect has changed the file extension, say from .doc to .exe, then the above problem becomes very tedious job. To eradicate these two problems, ANN internally analyze the files and will display only that content that is appropriate to Cyber Expert. While data recovery are already available.

- **Forensic Ballistics Division**

  ANN will guide experts, where to search for gunpowder, cartridge case and will compare bullet marks and other evidence from the database itself with the help of image processing without any manual interference.

- **Narco-Analysis & Psychology Division**

  ANN will analyze the activities undergoing the suspect's brain during brain-imaging to conclude whether he is behaving dummy or truly. Even the amount of narco drugs will be decided by ANN after analyzing that what amount of drug will produce the required effect.

- **Cyber Forensics**

  In crimes that are performed over an internet network, ANN will be of great usage, because it will tell us the activities of a web-surfer, who is surfing legally or illegally (will be using proxy servers and will be accumulating enough on-line-traffics over a server to crack it down).

  In investigation matters like phone calls tracing and other activities, Police and Forensic Experts face a political problem. To eradicate this problem also, ANN will decide itself which phone calls to trace and which not through its pattern recognition system through remote sensing and satellite facilities.

Pattern recognition for *Serial Killers* will be easier and will enable Forensic Expert to come to the conclusion very soon enough.

In Wildlife Sanctuaries also, poaching problem would be eradicated. Assuming that each and every species on the verge of extinction should have a nano-transmitter embedded in them that should remain in connection to Forest offices through satellites.

Conclusion: The Future Ahead

Artificial Intelligence has been in use for less than 50 years, yet we are proud that we have achieved a great number of applications and techniques with reference to our field. Still we have to work hard for the well-being of the mankind.

We cannot say that everything is perfect; to some extent, it has got some demerits. As rightly said by George Bernard Shaw: "*Science cannot solve a problem by creating ten more.*" There are some sorts of problems that we should consider before making a proper use of ANN:

- Problems like invasion to the privacy will extend to a common people.
- Manual control will be limited to much less extent as compared to the current scenarios.

Last but not the least, Scientists are working parallel on solutions to the problems that are mentioned above before applying Artificial Neural Networks in Forensic Sciences.

The day is not so far when we will be defining *Forensic Science* in terms of Neural Networks, Artificial Intelligence and Nanotechnology.

We can conclude that ANN can bring a wonderful, positive and Digital revolution (*Intelligent Systems*) into the field of *Forensic Science*, just like we had Green Revolution and White Revolution in our Nation's history. We should bring glory to our Nation and will defeat criminals in every aspect and every condition. As rightly said by a great poet:

"Long way to go before I sleep ..." ■

REFERENCES

1. www.en.wikipedia.org/wiki/neural_networks
2. www.en.wikipedia.org/wiki/artificial_intelligence
3. Richard P. Lipmann, "An Introduction to Computing with Neural Nets" (IEEE ASSP Magazine, April 1987).
4. Alkon, D.L. (1989). "Memory Storage and Neural Systems", Scientific American, July, pp. 42-50.
5. www.doc.ic.ac.uk/~nc'/surprise_96/journal/vol4/cs11/neural.html
6. www.en.wikipedia.org/wiki/artificial_neural_networks
7. Christos Stergiou & Dimitrios Siganos, NEURAL NETWORKS.
8. Bishop, C.M. (1995). "Neural Networks for Pattern Recognition", Oxford University Press.
9. Egmont-Petersen, M., de Ridder, D. & Handels, H. (2002). "Image Processing with Neural Networks - A Review", Pattern Recognition 35.
10. Wasserman, Philip (1993). "Advanced Methods in Neural Computing", Van Nostrand Reinhold, ISBN 0-442-00461-3.
11. Poole, David, Mackworth, Alan & Goebel, Randy (1998). "Computational Intelligence: A Logical Approach", New York: Oxford University Press.
12. Margaret Boden, "Mind as Machine", Oxford University Press, 2006.
13. Computer Network Books.

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Source Identification of the Inks used in Printing of Counterfeit Indian Banknotes

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Keywords

Counterfeit

Security Features

Ink Analysis

HPTLC

Spectral

Superimposition

Abstract

Advancement of technology in the field of computer printers, scanners, photocopiers and digital image system enable even unskilled would-be counterfeiters to produce Indian currency notes that bear at least a superficial resemblance to genuine ones. But, comparison of security features of counterfeit currency with RBI- Issued specimen Indian Banknotes, it is very easy to identify whether it is counterfeit or genuine. Analysis of the ink by High Performance Thin Layer Chromatography (HPTLC) can also reveal the source of ink used for printing the counterfeit currency. In recent case, we received several counterfeit currency notes of Rs. 50/-, 100/-, 500/- and 1000/- denomination and Inkjet cartridges of Inkjet printers. During the process of examination of security features and Ink analysis, we identified that all the currency notes were counterfeit. Among them, Rs. 50/- and 100/- denomination notes were printed from the Inkjet cartridges found at the scene of crime, whereas Rs. 500/- and 1000/- denomination currency notes were printed from the same source of unknown origin.

Introduction

NOW-A-DAYS, crime of counterfeiting currency in India is increasing with rapid rate. The crime of counterfeiting continues to present a potential danger to national economies and financial losses to consumers. Counterfeiters are counterfeiting the money by two means. *First,* by illegal manufacturing of currency notes without authorization using the genuine currency papers and ink, which are easily available globally with perfection up to 80% to 90%. (In such cases, we can also differentiate counterfeit currency from genuine currency notes, but it will be very much tedious for a Forensic Scientist to identify them, because it requires careful examination with minute observations.) *Second,* other means of counterfeiting the currency notes are scanning, photocopying and printing by using sophisticated scanners, printers and photocopiers [Ref. 1].

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Even though, there is advancement in Printing Technology, it is very difficult to counterfeit currency by using Computer Printing Technology. A number of security features distinguish genuine currency from counterfeit ones. One of the most obvious ones is the paper itself. Every variety of national currency is made with a special type of paper. For the counterfeiter, a genuine banknote is a veritable minefield of potential pitfalls, and literally, every square millimetre presents its own challenges. There are watermarks, embedded threads, see-through features, micro-printing, holograms, latent image - seven forms of embossing to facilitate recognition of various denominations by the blind and visually impaired. The printing of currency is also highly complicated, involving various processes at different stages. In addition to Lithography, Letterpress, and sometimes Silk Screening, there is Intaglio, an extremely expensive, technically difficult process in which the surface of the paper is deformed very slightly- another distinctive feature of official currency production [Ref. 2-4].

It is also very much important to identify the source of ink to link the crime exhibits to particular printers and photocopying machines. Several attempts have been made by several workers for analysis of ink. Some of them analyzed different photocopy toners, analyzed dyes used in inks [Ref. 5] and they differentiated different inkjet printer's cartridges by TLC [Ref. 6]. But, it is very much difficult to identify the source of ink used for printing counterfeit currency notes. Because, for differentiation only single difference is sufficient, but if we are concluding that they are from same source, then all features should match.

In this paper, we have described methodology as to how the counterfeit currencies printed by inkjet printers could be differentiated based upon security features. And also, we have analyzed ink cartridges used in the printing of counterfeit currency by HPTLC and spectral superimposition technique.

Experimental

Material and Methods

- ***Reference Standards***

  Indian Currency Banknotes of Rs. 50, 100, 500 and 1000 denomination issued by Reserve Bank of India (RBI), Mumbai.

- ***Exhibits Received***

  Counterfeit currency notes of Rs. 50/-, 100/-, 500/- and 1000/- denomination suspected to be counterfeit and two (02) Inkjet printer cartridges (one is black cartridge another one colour cartridge) received as case exhibits.

- ***Solvents used***

  Ethanol, Methanol and Chloroform are of AR grade and purchased from Qualigens (India).

- ***Apparatus***

  For the chromatographic investigations, a TLC Scanner III with computer system and winCATS software V. 1.4.2 (Camag, Switzerland) was used. ATS4 (Camag) was employed as the application device. The chromatograms were developed in a twin-through chamber (Camag). TLC plates and currency notes were documented by using Reprostar3 documentation system (CAMAG), Aluminium HPTLC plates coated with silica gel 60 F_{254} (10 cm x 10 cm) were obtained from Merck (Germany).

Examination of Security Features

Counterfeit currency Case exhibits along with Specimen Indian currency notes were observed as below:

- ***Physical Observation***

  Paper feels, Intaglio Printing, length and width of the counterfeit currency notes were compared with RBI issued specimen currency banknotes.

- ***Observation under Visible Light***

  Different parameters like Omron features, security thread, serial numbers, RBI seal, Mahatma Gandhi portrait, latent image and micro-printings were examined.

- ***Observation under UV Light (366 nm)***

  Different features like optical fibres, glowing of serial number panel, paper fluorescence, glowing of Omron features and security thread were examined.

- ***Observation under Transmittance Light***

  Security features like Mahatma Gandhi watermark, RBI watermark in the middle of the note and see-through register mark were examined.

Ink Analysis by HPTLC

- ***Sample Preparation***

  Ink from the currency notes of different denominations was washed by soaking them in 100 ml beakers containing ethanol. Whereas, ink from the Inkjet cartridges were extracted by soaking them in ethanol and sonicating for 15 minutes in ultrasonic bath.

- ***Application***

  For HPTLC analysis, samples were applied to the plates as 6 mm bands by spraying with the CAMAG Automatic TLC Sampler 4 (ATS4), enabling a maximum of 6 tracks to be applied to one 10 cm x 10 cm HPTLC plate (distance from lower edge 15 mm, distance from the left side 15 mm, distance between bands 35 mm).

- ***Chromatography***

  HPTLC plates were developed in a 10 cm x 10 cm CAMAG Twin-Trough Chamber (TTC). Using two mobile phases chloroform: methanol (7:3) (solvent system-I) and n-butanol: acetone: water: ammonia (25: 25: 5: 17.5) (solvent system-II). But, in this paper, we have given detail data of TLC analysis by using solvent system-I only. The development distance was 70 mm from the spotting point of the plate and the migration time was approximately 10 minutes.

- ***Evaluation and Documentation***

  Spectral evaluation of each spot was performed by using CAMAG TLC Scanner III by scanning in the wavelength range of 200 nm to 700 nm using Tungsten and Deuterium lamp as source of Visible and UV light respectively. Developed plates were documented by illuminating under UV 254 nm, UV 366 nm and White light using Reprostar3 documentation system (CAMAG).The data obtained were processed with winCATS software, version 1.4.2.

- ***Repeatability***

  Inks analysis was performed several times by HPTLC using solvent system-I to check the repeatability and also to rule out the ambiguity in the HPTLC system.

Results and Discussion

In counterfeit currency examination, it is very important to examine each and every feature with careful observation to ascertain whether it is genuine or counterfeit. In the present study, while analyzing exhibits, we found that texture of the paper is totally different and there is a variation in the length and width of counterfeit currencies. Features observed under visible light, transmittance light and UV 366 nm (*Figs. 1-3*), no security features were consistent with RBI specimen Indian Banknotes of same denominations.

As per analysis of currency note inks are concerned, ethanol was found to be suitable for extraction of ink from the currency notes as well as from the inkjet cartridges. Even though we used two solvent systems, but solvent system-I was found to be suitable for good separation of all the constituents of the ink, and also very short time is required for development of plate, which helps in rapid analysis of samples in short period. Comparison of inks of inkjet cartridges and currency note inks were observed under different sources of light (*Fig. 4*) like visible light, UV 254 nm light and UV 366 nm light. The R_f value and spectra's obtained for different colour bands obtained in chromatogram of inks for different exhibits were observed for comparing the inks of currency notes with inkjet cartridges. The R_f values of different spots obtained in exhibits are mentioned in *Table-1*.

Table 1: Showing the R_f values of different l spots present in the chromatogram obtained for ink of exhibits

Sl. No.	Sample	R_f						
1.	Black colour Inkjet cartridge	0.02	–	0.2	–	–	–	0.8
2.	Colour Inkjet cartridge	0.02	–	–	0.29	–	–	0.8
3.	Rs. 50/- Currency note	0.02	–	0.2	0.29	–	–	0.8
4.	Rs. 100/- Currency note	0.02	–	0.2	0.29	–	–	0.8
5.	Rs. 500/- Currency note	0.02	0.09	0.2	–	0.42	0.64	0.8
6.	Rs. 1000/- Currency note	0.02	0.09	0.2	–	0.42	0.64	0.8

In *Table 1,* it was observed that Rs. 50/- and 100/- denomination currency note ink is having the different bands at R_f 0.02, 0.2, 0.29 and 0.8 respectively. These bands were also present in Black and Colour inkjet cartridges inks. That means these denomination currency notes were printed by the inkjet printers recovered from the scene of crime. Further confirmation was done by superimposition of spectra of these bands (*Fig. 5*). Rs. 500/- and 1000/- denomination currency note inks were having similar band at R_f 0.02 and 0.8, but they do not have the band at R_f 0.29. These were having three additional bands at R_f 0.09, 0.42 and 0.64. Spectra of these three bands of Rs. 500/- and 1000/- denomination currency note inks were superimposed (*Fig. 6*). That means they were printed by the same printer.

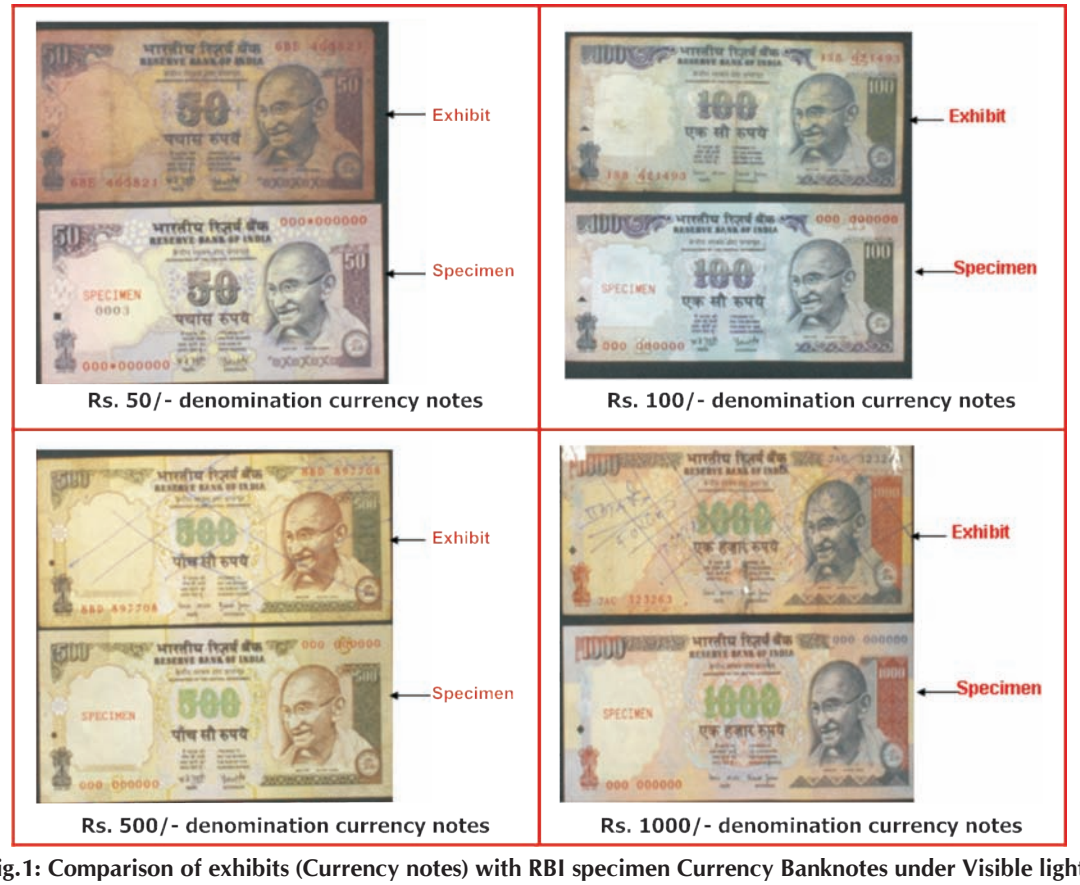

Fig.1: Comparison of exhibits (Currency notes) with RBI specimen Currency Banknotes under Visible light

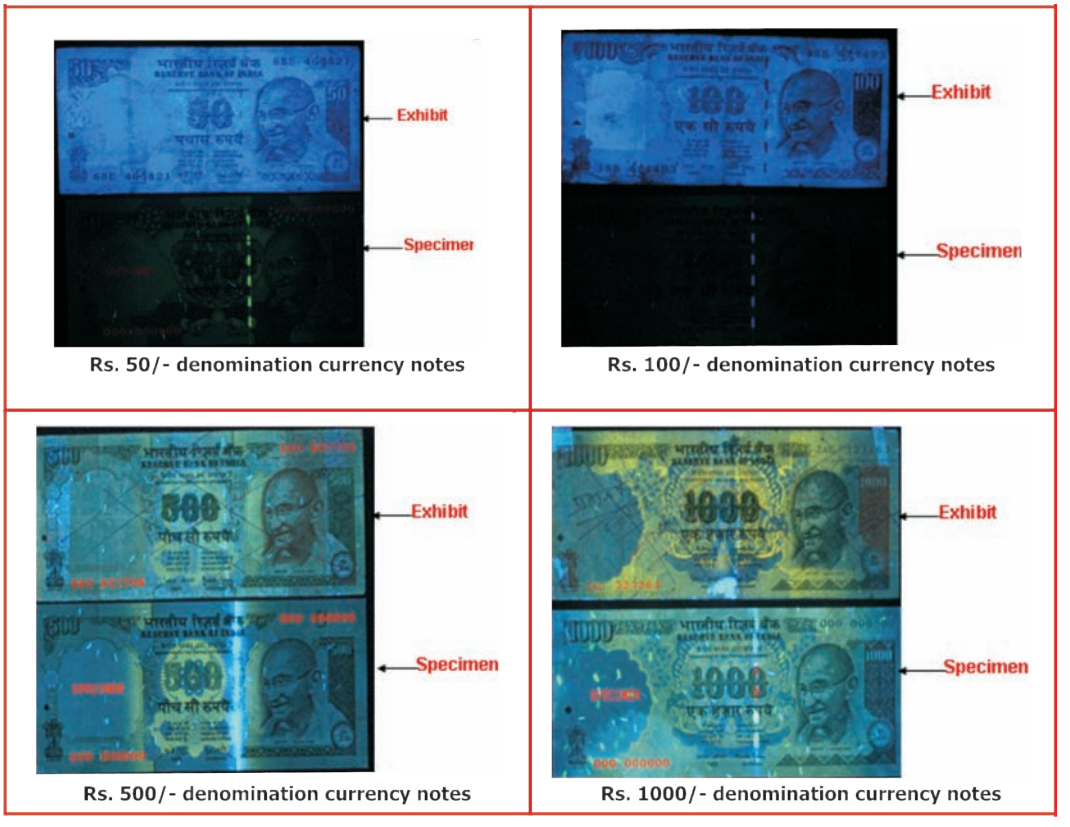

Fig. 2: Comparison of exhibits (Currency notes) with RBI specimen Currency Banknotes under UV 366 nm light

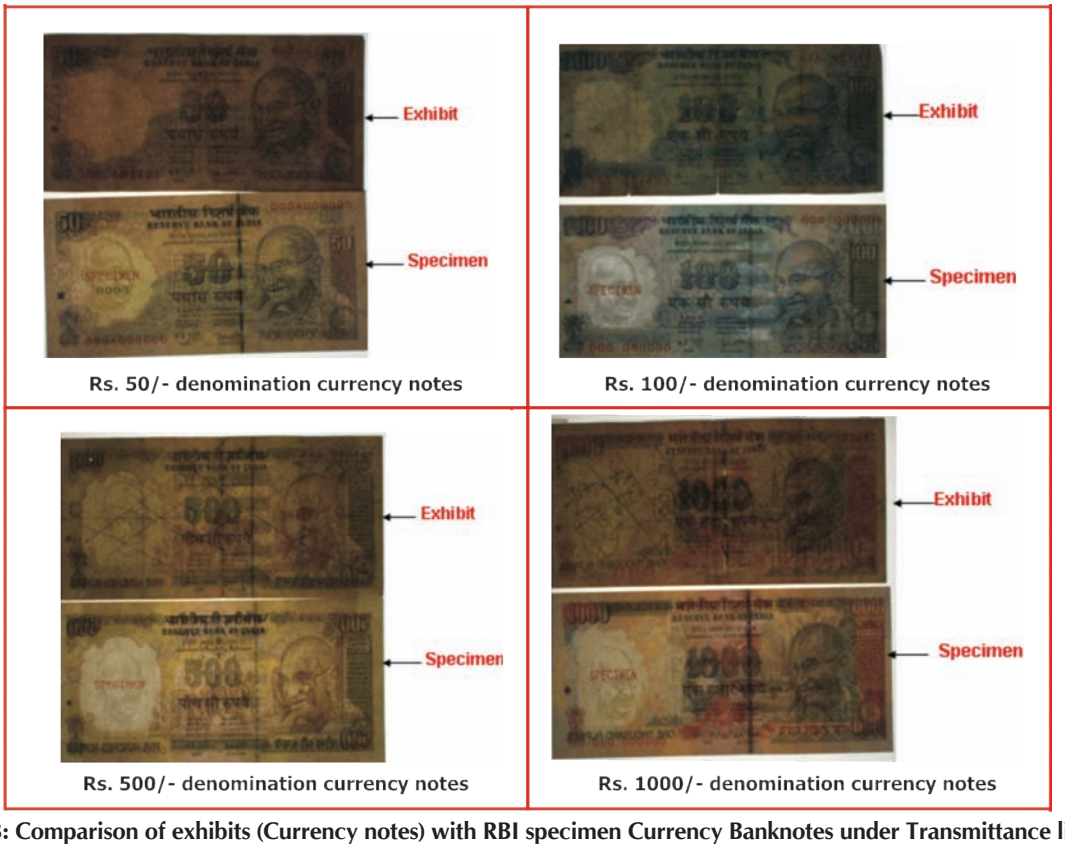

Fig. 3: Comparison of exhibits (Currency notes) with RBI specimen Currency Banknotes under Transmittance light

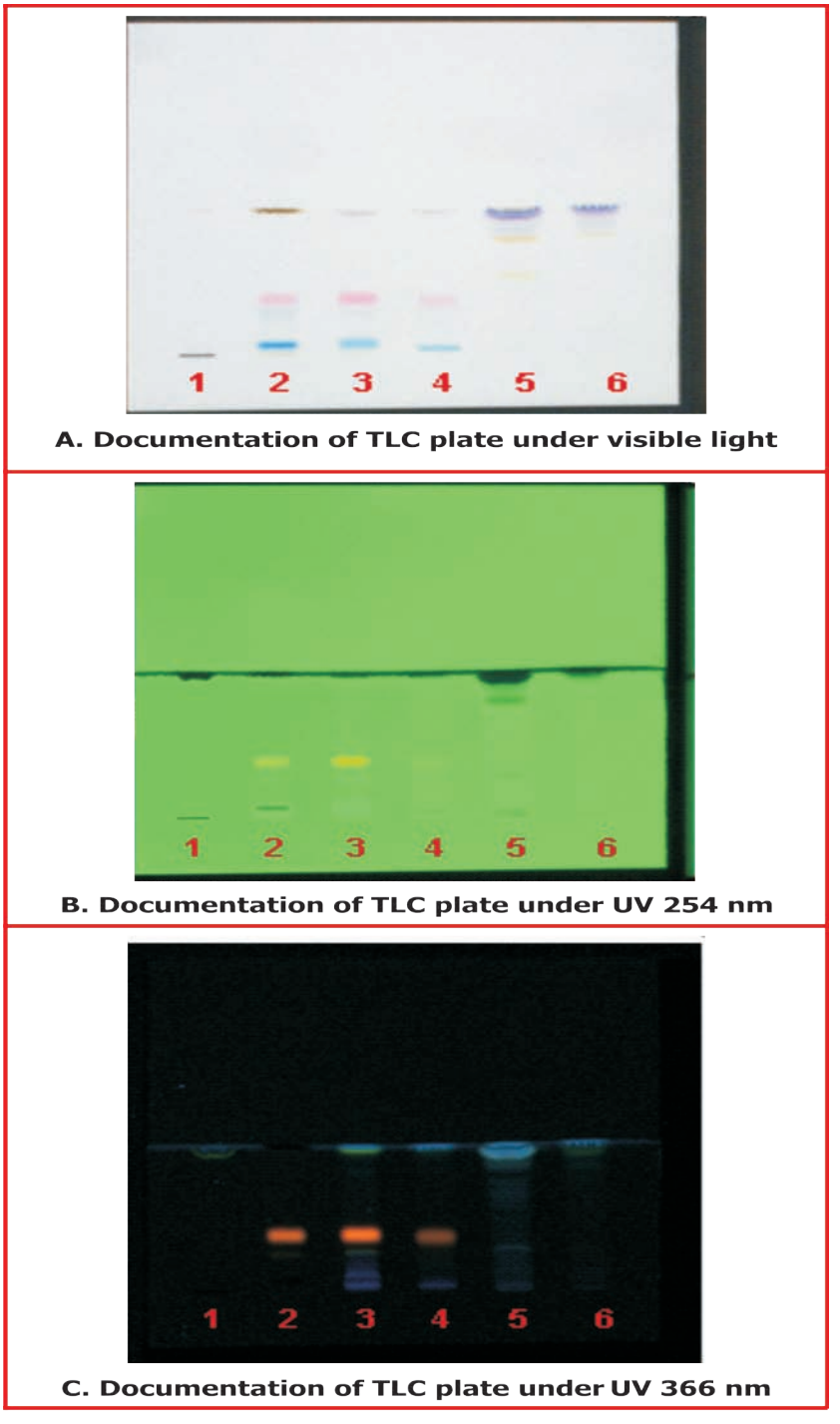

Fig. 4: Documentation of TLC plate under different sources of light (Visible light, UV 254 nm light and UV 366 nm light) (1. Black Inkjet cartridge, 2. Colour Inkjet cartridge, 3. Rs. 50/- Currency note ink, 4. Rs. 100/- Currency note ink, 5. Rs. 500/- Currency note ink, 6. Rs. 1000/- Currency note ink)

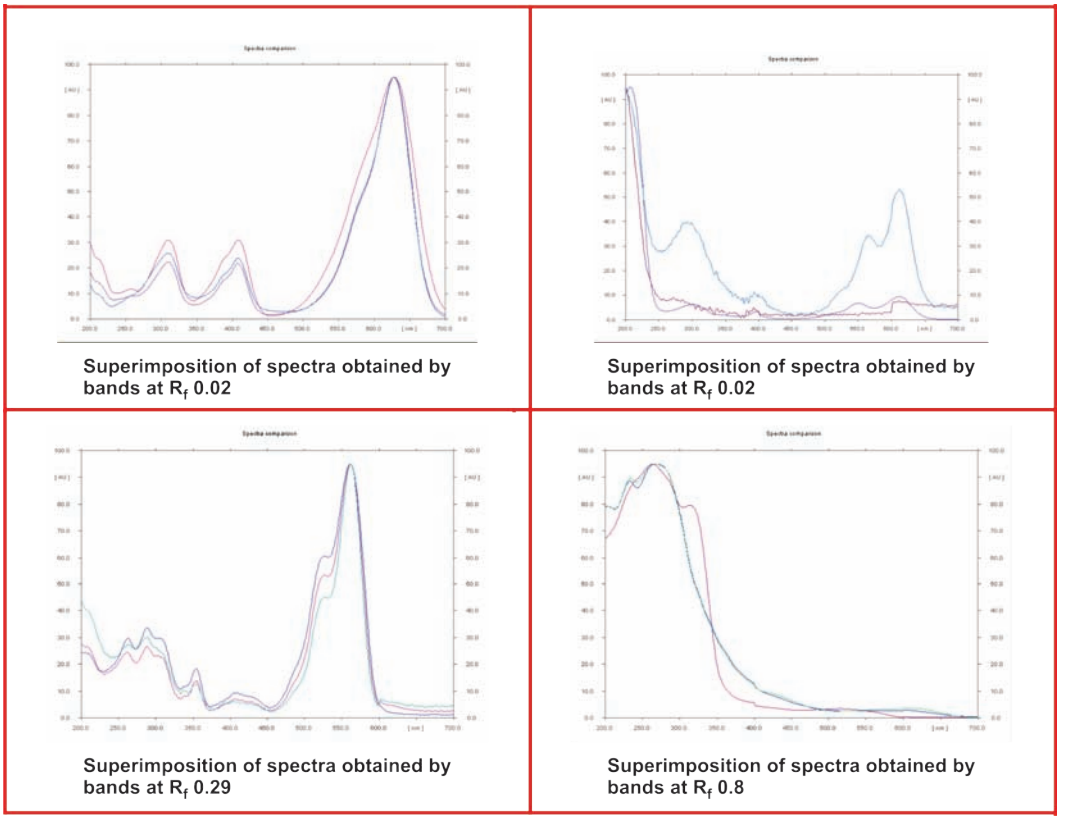

Fig. 5: Showing the superimposition of spectra obtained by different bands present in black, colour Inkjet cartridges and ink of currency notes of Rs. 50/- and 100/- denomination

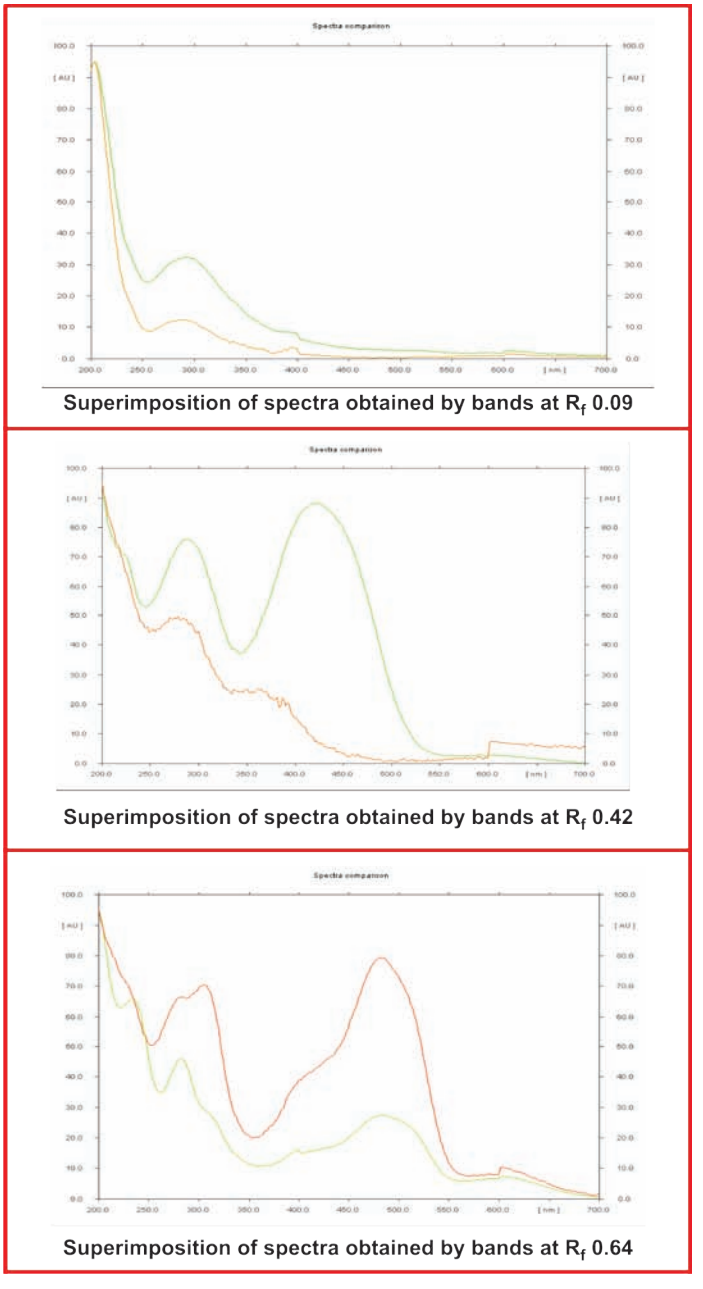

Fig. 6: Showing the superimposition of spectra obtained by Additional bands present in ink of currency notes of Rs. 500/- and 1000/- denomination

Conclusion

Based upon examination of physical parameters, observation under visible light, UV 366 nm light and Transmittance light, it was concluded that all currency notes of Rs. 50/-, 100/-, 500/- and 1000/- denomination were counterfeit. And, based upon ink analysis of inkjet printer cartridges found at the scene of crime and ink of currency notes of Rs. 50/-, 100/-, 500/- and 1000/- denomination, it was concluded that Rs. 50/- and 100/- currency notes were printed from the Inkjet printer cartridges recovered from the scene of crime, whereas Rs. 500/- and 1000/- denomination currency notes were printed by the same Inkjet printer cartridges, but not from the Inkjet printer cartridges recovered from the scene of crime ■

ACKNOWLEDGEMENT

Authors are very much thankful to Dr. C.N. Bhattacharya, Incharge-Chief Forensic Scientist, Directorate of Forensic Science, MHA, Government of India and Shri A.K. Ganjoo, Director, Central Forensic Science Laboratory, Hyderabad for providing necessary facility for research work. Thanks are also due to Reserve Bank of India, Mumbai for issuing specimen Indian currency banknotes.

REFERENCES

1. http://www.enotes.com/forensic-science/counterfeit-currency-technology-manufacture
2. http://www.schneier.com/blog/archives/2009/01/trends_in_count.html
3. http://www.rbi.org.in
4. CFSL Working Procedure Manual for Counterfeit Currency Examination bearing Controlled Document No. CFSL-HYD-CCEU, Issue No. 1, Copy No. 3.
5. Arsov Mesrob, Gateva, "Thin-layer Chromatography of Basic Dyes", Journal of Chromatography, **81** (1973), pp. 181-186.
6. Poon NL, Ho SSH & Li CK, "Differentiation of Colored Inks of Inkjet Printer Cartridges by Thin Layer Chromatography and High Performance Liquid Chromatography", Science & Justice, **45** (2005), pp. 187-194.

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Codec Impact on Voice Spectrographic Features: A Forensic Study

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Keywords

Voice Spectrogram

Codec

Formants and Fundamental Frequency, etc.

Abstract

In spectrographic analysis of voice samples, there is a question of the impact of Codec schemes on the visual representation of voice spectrogram. The spectral features of the wide/narrow-band, Linear Prediction Coding (LPC), including formants, shape and their position due to Codec reconstruction of the speech signal have been studied. For this work, the voice spectrogram of the words recorded simultaneously in seven different formats, such as avi, tsh, wav, analog, mp3, mpg, amr in different recorders have been analyzed and analytical data were evaluated.

Introduction

THE laboratory is frequently receiving the voice samples for speaker's identification purpose, in which question and specimen voice samples have not been recorded with similar recorder and in the same Codec. The present work has been carried out to find out whether there is any variation in their spectrographic features due to different recorders and different formats.

Material and Method

Ten appropriate Hindi words ***HELLO, NAMASTEY, RUPAIYA, PAISA, INTZAAM, GATE PAR, MILNA, MAAR & DENGEY*** have been simultaneously recorded with different recorders in different formats, such as avi (Canon), tsh (Cenix), wav (LG-mobile), mpg (Sony), analog (Sony), mp3 (computer), amr (LG-mobile) in noise free condition in speech lab in CFSL, Chandigarh. The recorded samples have been digitized/converted into wave format using GOLD-WAVE software. The spectrographic analysis has been carried out by standard software MULTI-SPEECH present in the lab. The detail of recorders and their formats is given in *Table 1*.

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Table 1: Detail of recorders and their formats

Sl. No.	Device/Recorder	Code	Format	Sampling rare (Hz)
1.	Canon Digital Camera	R1	avi	11024
2.	Cenix Digital Recorder (VR-P2340)	R2	tsh	12000
3.	Cenix Digital Recorder (VR-810)	R3	tsh	22000
4.	LG-Mobile (KG 195)	R4	wav	8000
5.	MP3	R5	mp3	44000
6.	Sony Digital Camera (DSC-W35l)	R6	mpg	32000
7.	Sony analog	R7	analog	22050
8.	Nokia 6600	R8	amr	8000

Results and Discussion

The voice spectrogram and LPC of the word "Hello" is shown in *Fig. 1* and *Fig. 2*. The F0 for the word "Hello" for all recorders/formats was found 125 Hz. The third formant of R2 (tsh), third and fourth formant of R4 (wav-mobile) and R8 (amr-mobile) in wide band spectrogram were found missing. The position of resonance frequencies of different formants (F1, F2, F3 and F4) slightly varies with the formats and it comes very close for the same make of different model recorders. The LPC also shows close similarity for same make recorders. The comparison of different acoustic features, such as mean fundamental frequency (F0), presence/position of different formants (F1, F2, F3, F4) is shown in *Table 2*.

Overall comparison for all words of different recorders and their Codec is shown in *Table 3*. The average pitch/fundamental frequency (F0) showing close variation with recording formats. The mean F0 for different recorders/formats of different words were estimated as (Hello-125-125), (Namastey-117-121), (Rupaiya-117-123), (Paisa-116-120), (Intzaam-116-117), Gat par-117, Milna-117-120, Maar-117 and Dengey-113) Hz. The impact of Codec on spectrographic features varied for different words. For the word *hello,* F3 in R2 (tsh), F3 & F4 in R4 (wav-mobile) and in R8 (amr) were found missing. For the word Rupaiya F3 in R2 (tsh), F4 in R4 (wav-mobile), F3 & F4 in R8 (amr) were not present. The comparison of all parameters for all recorder/Codec formats is shown in *Table 3*. The R8 (amr) and R4 (wav) recorded by mobile phones, showing very poor formants characteristics in their voice spectrogram for all words. The R6 (mpg), video and R7 (analog) Sony recorders, showing very good acoustic information in their voice spectrogram. The R1 (avi) Canon video recorder also showing good formants information in their spectrogram. The digital voice recorder R2 (tsh) Cenix (VR-P2340), showing almost sufficient acoustic features in their voice spectrogram, however, the spectrogram of R3 Cenix Digital Recorder (VR-810) contained insufficient formants information.

Table 2: (Hello) Comparison table showing presence/position of different formats

	R1 (avi)	R2 (tsh)	R3 (tsh)	R4 (wav)	R5 (mp3)	R6 (mpg)	R7 (analog)	R8 (amr)
F0	125	125	125	125	125	125	125	125
F1	628	636	638	585	559	625	630	576
F2	1402	1350	1400	1273	1330	1362	1325	–
F3	2513	–	–	–	2564	2500	2470	–
F4	3510	3420	3340	–	3478	3535	3537	–

Table 3: Spectrogram containing information about formants of all words

	R1 (avi)	R2 (tsh)	R3 (tsh)	R4 (wav)	R5 (mp3)	R6 (mpg)	R7 (analog)	R8 (amr)
Hello	All features	F3 absent	F4 not clear	F3 & F4 absent	Slightly clear	All features	All features	F3 & F4 absent
Namastey	All features	F3 absent	F4 not clear	F3 & F4 absent	Slightly clear	All features	All features	F3 & F4 absent
Rupaiya	All features	All features	All features	Slightly clear	All features	All features	All features	F3 & F4 absent
Paisa	All features	F3 absent	F3 absent	Slightly clear	All features	All features	All features	F3 & F4 absent
Intzaam	All features	All features	All features	F3 & F4 absent	All features	All features	All features	F3 & F4 absent
Gate	All features	Sufficient Information	F3 & F4 absent	Slightly clear	All features	All features	All features	F3 & F4 absent
Par	All features	All features	F3 & F4 absent	Slightly clear	All features	All features	All features	F3 & F4 absent
Milna	All features	All features	All features	F3 & F4 absent	F3 absent	All features	All features	F3 & F4 absent
Maar	All features	All features	Slightly clear	F3 & F4 absent	All features	All features	All features	F3 & F4 absent
Dengey	All features	All features	Slightly clear	F3 & F4 absent	All features	All features	All features	F3 & F4 absent

All features : Indicated for all formants information, such as shape/position of formants.
Slightly clear : Voice spectrogram having limited information about their formants features.

Conclusion

The above study "Codec Impact on Voice Spectrographic Features" reveal that the compressed formats have less or insufficient formants information for speaker identification purpose. The voice spectrogram of amr and wav formats of mobile phone contained very limited acoustic features in their voice spectrogram. The Cenix Digital Recorder (VR-810) made in China record the voice in tsh format does not contain all formants information in their voice spectrogram. The Canon recorder in which voice was recorded in avi format, having sufficient information in their voice spectrogram. The Sony recorders in which voice have been recorded in analog and mpg formats, showing very good visual representation of all formants features in voice spectrogram. ■

ACKNOWLEDGEMENT

The authors are grateful to Director, Central Forensic Science Laboratory, Chandigarh for his guidance and giving an opportunity to do such work.

REFERENCES

1. Nolan, F. (2002). "The Telephone Effect on Formants: A Response", Forensic Linguistics 9, 1, pp. 74-82.
2. K.E. Cummings & M.A. Clements, "Analysis of the Glottal Excitation of Emotionally Styled and Stressed Speech", J. Acoust. Soc. Amer., Vol. 98, No. 1, 1995, pp. 88-98.
3. S.E. Bou-Ghazale & J.H.L. Hansen, "A Comparative Study of Traditional and Newly-proposed Features for Recognition of Speech under Stress", IEEE Trans. Speech, and Audio Processing, Vol. 8, No. 4, pp. 429-442, 2000.
4. Y. Chen, "Cepstral Domain Talker Stress Compensation for Robust Speech Recognition", IEEE Trans. Acoustics, Speech and Signal Processing, Vol. 36, No. 4, 1988, pp. 433-439.

Nanoparticle-Size Fingerprint Dusting Compositions based on Crystal Violet Dye

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Keywords

Fingerprints

Fluorescent

Nanoparticles

Powers

Stain

Abstract

In this communication we report two novel, fluorescent fingerprint dusting compositions based on the colourant, crystal violet. The adhesive base material in one composition is nanoparticle-size alumina, while in the other, is nanoparticle-size meshed copper. The formulations develop sharp and clear fingerprints on an array of surfaces, both absorbent and non-absorbent. The quality of prints depends on the degree of interaction between the colourant and the adhesive. Due to its polar nature, alumina has a stronger attraction for crystal violet than copper. Thus, better results are obtained with the formulation in which alumina is the base material. Being non-toxic, these compositions do not pose occupational hazard to the users. The technique is simple to operate and does not require costly equipment or a sophisticated instrument.

Introduction

IT may be claimed that there is no more effective deterrent to crime than the certainty of detection. Equally true is that there is no surer way of establishing identity than by fingerprints. The detection of latent fingerprints at the scene of crime and their subsequent development is, therefore, one of the most powerful tools available in casework investigations.

The fingerprints found at the scene of crime or an article removed from it are formed when the papillary ridges leave a deposit of perspiration on a surface with which the finger has been brought into contact. The constituents of sweat may be selectively fixed by different chemical reagents, so as to make the latent prints visiblel.[1, 2]

The simplest and most commonly used method for detecting latent fingerprints is the powder dusting. This technique relies on the mechanical adherence of the detecting composition to the oily components of sweat.[3, 4] While selecting the powder, it must be ascertained that its ingredients do not interact chemically with the

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surface bearing the latent impression.[2] Nor should it be strongly physically attracted to the surface.

Fingerprint dusting powders are available in a wide range of compositions. Regular powders consist of an adhesive, usually a resinous polymer, and a colourant for contrasts.[5] The adhesive sticks to the moisture and oily components of sweat, while the colourant is adsorbed onto the adhesive. Commonly used adhesives are starch, kaolin, rosin and silica gel; commonly used colourants are charcoal, iron oxide and manganese dioxide. Organic dyes like aniline blue and Azure may also be used as colourants.[6, 7]

Powder formulations containing meshed metals have also been used for a considerable time.[2] Their advantage is that they have longer shelf-lives as compared to regular powders. Their disadvantage is that the metallic components elicit toxic effects to the users. Silver powder containing aluminium flake and pulverized quartz; gold powder containing bronze flake and pulverized quartz; and gray powder containing meshed aluminium and kaolin are some examples of metallic dusting compositions.

A good number of powder formulations contain organic derivatives that fluoresce or phosphoresce upon exposure to ultraviolet or laser lights.[8, 9] The advantage of such compositions is that these are useful for visualization of latent prints impinged on multicoloured surfaces that would present a problem of contrast, if developed with regular or metal-based powders. Moreover, these may be used for detecting weak, chance and fragmented fingerprints that are often encountered at crime scenes. Their disadvantage is that these can rarely be used in fieldwork. Some common organic compounds that have been used for preparing luminescent powders are rhodamine B, acridine orange and crystal violet.

Conventional fingerprint dusting powders pick up prints since the oil secreted by fingertips has a natural tackiness. In the course of time, the oil tends to evaporate and, therefore, old fingerprints are difficult to detect by powder method. This problem is specifically relevant to a tropical country like India where hot climate prevails eight out of twelve months in a year. Nanotechnology provides a solution to this problem. Nanoparticles have the ability to actively seek out oil from the fingerprint residue, however small the amount may be. This paves the way for development of even extremely faint fingerprints.

In the present investigation, nanoparticles of alumina or copper have been coated with fluorescent crystal violet stain (*Fig. 1*), so that week prints are enhanced under a suitable light source. This follows from our interest in propounding Nanotechnology-based fingerprint detecting formulations.[10, 11]

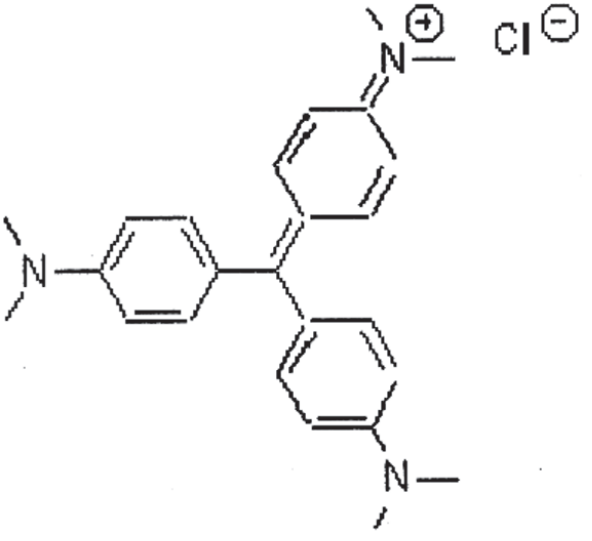

Fig. 1: Structure of crystal violet

Experimental

Crystal violet, alumina and copper powder were purchased from Sigma-Aldrich Foreign Holding Co. and used without any further purification.

Nanoparticle-size alumia (0.5 g) was suspended in distilled water (50 ml) and sonicated for 30 minutes. Crystal violet stain (0.0075-0.01 g) was dissolved in distilled water (10 ml) and the solution was added to alumina nanoparticles. The contents were sonicated for another 30 minutes. The mixture was dried under natural conditions. The solid mass was ground to a fine powder. The dye content in the composition was 1.5-2.0%. The composition based on nanoparticles of copper was prepared by an analogous method.

Each composition was dusted on different surfaces containing the latent fingerprints with a camel hair brush. The excess powder was blown off. The surface was photographed.

Results and Discussion

The adhesion of a powder formulation to fingerprint residue is governed by the pressure deficit mechanism. If a powder particle is wetted only on its lower side by the sweat deposition then, owing to the curvature of the meniscus, there will be a pressure deficit inside the droplet, causing the particle to adhere. The electrostatic attraction between the sweat residue and the powder particles too play a role in adhesion, albeit a minor one.[12]

The effectiveness with which the powder adheres to the ridges depends on the size and shape of the particles that compose the formulation.[1] Small, fine particles adhere more easily than large, coarse ones. Particles with size in nanometer range have excellent adhesion ability. It was with this aim that Nanotechnology-based compositions were prepared for the present study.

The novel compositions detect latent fingerprints on a wide range of surfaces, absorbent and non-absorbent; white and multicoloured. These are specifically useful for developing imprints on glossy items. A sample fingerprint developed on glossy paper by composition containing copper as adhesive material is shown in *Fig. 2*.

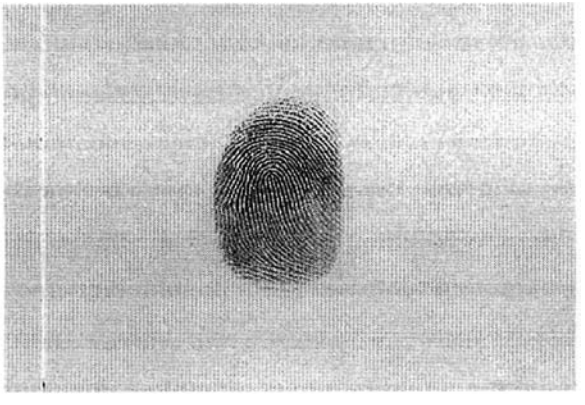

Fig. 2: Fingerprint developed on glossy paper

Good quality prints have been lifted from lamination sheets. Thus, the present method may be extended for obtaining fingerprints from laminated documents, such as archaeological scripts, certificates, driving licences and identity cards. Prints may be developed on polythene bags - commonly used for carrying household items, and polythene bottles - commonly used for storing household items. These also detect imprints on obverse and waxed, reverse sides of postal stamps. *Fig. 3* shows a fingerprint detected on a steel article by alumina-based composition.

Fig. 3: Fingerprint developed on steel article

Other surfaces on which an unscrupulous element is likely to leave his fingerprint impressions include glassware, steel handles and knobs, bakelite switches and switchboards and plastic table mats. The present technique of fingerprint detection gives good results on all such items. A representative impression developed on glass surface using copper-based composition is shown in *Fig. 4*.

Fig. 4: Fingerprint developed on glass

The fluorescent nature of the compositions assists in enhancing weak fingerprints that are frequently encountered at scenes of crime. The developed fingerprints showed considerable enhancement when impinged with radiation having 500-550 nm wavelength range and simultaneously observed through red goggles/filter.

In the course of this investigation, it was observed that the quality of developed fingerprints was profoundly affected by the degree of attraction between the adhesive material (alumina or copper) and the colourant (crystal violet). Stronger the interaction, better is the quality of the developed fingerprints. The attraction between the adhesive and the colourant, in turn, is dictated by dipole-dipole forces between the two chemical entities. Crystal violet is a polar species, with small positive and negative charges residing on different atoms in its molecular structure (*Fig. 1*). Alumina too is a polar molecule in which a partial positive charge resides on aluminium, while a partial negative charge resides on oxygen. The dipole-dipole attraction between alumina and crystal violet is substantially large. On the other hand, there is no charge separation on the nanoparticles of copper. The dipole-dipole attraction with crystal violet is concomitantly small or altogether absent. For this reason, the fingerprints developed by alumina-based composition are clearer and sharper as compared to those detected by copper-based composition. A comparison of fingerprints developed on photostat paper by alumina-containing formulation [*Fig. 5(A)*] and copper-containing formulation [*Fig. 5(B)*] supports this assertion.

The technique may be operated by an amateurish hand. It may be used at crime scenes, as well as in the laboratory.

Several studies have indicted powder formulations as being a health hazard to fingerprint examiners.[13,14] In fact, toxic effects of heavy metals and their salts have led to phasing out of some of the compositions. For example, the lead-based and mercury-based powders are no longer in use. However, the present compositions are non-toxic in nature.

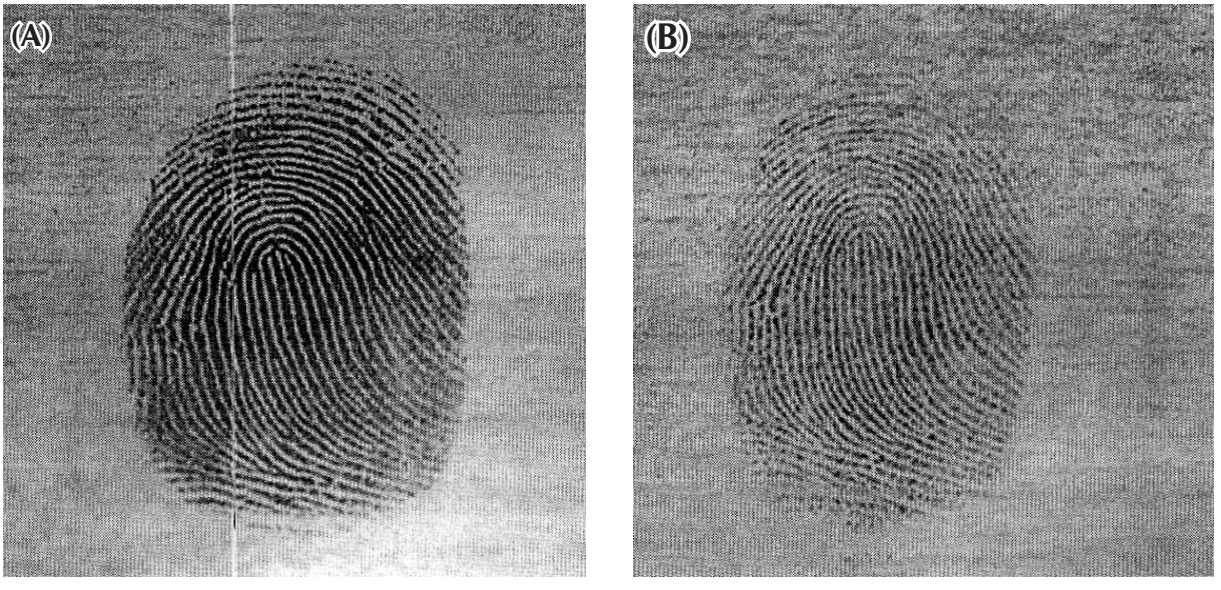

Fig. 5: Fingerprint developed on photostat paper by (A) alumina-based composition; and (B) copper-based composition

Conclusion

Fingerprint dusting powders based on crystal violet stain are versatile compositions for detecting fingermarks on a spectrum of absorbent and non-absorbent surfaces. These may be used, both at the scene of crime or in the laboratory. They are cost-effective, non-toxic and luminescent in nature. The technique is simple to operate. The results obtained with composition containing nanoparticles of alumina are better than those obtained with copper powder. ■

ACKNOWLEDGEMENT

The authors are grateful to the Department of Science and Technology, New Delhi for sanctioning a research project on Nanotechnology of which the present work is a part.

REFERENCES

1. Wilshire, B., "Advances in Fingerprint Detection", Endeavour, 1996, **20,** pp. 12-15.
2. Lee, H.C. & Gaensslen, R.E. (Eds.) in "Advances in Fingerprint Technology", Elsevier, New York, 1991, pp. 59-101.
3. Knowles, A.M., "Aspects of Physicochemical Methods for the Detection of Latent Fingerprints", Journal of Physics, E: Scientific Instrumentation, 1978, **11**, pp. 713-721.
4. Sodhi, G.S. & Kaur J., "Powder Method for Detection of Latent Fingerprints: A Review", Forensic Science International, 2001, **120**, pp. 172-176.
5. Olsen, R.D., Fingerprint Mechanics, C.C. Thomas, Springfield, 1978.
6. Sodhi, G.S. & Kaur, J., "A Fingerprint Powder Formulation based on Aniline Blue Dye", The Indian Police Journal, 2002, **49**(3), pp. 44-45.
7. Sodhi, G.S. & Kaur, J., "Fingerprint Powder Formulation based on Azure II Dye", Defence Science Journal, 2004, **54**, pp. 179-182.
8. Menzel, E.R., "Laser Detection of Latent Fingerprints - Treatment with Fluorescers", Journal of Forensic Science, 1979, **24**, pp. 96-100.
9. Menzel, E.R., "Laser Detection of Latent Fingerprints - Treatment with Phosphorescscers", Journal of Forensic Science, 1979, **24**, pp. 582-585.
10. Sodhi, G.S. & Kaur, J., "A Novel, Nanoparticle Size Fingerprint detecting Composition based on Fluorescent Lucifer Y Dye", Fingerprint World 2007, **34**, pp. 24-25.
11. Sodhi, G.S. & Kaur, J., "Nanotechnology in aid of Fingerprint Detection", CBI Bulletin, 2008, **16**, pp. 35-36.
12. Thomas, G.L., "The Physics of Fingerprints and their Detection", Journal of Physics, E: Scientific Instrumentation, 1978, **11**, pp. 722-731.
13. Van Netten, C., Teschke, K.E. & Souter, F., "Occupational Exposure to Elemental Constituents in Fingerprint Powders", Archives of Environmental Health, 1990, **45**, pp. 123-127.
14. Souter, F.C.G., van Netten, R. & Brands, R. "Morbidity in Policemen Occupationally Exposed to Fingerprint Powders", International Journal of Environmental Health and Research, 1992, **2**, pp. 114-119.
15. Green, F.J., "The Sigma - Aldrich Handbook of Stains, Dyes and Indicators", Aldrich Chemical Co., Milwaukee, 1991.

Differential-Pulse Anodic Stripping Voltametry (DPASV) Determination of Lead (Pb) Heavy Metal in Blood

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Keywords

Anodic Stripping Voltammetry

Hanging Mercury Drop Electrode

Lead

Blood

Heavy Metal

HMDE

BLL, etc.

Abstract

In the present work, the direct determination of Lead (Pb) heavy metal in blood was carried out by differential pulse anodic stripping voltametry technique at Hanging Mercury Drop Electrode (HMDE). Blood was processed by wet digestion method using a mixture of concentrated nitric acid (HNO3) and sulphuric acid (H2SO4). Determination of Lead was made in acetate buffer (pH 4.6) with a sweep rate (scan rate) of 60 mV/s and pulse amplitude 50 mV by Hanging Mercury Drop Electrode (HMDE) by standard addition method. The solution was purged with nitrogen gas and pre-electrolysis was done at –1150 mV (vs.Ag/AgCl) for 90 seconds and the potential was scanned from –1150 mV to –700 mV (vs.Ag/AgCl). The Lead ions were deposited by reduction at –1150 mV on HMDE. Then the deposited metal was stripped (oxidized) by scanning the potential from –1150 mV to –700 mV using a differential pulse mode. The stripping current arising from the oxidation of metal was correlated with the concentration of the metal in the sample. The amount of lead determined in the blood sample came out to be 5.555 mg/L.

Introduction

LEAD is the poisonous metalloid found in different allotropic forms. The four stable isotopes of lead are 204_{Pb}, 206_{Pb}, 207_{Pb} and 208_{Pb}. Metallic lead occurs very rarely in nature. Major sources of lead exposure are lead containing paints, household dust, soil, groundwater and surface water, herbal remedies, such as Indian Ayurvedic preparations and remedies of Chinese origin and Ceramic glaze. Ingestion is the major pathway and the major source, which contributes to lead poisoning through lead paints. Inhalation is the second major pathway, especially for workers in lead-related occupations and dermal exposure for people working with lead compounds. When lead is present in environment, it can affect all the components of environment. Lead can end up in water

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and soil through the corrosion of leaded pipelines in water transporting system. Lead can result into stunted growth or killing of plants.[1] In humans, it can affect many essential systems and organs of body like reproductive system, nervous system, kidneys, liver, neurons, etc.[2] Some of the major effects are given below:

- It can damage hippocampus.
- It interferes with the release of neurotransmitters, especially glutamate by blocking NMDA receptors.
- It causes apoptosis in brain cells.
- It causes nephropathy and may cause Fanconi syndrome.
- It inhibits excretion of the waste product, urate, and causes a predisposition for gout, called saturnine gout.
- It can cause high blood pressure, coronary heart disease, heart disease, heart rate variability, death from stoke.
- Cardiac autonomic dysfunction.
- Affects CNS and PNS.
- Degeneracy of axons of nerve cells and loss of myelin sheath.
- Interferes with normal development of child's brain and nervous system. In child's brain, it interferes with synapse formation in the cerebral cortex, neurochemical development and organization of ion channels.
- Between blood levels of 5-35 μg/dL, an IQ decrease of 2-4 points for each μg/dL increase is reported in children.
- In men, at levels above than 40 μg/dL, there is a reduced sperm count, low volume of sperm, reduced motility and distorted morphology.
- In pregnant women, high Blood Lead Level (BLL) can lead to miscarriage, prematurity, low birth weight and in utero poisoning of foetus.
- Cataract development in men.

Lead inhibits porphobilinogen synthase and Ferrochelatase, preventing both porphobilinogen formation and the incorporation of iron into protoporphyrin IX, the final step in heme synthesis.[3] Lead also interferes with the activity of an essential enzyme called *delta-aminolevulinic acid dehydratase or ALAD*, which is important in the biosynthesis of heme. The normal values are less than 10 μg/dL for children and less than 20-25 μg/dL for adults, but a person may show symptoms at higher levels than this. *Table 1* gives the general symptoms associated with higher levels of lead in blood.[4]

Table 1: General symptoms associated with Different BLL

Blood Lead Level (BLL) in μg/dL	Blood Lead Levels (BLL) in ppm	General symptoms
25-60 μg/dL	0.25-0.60 ppm	Neuropsychiatric effects
> 50 μg/dL	> 0.50 ppm	Anaemia
> 80 μg/dL	> 0.80 ppm	Abdominal colic in adults
> 100 μg/dL	> 1.00 ppm	Wrist drop and foot drop in adults, signs of encephalopathy in adults
> 70 μg/dL	> 0.70 ppm	Signs of encephalopathy in children

In case of lead poisoning, most commonly given treatment involves chelation therapy. A chelating agent has at least two negatively charged groups that forms complexes with metal ions with multiple positive charges like lead. The chelate thus formed, is non-toxic and can be excreted in urine. Common chelating agents used in lead poisoning are Edetate Calcium Disodium (CaNa.2EDTA), Dimercaprol (BAL), Succimer and Penicillamine.[5] Another compound, which is used to treat lead poisoning, is DMSA. It decreases the blood lead levels by 35-81% and induces 4.5-16.9 fold increase in mean daily urinary excretion of metal.[6]

The analysis of blood lead levels in the laboratory can be carried out in many ways. Blood film examination may reveal basophilic stippling of RBCs as well as the changes normally associated with iron deficiency anemia.[7-8] Measuring Erythrocyte Protophyrin (EP)[7-8] also gives us the clue about lead poisoning. Lead in bones can be measured by X-ray fluorescence.[9] The qualitative

tests include sodium sulphide test and sodium rhodizonate test.[10] In sodium sulphide test, a positive reaction is indicated by a black or gray colour and in sodium rhodizonate test, the change of pink area to a blue-violet colour confirms the presence of lead.[10] Many other methods are also used to quantitate lead levels in blood. Some of the methods are:

- Miniaturized lead sensor based on Lead-specific DNAzyme in a nanocapillary interconnected micro-fluidic device.[11]
- PNNL's portable analyzer system.[12]
- By chelation with ammonium pyrrolidine dithio-carbamate, followed by tungsten-coil atomic absorption spectrometry.[13]
- Disposable carbon micro-array electrode.[14]
- ICP-MS Graphite Furnace Atomic Absorption Spectrophotometer
- Determination by Dithizone solution.[15]

Keeping in view of above, a new method has been developed for quantitative determination of Lead (Pb) in blood samples by Differential Pulse Anodic Stripping Voltametry. Anodic Stripping Voltametry (ASV) is a powerful technique, which is used for the direct determination of trace metals in different samples. In this study, determination of lead in blood by DPASV was carried out by Hanging Mercury Drop Electrode (HMDE). Blood was processed by wet digestion method using a mixture of concentrated nitric acid and sulphuric acid. Determination of lead was made in acetate buffer (pH 4.6) with a sweep rate (scan rate) of 60 mV/s and pulse amplitude 50 mV by standard addition method. The solution was purged with nitrogen gas and pre-electrolysis was done at –1150 mV for 90 s and the potential was scanned from –1150 mV to –700 mV. Differential Pulse Anodic Stripping Voltametry (DPASV) technique is new, rapid, simple, selective and inexpensive for qualitative and quantitative determination of heavy metals in blood.

Materials and Methods

- **Instrumentation/accessories and Operating Conditions**

  Voltametric determination of Pb was performed by Trace Metal Analyzer model 797 VA Computrace from Metrohm AG Ltd., Switzerland (*Fig. 1*). It is a three-electrode system consisting of Multi-Mode Electrode MME (mercury) as working electrode, Platinum (Pt) as auxiliary electrode and Ag/AgCl/3M KCI as reference electrode. The operating parameters are given in *Table 2*. Nitrogen gas of high purity was used. Micropipette of Eppendorf make of volume 10-100 μl and 100-1000 μl were used. pH measurements were done with pH meter of model Inolab WTW series at ambient temperature of laboratory. Whatman filter paper 41 Ashless Circles of 125 mm Cat No. 1441 125 from Whatman International Ltd., Maidstone England were used.

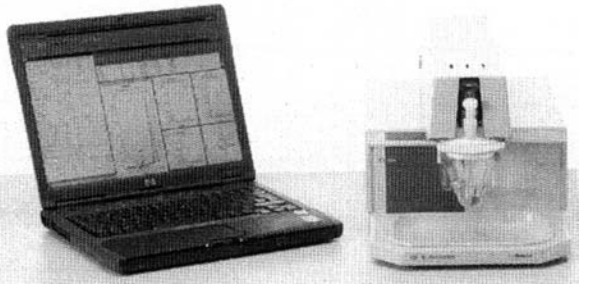

Fig. 1: 797 VA Computrace (Trace Metal Analyzer)

- **Reagents/Chemicals**

  Suprapure acetic acid from Merck GaA, 64271 Darmstadt, Germany, Nitric acid, Liquor ammonia, Ammonium oxalate, Lead nitrate from Merck Specialities Private Limited, Shiv Sagar Estate 'A', Dr. Annie Besant Road, Worli, Mumbai-400 018, Sulphuric acid from Qualigens Fine Chemicals, a Division of GlaxoSmithKline Pharmaceuticals Limited, Dr. Annie Besant Road, Mumbai-400 025, water from milli Q were used.

- **Preparation of ammonium acetate buffer**

  Ammonium acetate buffer was prepared by dissolving 5.55 ml of acetic acid in 10 ml of milli Q. Then, 3.7 ml of Suprapure ammonia was added slowly and pH was adjusted to 4.6 by adding few drops of Suprapure ammonia. Finally, the volume was made upto 50 ml with milli Q.

Table 2: Operating parameters for the determination of Lead by DPASV

Parameters	Description
Working electrode	Hanging Mercury Dropping Electrode
Calibration	Standard addition method
Number of replications	2
Drop size	4
Stirrer speed	2000 rpm
Mode	Differential pulse
Initial purge time	300 s
Addition purge time	10 s
Deposition potential	–1150 mV
Deposition time	90 s
Equilibration time	10 s
Pulse amplitude	50 mV
Start potential	–1150 mV
End potential	–700 mV
Voltage step	6 mV
Voltage step time	0.1 s
Sweep rate	60 mV/s
Peak potential Pb^{2+}	–380 mV

- **Preparation of saturated solution of ammonium oxalate**

  Saturated solution of ammonium oxalate was prepared in milli Q.

- **Preparation of standard solution of Lead**

  1000 ppm solution of Lead was prepared from Lead Nitrate. 1 ppm standard of lead was prepared by diluting 0.1 ml of 1000 ppm stock solution of lead to 100 ml milli Q water.

- **Sample preparation**

  1 ml of blood sample was taken in a beaker and kept over a wire gauge on the hot plate at 60°C till it was completely charred. Then, 1.5 ml concentrated sulphuric acid and 2.5 ml concentrated nitric acid was added to it and again heated on the hot plate near boiling to complete dissolution of the residue and then cooled. After cooling, the contents of the beaker was heated till just carbonized. Concentrated nitric acid was added to the beaker dropwise with the help of a dropping funnel at the rate of about 20 drop/minute and heating is continued. Addition of nitric acid and heating was continued till the contents of the beaker becoming nearby colourless. (When organic material is not completely oxidized, red fumes will appear in the beaker and charring will occur on further heating.) When the contents of the beaker become colourless dropwise addition of the nitric acid and heating was stopped and kept for cooling. After cooling, 2.5 ml of the saturated ammonium oxalate solution was added to the beaker and the boiling was continued till sulphuric acid begin to reflux. The sample was cooled, diluted with 20 ml milli Q water and filtered with Whatman filter paper 41. The sample was then quantitatively transferred to a 50 ml volumetric flask and make up to mark by milli Q water.

- **Anodic Stripping Voltametric measurements**

  10 ml milli Q and 1 ml of acetate buffer (pH 4.6) is taken in polarographic vessel and then, the measurement was started under the given parameters (*Table 2*). After this, voltamogramme of the blank was recorded. 0.1 ml of prepared sample solution was added to polarographic vessel and then, voltamogramme of the sample solution was recorded under the same conditions. After the sample voltamogramme was recorded, 0.1 ml of 1 ppm standard of lead was added twice and then, voltamogramme of the standard was recorded (*Fig. 2 and Fig. 3*). Finally, the concentration of the metal was calculated by linear regression method (standard addition) using following formula:

$$\text{Final Result} = \text{Concentration} \times \frac{\text{Cell Volume}}{\text{Sample amount}} \times \frac{\text{Multiplier}}{\text{Divisor}}$$

Where,
Multiplier = Dilution
Divisor = Sample amount taken for preparation

Results and Discussion

In this present study, the concentration of the Lead metal in blood was successfully determined by ASV technique. DPAS voltamogramme of Pb obtained from standard addition technique are given in *Fig. 2* and *Fig. 3*. The sensitivity was calibrated by standard additions to the sample and the initial metal concentrations were calculated by extrapolation (*Fig. 3*). Consequently, the linear calibration range was automatically obtained as being related to quantitative mode of the Voltametric unit. The "automatic blank correction" feature of the instrument was used to subtract the blank contribution due to chemicals, water, etc. As can be seen from *Fig. 3*, the current of oxidation peak of lead increased by the addition of the standard solution. A further increase in sensitivity of peak currents was achieved by increasing the deposition time to 180 s. In addition, to increase sensitivity, the optimum pH value of acetate buffer was determined to be 4.6. Under these conditions, the concentration of Pb in blood sample was found to be 5.555 mg/L. Several papers have discussed the determination of Lead in matrices other than the blood. The advantages of proposed voltametric method over the other known techniques were sensitivity, rapidity, cost-effectiveness and less sophistication.

Conclusion

In this work, Lead determination was carried out under the most appropriate conditions, which were fixed. Direct determination of Pb in blood sample is possible by DPASV. Under the working conditions to be 4.6 of pH using acetate buffer and 90 s of the deposition time, lead amount in blood sample has been successfully determined.

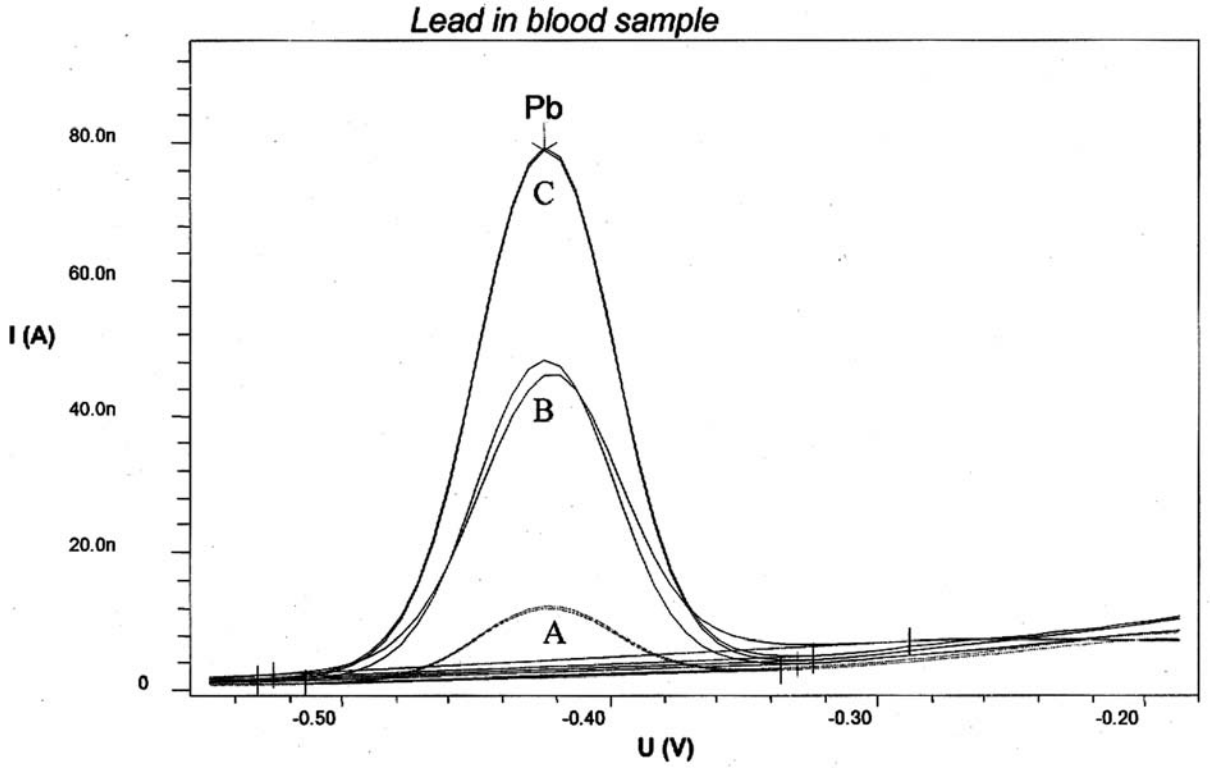

Fig. 2: DPAS Voltamogramme of Pb obtained from standard addition technique with number of replications being 2. (A) 0.1 ml sample in 1 ml acetate buffer (pH 4.6) + 10 ml distilled water; (B) A + 0.1 ml standard solution of Pb (1 ppm); (C) B + 0.1 ml standard solution of Pb (1 ppm)

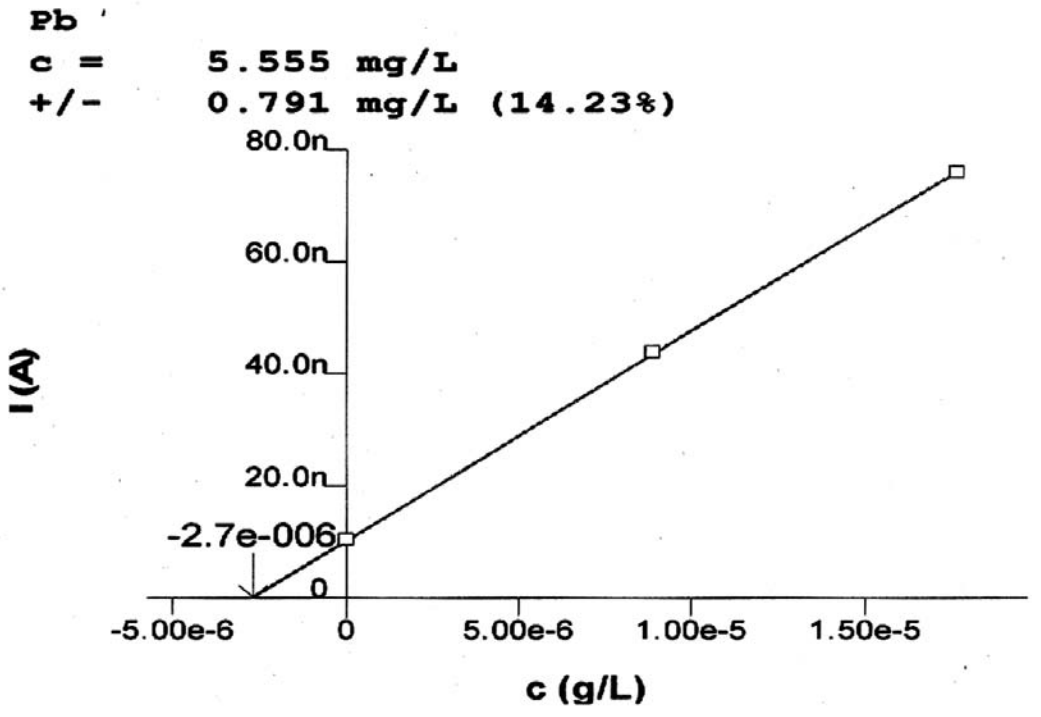

Fig. 3: The calibration plot of Pb obtained from standard addition by DPASV technique

REFERENCES

1. D. Greene, "Effects of Lead on the Environment", Lead action news Winter, **1** (2) (1993).
2. T.I. Lidsky & J.S. Schneider, "Lead Neurotoxicity in Children: Basic Mechanisms and Clinical Correlates", Brain, **126** (2003), pp. 5-19.
3. J.N. Gordon, A. Taylor & P.N. Bennett, "Lead Poisoning: Case Studies", Br J Clin Pharmacol, **53** (2002), pp. 451-456.
4. J.C. Merrill, J.J.P. Morton & S.D. Soileau, "Metals". in Hayes, A.W., "Principles and Methods of Toxicology", 5th Edition, CRC Press (2007), p. 860.
5. J.J. Jr. Chisolm, "The Use of Chelating Agents in the Treatment of Acute and Chronic Lead Intoxication in Childhood", J. Pediatr., **73**(1) (1968), pp. 1-38.
6. H.L. Needleman, A. Schell, D. Bellinger, A. Leviton, E.N. Allred, "The Long-term Effects of Exposure to Low Doses of Lead in Childhood", N Engl J Med, **322** (1990), pp. 83-88.
7. McElvaine, H.G. Orbach & S. Binder, *et al*., "Evaluation of the Erythrocyte Protoporphyrin Test as a Screen for Elevated Blood Lead Levels", J. Pediatr., **119**(4) (1991), pp. 548-550.
8. L. Patrick, "Lead Toxicity, a Review of the Literature. Part 1: Exposure, Evaluation and Treatment", Alternative Medicine Review, **11**(1) (2006), pp. 2-22.
9. T.M. Ambrose, M. Al-Lozi & M.G. Scott, "Bone Lead Concentrations assessed by *in vivo* X-Ray Fluorescence", Clinical Chemistry, **46**(8) (2000), pp. 1171-1178.
10. http://projects.nfstc.org/firearms/module12/fir_m12_t05_03j.htm
11. I.H. Chang, J.J. Tulock, J. Liu, W.S. Kim, D.M. Jr. Cannon, Y. Lu, P.W. Bohn, J.V. Sweedler & D.M. Cropek, "Miniaturized Lead Sensor based on Lead-specific DNAzyme in a Nanocapillary Interconnected Microfluidic Device", Environ Sci Technol, **39**(10) (2005), pp. 3756-3761.
12. G. Harvey, "New Sensor System helps Detection of Lead, Heavy Metals", PNNL (2008).
13. A. Salido, C.L. Sanford & R.T. Jones, "Determination of Lead In Blood by Chelation with Ammonium Pyrrolidine Dithio-Carbamate, followed by Tungsten-Coil Atomic Absorption Spectrometry", Spectrochimica Acta Part B: Atomic Spectroscopy, **54**(8) (1999), pp. 1167-1176.
14. B.J. Feldman, D. Alessandro, J.D. Osterloh & B.H. Hata, "Electrochemical Determination of Low Blood Lead Concentration with a Disposable Carbon Microarray Electrode", Clinical Chemistry, **41**(4) (1995), pp. 557-562.
15. M.K. Horwitt & G.R. Cowgill, "A titrimetric Method for the Quantitative Estimation of Lead in Biological Materials", J. Biol. Chem. (1937), pp. 553-564.

Psycho-Physiological Basis of the Forensic Assessment

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Keywords

Nervous System

Central Nervous System

Autonomic Nervous System

Parasympathetic Nervous System

Sympathetic Nervous System

Forensic Assessment

Abstract

The discipline of determining truth and detecting lies is based on scientific principles. In order to better understand the nature of deception, its behavioral correlates, and its detestability, it is helpful to first understand the underlying processes that provide the framework for deceptive communication. Communication is the transfer of information from one person to another. Most of us spend about 75% of our waking hours communicating our knowledge, thoughts, and ideas to others. However, most of us fail to realize that a great deal of our communication is of a non-verbal form as opposed to the oral and written forms. Non-verbal communication includes facial expressions, eye contact, tone of voice, body posture and motions, and positioning within groups. The determining of truth and deception is a discipline based on scientific principles which are grounded in the data derived from research findings in Physiology and Psychology.

Introduction

THE determination of the truth as to where the truth can be found, and the detection of lies, is a discipline based on scientific principles. Since lying in such a commonplace occurrence, most of us are personally acquainted with the inner sensations that so often accompany the telling of lie. We have also learned from personal experience in the ordinary, everyday affairs of life that it is sometimes possible to detect a lie in other simply by observing their facial expressions of their general conduct and behaviour, such as blushing, twitching of the lips, squinting of the eyes, a failure to look inquirer "straight in the eye", a peculiar monotone of the voice, a "forced laugh", a counter inquiry of "who, me?" movements of the hands and feet exhibiting a state of uneasiness and many other reactions of a similar nature.

An overview of research on non-verbal indicators of deception shows that liars tend to have a higher-pitched voice, make longer pauses and move their arms, hands, fingers, feet and legs less than truth-

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tellers (Vrij, 2000). None of the other non-verbal characteristics (e.g., gaze aversion, smiling, eye blinks, self-manipulations and shifting position) seem to be systematically related to deception. It should be noted that these findings do not suggest that all people display all of these cues during deception. What the findings do suggest is that the majority of liars do display these behaviours.

In view of the many years of experience, human beings have had in lying and in detecting lies in others on the basis of various outward indications, such as the ones previously mentioned, it was inevitable that eventually, someone would conceive the idea that it might be possible to make a scientific determination of deception or truthfulness by obtaining indications or recordings of non-observable physiological phenomena, such as changes in blood pressure pulse and respiration.

The determination of the truth and deception is based on scientific principles of Physiology and Psychology. The key physiological sources of these manifestations is found in the body's autonomic nervous system, in a response commonly called the "fight or flight" response mechanism. This psycho-physiological response occurs when an individual consciously or unconsciously perceives a threat to his/her immediate well-being. This response involves a complex and specific range of physiological changes occurring spontaneously, which prepare the individual to either stand and fight, or flee the threat. A less well-known phenomenon related to this mechanism has been identified as the "freeze/hide" syndrome. The latter occurs in those circumstances when the threatened individual is either too young, too weak or too psychologically disempowered to Fight or flee.

The suspect has the same three instinctual options: fight, flight or freeze/hide. It is the conflict among these evolutionary drives and the psychological reality of his/her situation, which will create the non-verbal and verbal indicators that are read and interpreted by the trained interviewer as signs of responses to a threat. In this case, the threat is that being exposed, and the resultant psycho-physiological response can be read as deception.

Scientific Basis of Forensic Assessment

Physiologist recognized the phenomenon of homeostasis, which is one of the requirements for any living organism's survival, is to maintain an ideal internal environment free of distress or threat. In humans, this homeostatic condition is made possible by the maintenance of physiological functions by the body's various nervous systems:

- The Central Nervous System (CNS) consists of the brain and spinal cord.
- All other nerve-ways are within the peripheral nervous system, which itself separate into the somatic nervous system and the Autonomic Nervous System (ANS).
  - (i) The somatic nervous system is involved with the voluntary functions over your skeletal muscles, e.g., you control and direct the movement of your arms and hands with your skeletal muscles through your somatic nervous system.
  - (ii) The autonomic nervous system controls those involuntary physiological functions of the body and has considerable psychological impact as well. The autonomic nervous system controls smooth muscles, glands and organs not usually under conscious control.

The autonomic nervous system is divided in its functions:

- Parasympathetic Nervous System (PNS)

  and
- Sympathetic Nervous System (SNS).

➢ **Parasympathetic Nervous System (PNS)**

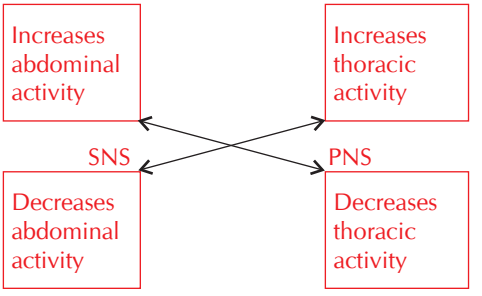
The Parasympathetic Nervous System is the "housekeeping" or braking system. It is responsible for conserving energy and making sure necessary bodily functions, such as digestion and waste elimination take place. It also functions to restrain sympathetic arousal and attempts to maintain homeostatic norm. In doing so, it conserves physiological resources.

➢ **Sympathetic Nervous System (SNS)**

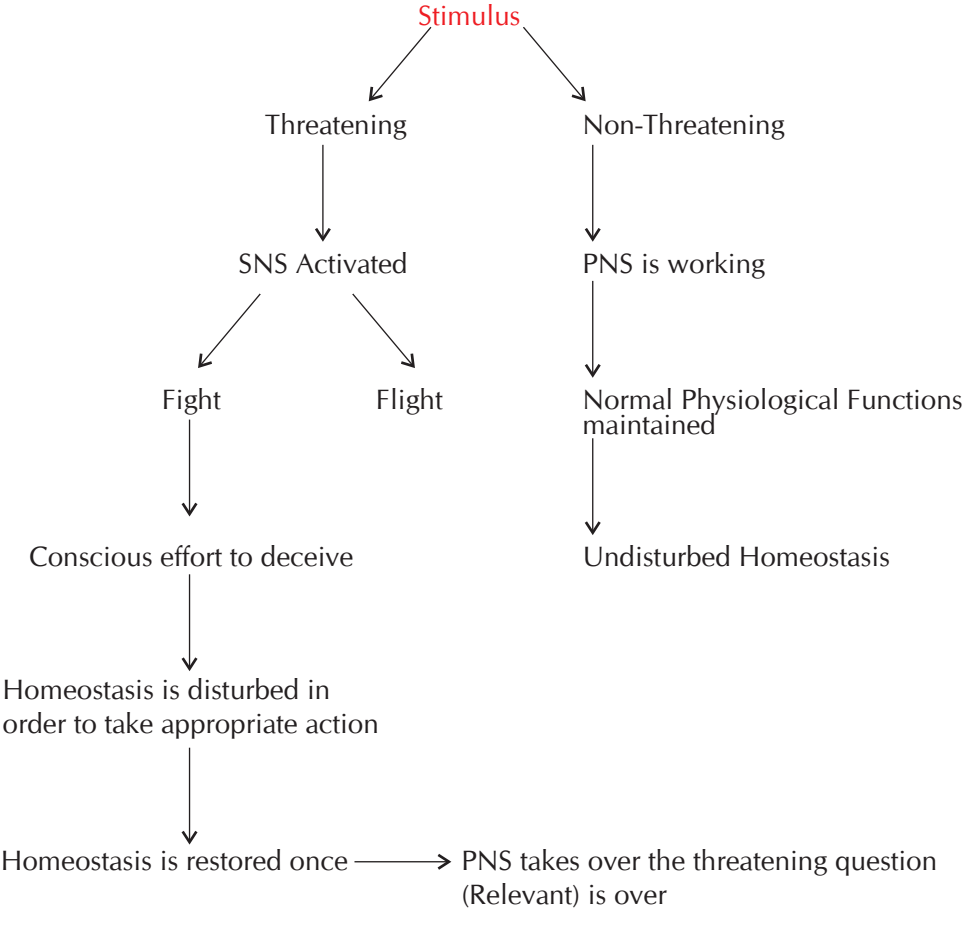
The Sympathetic Nervous System is our emergency or action system. It is

the system, which caused the sudden and dramatic changes. The brain is in constant struggle against various psychological and physiological stressors to maintain or regain homeostasis through the dual controls afforded it by the Parasympathetic and Sympathetic Nervous Systems. The brain can slow the heart down by sending it a parasympathetic neural message or speed it up by sending it a sympathetic message.

Generally, the PNS increases abdominal activity, allowing for digestion and waste elimination, while it slows thoracic (chest) activity, and conserves energy by slowing the heart rate, lowering blood pressure and decreasing the rate of breathing. The SNS decreases abdominal activity (there is no need for digestion or waste elimination under conditions of dire threat) and increases thoracic activity in an attempt to get more oxygen to the critical areas of the body necessary to assist in survival.



Thus, the Parasympathetic Nervous System is constantly trying to balance the activity of the Sympathetic Nervous System in order to conserve energy and prevent bodily dysfunction. However, frequently, its efforts are defeated. When this occurs, sympathetic arousal takes place, causing sudden involuntary changes to prepare for the threat. The heart rate is increased and additional levels of adrenaline are secreted into the blood. The combination of an increase in cardiac output and adrenaline causes increases in blood pressure. The additional red blood cells are released from the spleen to increase the amount of oxygen delivered to the body cells, and remove additional waste products produced by the excited metabolism.



The interaction of the two branches of ANS is clearly seen and felt in the following figure. Sympathetically, visual and hearing activity increases maintaining the individual in a heightened state of awareness. Parasympathetically, the salivary glands are inhibited. They are part of the digestive system and considered unimportant during fight/flight. This causes the "dry mouth" phenomenon utilized in "Trials of ordeal" by earlier cultures.

Parasympathetic		Sympathetic	
Constricts	←	Eye	→ Dilates
Stimulates	←	Salivary Glands	→ Inhibit
Slows	←	Breathing	→ Increases
No Comparative	←	Sweat Glands	→ Increase
Slows	←	Heart	→ Accelerates
Stimulates	←	Digestion	→ Inhibits
Stimulates	←	Waste Elimination	→ Inhibits

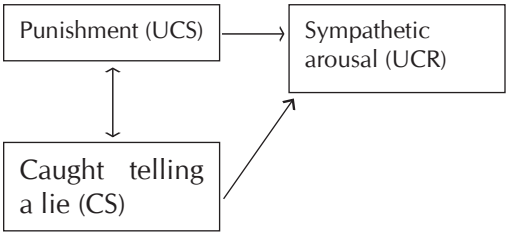
This clearly demonstrates and substantiates the differences cited between the Parasympathetic and Sympathetic Nervous Systems.

Psychological Theories of Lying

Hans Selye, a Canadian Physiologist, in 1926 theorized the General Adaptation Syndrome. He postulated that upon experiencing, distress, the body entered an "alarm" stage, where psycho-physiological factors were heightened. The body next entered a stage of "resistance", where it attempted to overcome distress. If the body was unable to correct the problem, it entered into a stage of "exhaustion", which ultimately, led to death. The majority of people speak during the exhalation cycle in breathing. Therefore, it is believed that answers will cause distortion in natural flow of an examinee's breathing pattern. By requiring "Yes"/"No" answers, this problem is kept to a minimum.

This clearly demonstrates and substantiates the differences cited between two Parasympathetic and Sympathetic Nervous Systems.

Conditioned response to a lie



B.F. Skinner, the famous Behavioural Psychologist, designed a plastic, see-through cage with a metal floor to allow him to study animal behaviour.

There is another explanatory theory of "choice conflict". Any time conflicts occur, we experience emotional changes which, in turn, cause physiological changes to occur. If you have the choice of going to a movie or to a football game, and you really want to do both, you are experiencing an Approach-approach conflict. The greater the conflict would be and the resulting physiological changes that will be created. Avoidance-avoidance conflict results from having to choose between two negatively impacting options. The greater the negative impact of the options, the greater the accompanying physiological response.

When an action causes something desirable or undesirable, with neither being predictable, it is called an Approach-avoidance conflict. Like the rat in the Skinner-Box, an individual telling a lie also places himself in an Approach-avoidance conflict.

Polygraph Expert Cleve Backster introduced the third theory of psychological set. The psychological set postulates that an individual being asked a series of questions will mentally focus on those questions, which pose the greatest immediate threat to his general well-being. The Forensic Assessment Interview utilizes relevant questions dealing with the crime, to pose the greatest threat to the guilty suspect, since he/she will be forced to either confess or lie to the matter at hand.

Sl.No.	Truthful Behaviour	Deceptive Behaviour
1.	Rich in details	Lack of details
2.	First person singular, past tense	Deviates from the first person singular, past tense
3.	Proper introduction of the victim "My daughter"	Improper introduction of the victim "she"
4.	Uses possessive pronoun "My daughter"	Lack of possessive pronoun "The child"
5.	No gaps in time	Missing time "Two hours later"
6.	Appropriate emotions in right place (post-incident)	No emotions
7.	Will deny doing crime before being asked	Only makes denials to direct question
8.	Proper flow of story	Incorrect flow of story
9.	Wants truth known	Wants truth hidden
10.	Talkative	Not talkative
11.	Tries to narrow or assist investigation	Has no information/tries to broaden investigation
12.	Uses appropriate and strong terms	Uses mild/erasive terms
13.	Express real feelings	Detached/distant
14.	Admit the opportunity	Denies opportunity/makes declaration to exclude self
15.	Argues actual innocence	Argues legal innocence
16.	Relaxed and confident	And defensive
17.	Face-to-face alignment	Evasive body alignment
18.	Uses illustrators	Uses adaptors
19.	Natural/settled foot and leg positioning	Tears, repetitive, restless foot and leg movements

Guidelines for Forensic Assessment

- The Forensic Assessment should be in extreme detail.
- Crime Scene visited needs to be recorded in detail with Experts.
- History of psychiatric illness and related records of the persons concerned.
- Educational history of the individual.
- Crime and Police reports.
- Records of a crime committed as a juvenile or as an adult.
- Interpersonal relation with family members.
- History of any physical illness.
- Social and background history.

Legal Implications

Among the legal decisions that have been assisted by Forensic Psychological Assessment are:

- Criminal court issues
- Correctional decisions
- Mental health law decisions
- Juvenile delinquency decisions
- Family law matters
- Law Enforcement personnel selection
- Evaluation of disability claims.

Conclusion

There is no common or universal behavioural cue set that identifies deception across all individuals. While the presence of a universal cue would be convenient, the usage of behavioural information still can contribute a great deal to deception prediction, if appropriately analyzed. The difficulty with lying is that the subconscious mind acts automatically and independently of our verbal lie, so our body language gives us away. This is why people, who rarely tell lies, are easily caught, regardless of how convincing they may sound. The moment they began to lie, the body sends out contradictory signals, and these give us our feeling that they are not telling the truth. During the lie, the subconscious mind sends out nervous energy that appears as a gesture that can contradict what the person said. Many

researches show that even when major body gesture are consciously suppressed, numerous microgestures will still be transmitted. These include facial muscular twitching, expansion and contraction of pupils, sweating at the brow, flushing of the cheeks, increased rate of eye blinking and numerous other minute gestures that signal deceit. When a person tells lie, the degree of physiological changes take place in an individual's body. The degree of change will depend on the following factors:

- The suspect's perception of the interviewer's ability to detect the truth.
- The degree of guilt the suspect feels about his action.
- The suspect's past success in similar situation.
- The suspect's perception of the seriousness of being caught.

As Forensic Assessors, we understand that we must limit the stimuli, so that we can assign a distinct cause to any effect we observe.

Forensic Assessment is a non-instrumental analysis, it offers a considerable advantage, i.e. the absence of technology leaves the suspect less aware of what is being monitored and less guarded and intimidated. Most important, the interviewer can evaluate a broader range of suspect responses to make a reliable assessment of witness/suspect credibility. ■

BIBLIOGRAPHY

1. Allan Pease (1981). "Body Language: How to read others' Thoughts by their Gestures", Pease Training International.
2. David L. Shapiro (1943). "Forensic Psychological Assessment: An Integrative Approach", Allyn and Bacon, Boston.
3. Fred E. Inbau, John E. Reid, Joseph P. Buckley & Brian C. Jayne. (2004). "Criminal Interrogation and Confessions", Jones and Bartlett Publishers, Sudbury, Massachusetts, USA.
4. Goodman-Delahunty, J. (1997). "Forensic Psychological Expertise in the Wake of Daubert", Law and Human Behavior, **21** (2), pp. 121-140.
5. Hartwig, M, Granhag, P.A., Stromwall, L.A. & Vrij, A., "Deception Detection: Effects of Conversational Involvement and Probing", Goteborg Psychological Reports, 2002, 32, No. 2.
6. John E. Reid, Fred E. Inbau (1962). "Truth and Deception - The Polygraph Technique", Second Edition, The Williams & Wilkins Company, Baltimore.
7. James Allan Matte (1980). "The Art and Science of Polygraph Technique", Charles C. Thomas Publishers, Springfield, Illinois, USA.
8. Miller, G.R. & Stiff, J.B. (1993). "Deceptive Communication", Sage Series in Interpersonal Communication 14, Newbury Park: Sage Publications.
9. Rabon, D. (1992). "Interviewing and Interrogation", Durham, N.C.: Carolina Academic Press.
10. Veeraraghavan Vimla (2009). "Handbook of Forensic Psychology".

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Investigation of Railway Accidents

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Keywords

Railway Accidents
Train Derailments
Broad Guage
Metre Gauge
Sabotage
Tampering
Sleepers
Spikes

Abstract

Railway accidents have become a common phenomenon now-a-days all over the world. It involves huge loss of life and property. The cause can be human errors, system failures, adverse climatic conditions or acts of sabotage. Such accidents can be avoided if anti-sabotage measures are fully adopted by the Railways and proper scientific investigations are carried out in the cases of accidents and the guidelines are framed and implemented for future safety. Strict vigilance of the control systems, quality assurance for material management at the stations and of the tracks can avoid most of such accidents.

Introduction

WE very often come across reports of Railway accidents and train derailments through print and electronic Media now-a-days. The loss of life and property is always irreparable. The scenes of accidents leave such terrifying impacts on our minds, which are unforgettable. Large number of people assemble at the accident site and provide immediate help to the victims of such accidents. The Police, Military, Paramilitary Forces and Railway Protection Force play vital roles in providing all possible help to the injured and for extricating the trapped dead bodies inside the compartments. The Government and the Railways pay huge compensations to the victims of these accidents. But, the loss of human life cannot be compensated in any way, which leaves behind orphan children, unfateful widows and widowers, who have to lead their lives in the absence of their kiths and kins and the scene of accident always remains a torturous unfateful memory in their lives. All these human sufferings can be avoided if we have a check on Railway accidents and derailments by adopting appropriate measures after scientific investigations in the cause of accidents/derailments. The causes of such accidents can be of the following types:

Natural Causes

- Earthquakes, heavy rains, floods, forest fires may damage or wash away the Railway tracks quickly without giving

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any chance to the drivers for controlling the speed or for stopping the trains. The ground fog in winters, the low clouds and dust storms leading to poor visibility can be another cause of such accidents. If high quality material is used in the construction of Rail tracks, quakeproof measures are taken in construction and controlled speeds and appropriate floodlights are used in poor visibility, a lot of such accidents can be avoided.

Human Negligence

- **Overspeed:** The drivers of the trains sometimes cross the speed limits prescribed for various areas of their operation. The less load-bearing capacity of the tracks may not permit safety at such high speed. The speed, as prescribed for hill tracks, may also not be observed by the drivers. The speedometer graph, if records the speed at various locations and is examined by the scientific examiners, can provide a clue regarding the cause of accident, if due to overspeed or otherwise.

- **Wrong Signals:** Sometimes, where manual systems of signal is operational, human error is the main factor for causing Railway accidents. One such incident had occurred at Ambala Cantt. Railway Station, where a coming train had hit the middle of the standing train due to wrong signal, which was due to human error. Similarly, in Uttar Pradesh, due to communication gap, a few years ago, a train had hit from behind on the another train standing on the outer signal. In another incident in Punjab, at a Railway crossing, the keyman had opened the crossing on the request of a bus driver, who used to bring newspaper for the keyman daily. As soon as the bus came in between the line, it was hit by the speeding train. Multiple casualties had occurred and even one daughter of the keyman, who had boarded the bus from the Railway crossing, also died in the accident. Such human negligence can be avoided by maintaining work efficiency, observance of rules and by posing strict discipline and exemplary punishments to the defaulters.

Mechanical and Construction Faults

- Brake failures and control system failures are commonly observed to be responsible for several Railway accidents. Such accidents can be avoided by proper maintenance of the train and the control systems and through periodical regular check-ups of the brakes and control systems.

- Derailments of trains sometimes take place due to track faults as it happened in the derailment of a train of North-East Frontier Railway in West Bengal. The major causes can be attributed to the—

  (i) Use of wooden worn-out sleepers.

  (ii) Improper size and dimensions of sleepers.

  (iii) Improper spacing of sleepers.

  As per norms, there is specified size of sleeper in broad gauge line and in metre gauge line. Spacing of sleepers is also specified for broad gauge and metre gauge lines per unit length, failing which it permits tilting of rails laterally. In fact, spacing of sleepers should be in accordance with axle load. Indian Railways for avoiding such accidents has now started giving preference to concrete and metallic sleepers instead of wooden sleepers.

- Loose spikes fixed between rails and sleepers can also be the cause of accident/ derailments. It should be checked that spikes should always be tight.

- Worn-out jaws of sleepers cause loosening of tracks, which leads to derailments. Such care must be taken at turnings of the tracks, especially, that the jaws of sleepers are not worn out, so that Railway tracks are able to bear lateral thrust of the running trains.

Sabotage and Railway Accidents

- Railway sabotage means criminal interference with any part of working machinery with the object of rendering it inoperational or any act intended to cause loss of life and damage to the Railway property. This may lead to train wrecking by wilful obstruction or tampering

with the pathway, works or rolling stokes, resulting in an accident to trains with or without loss of life and damage.

When an accident occurs due to certain action on the part of some miscreant, who intended to cause the accident or knew that his action would result in train wrecking, it is classified as sabotage. Sabotage can be with the passenger train, goods train, with the track or the control system. The acts of sabotage, which have commonly been observed, can be as follows:

- Putting obstacles on Railway track, viz., stones, wooden logs, etc.
- Sleepers, rails and fish-plates may be removed.
- Turning, moving, unlocking, and diverting any points or other machinery belonging to Railways.
- Making, showing, hiding or removing any signal or light upon or near to any Railway line or Station.
- Causing destruction to Railway track, bridges, station installations, locomotive, signals, telecommunications, electric traction and substances.

Anti-sabotage Measures taken by Railways

- The Railways are using long-welded rails now-a-days in tracks and the joints have been reduced.
- Reverse jaw sleepers (at least three per rail) are being affixed, so as to keep the rails in position.
- The ends of the fish-plates and the bolts are buried under the stones and the earth, so that these cannot be removed easily.
- The pathway tools are kept safely and are not allowed access by the outsiders.
- Patrolling continues round the clock in sabotage-prone zones.
- Pilot trains are run before passenger trains in sensitive areas.

Forensic Examination of Scenes of Railway Accidents

The sites of accident should be jointly inspected and examined by the Forensic Experts, Police and the Railway officials. Photography and videography of the scene should be carried out meticulously, especially of the damaged/ affected parts, equipments and the tracks. Rescue operations should not be adversely effected by the inspecting team and safety of luggage of the passengers and the victims should be given priority. Following examinations should be carried out and observations be made:

- Wheel marks on sleepers, rails and other fittings.
- Damage to sleepers and fittings.
- Places of loose fittings and damage should be noted.
- Tampering marks, if any, on fish-plates and boards should be recorded.
- Missing keys, if any, should be taken note.
- Curvature of rails should be noted at the site.
- Ends and jaws of sleepers should be examined to know whether they are worn out or otherwise.
- Description of displaced railheads should be given.
- Position of wheels, coaches and engine should be noted.
- Marks, if any, on rails table should be noted.
- Initial point of derailment should be scrutinized.
- Signal system and control system should be examined to know whether they are in correct operation or faulty.
- Use of welding sets or obstacles or explosives, etc., should be examined.
- Sketch should be prepared with respect to installations and damage.
- The speedometer graph should be analyzed in the light of speed fixed en route.

- Factual note should be jointly signed by the Forensic Experts, Police and Railway authorities and any differences of opinion should be recorded in writing.
- Weather information should be recorded and the driver's identity, physical fitness and eating habits, especially with respect to alcohol and drugs, should be noted and verified.
- The reconstruction of scene of occurrence and the inferences should be drawn on the basis of above-stated physical evidences.

If above-narrated facts are kept in view for safety and examinations, the rate of Railway accidents and derailments can be reduced enormously, which can save huge loss of human lives and property. Not only this, Railway should also pay heed to Human Resource Development (HRD) and the knowledge of technical staff and drivers should be updated from time to time through refresher courses, which will enable them to work with the latest trends in the field. The duty hours of the drivers and the operation staff should be fixed to such an extent that the physical and mental unfitness of the staff does not become a cause of accidents. ■

ACKNOWLEDGEMENT

The secretarial assistance given by Shri Dinesh Kumar, Computer Operator is thankfully acknowledged.

BIBLIOGRAPHY

1. 1999 Proc: In. 15th Triennial meeting, International Association of Forensic Sciences, Los Angeles, California, USA, pp. 1-309.
2. Brian Caddy (1987). "Uses of the Forensic Sciences", Scottish Academic Press, London, pp. 1-184.
3. Gaur, J.R. (1990). "Scene of Crime Investigation in India", The Indian Police Journal, 37 (I-IV), pp. 53-56.
4. Gaur, J.R. (2003). "Role of Forensic Science in Criminal Investigation with Special Emphasis on Scene of Crime": Proc. National Seminar organized by M.P. Police and Bureau of Police Research & Development, New Delhi, 15-16 March (Bhopal), pp. 10-13.
5. Mettler, G.B. (1977). "Criminal Investigation", Holbrook Press, Inc. Boston, pp. 1-332.

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Incorrigible Corruption

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Keywords

Corruption

Incorrigible

Escape Routes

Avarice

Manifestation Voluntary

Vigilence,

Nouveau Nobles

Abstract

Corruption warps a man with wealth and equips him with various escape routes. The systems and rules come to his rescue, and he knows how to use them to avoid getting caught, and how to wriggle out if he gets caught. Detection itself is difficult, If detected, process of justice can be delayed, purchased, obstructed; witnesses won over, and Senior Advocates and Prosecutors can even influence the system by foul means for willy-nilly helping him. Since the trial takes ages, his name is not sullied, as "he is still not convicted" and is allowed to use this advantage to worm up again to a warm place.

Introduction

WHEN it is considered brazenly normal that official decisions and actions are influenced by the glitter of gratifying gifts and not by the merits of mundane matters, defining corruption seems the least relevant. More so, when, dizzy with the agony, caused by this omnipresent virus, the society has already reconciled to it as a grim reality of a common, intractable and incurable affliction.

From death certificates, disposal of dead bodies, to surgeries and supplies of medicines; from normal traffic challans to registration of FIRs, investigations to trial and jail; from ration cards to land records; from parking to hawking; from permissions for constructions to prevent demolitions; from purchases, processing of files, clearance of cheques to developmental works and welfare schemes; varieties of NOCs; and tax assessments; and even in administrative matters—from appointments and promotions to transfers and punishments—you name any Government activity, without a gratis nothing moves. With exceptions being very rare, the society is stupefied.

Corruption warps a man with wealth and equips him with various escape routes. The systems and rules come to his rescue, and he knows how to use them to avoid getting caught, and how to wriggle out if he gets caught. Detection itself is difficult, If detected, process of justice can be delayed, purchased, obstructed; witnesses won over, and Senior Advocates and Prosecutors can even influence the system by foul means for willy-nilly helping him. Since the

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trial takes ages, his name is not sullied, as "he is still not convicted" and is allowed to use this advantage to worm up again to a warm place. While uninhibited corruption is, therefore, used undauntedly for assuaging his avarice, society is (un)scrupulously silent.

While the Scandinavian countries, New Zealand and a few others have been able to contain corruption, we are still unable to understand, let alone control this menace, though we are signatories to the UN Convention with regard to corruption. In place of a spirited action, we only continue to believe in ritualistic motions, gurgling out statistics, or churning our brains at frequent conferences, which are crudely described by some as places of resultless intellectual shadow-boxing. Therefore, we do not even raise eyebrows when public servants insincerely follow the annual ritual of taking the grand pledge in a chorus:

> *"We, the public servants of India, do hereby solemnly pledge that we shall continuously strive to bring about integrity and transparency in all spheres of our activities. We also pledge that we shall work unstintingly for eradication of corruption in all spheres of life ...",* though we know fully well that it is broken the very next moment.

It is, therefore, no surprise that all efforts made through vigilance and watch, penal processes and pledges, could not even prevent the spread of this virulent virus, leave aside its eradication. Though the road ahead looks fizzy without a salubrious solution to celebrate, there may still be some ways and means. Perhaps, Joseph Pulitzer rightly said -

> *"There Is not a crime, not a dodge, not a trick, not a swindle, not a vice, which does not live by secrecy. Get these things out in the open, describe them, attack them, ridicule them in the Press and sooner or later, public opinion will sweep them away."*

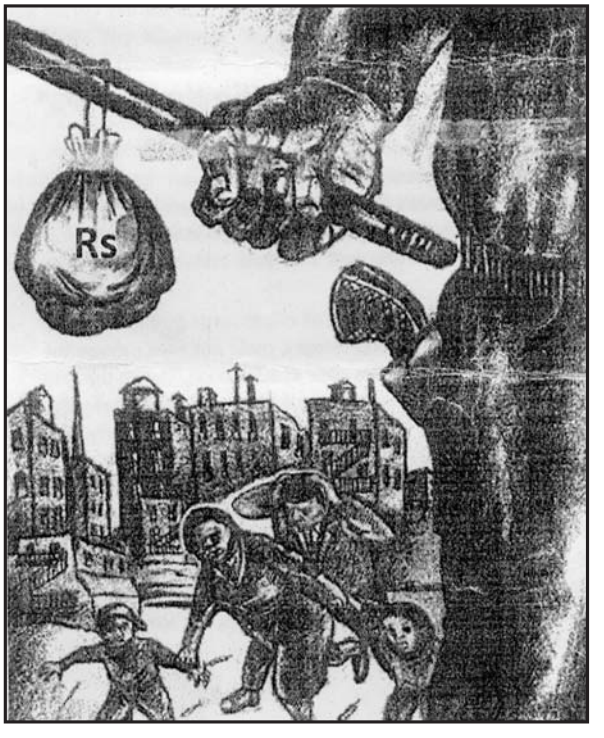
By taking a cue from these words, and putting in quarantine the afflicted people through social boycotts and administering them the bitter medicine of fear of social stigma, additionally, we may succeed in combating this age-old disease, Society also has to change its attitude.

The Age-old Virus

Like the transmigrating soul of an individual, the millennia-old virus of corruption has been evolving and erupting in new virulent forms, with effective mutations from time to time and resisting all the medications invented and administered. History is replete with many known instances.

We are all familiar with the efforts made by Chanakya in controlling corruption as recorded in his *Arthashastra*, in which he compared a public servant with a fish stating that it is difficult to know if the fish in the water is drinking it or is just sleeping. Similarly, the story of an incorrigibly corrupt courtier of Akbar, who found another ingenious way to extract bribes when he was finally abandoned to count waves of the river Yamuna, is oft-repeated. He would stop the transiting ship for disturbing his duty of counting of waves and would thereby create an alibi for reaching a compromise with a bribe. During the British days, the impeachment motions against Warren Hastings and Robert Clive for their indulgence in corrupt activities, as also the efforts of the East India Company in defining misdemeanours of public servants and prescribing punishments for them, are familiar episodes.

Subsequently, while the call for "Quit India" reaching its crescendo was engaging the Government on the one hand and the Second World War sapping its strength simultaneously on the other, there were operatives actively siphoning off funds and exploiting the scarcities for making quick money.



Now, as foretold by Dr. Rajendra Prasad, the country is witnessing unending squabbling for the crumbs of power by unscrupulous elements. Whereas, for attaining freedom for self-governance, emotionally propelled by ethical values, people made many sacrifices; those in governance, unashamedly fuelled by unethical avarice, are making huge personal gains. The age-old virus has travelled a great distance of time.

A Corrupt Gentleman! The Dichotomy!

It is a dichotomy that on the one hand, there are demands and expectations of honesty in public, while on the other, those who swindle the Public Exchequer and extort from the public in the name of governance are admired and virtually worshipped. Conspicuously, society is conspiring with the corrupt by treating them as its nouveau nobles. Big-wigs involved in big scams like Animal Husbandry, JMM bribery, Cash for Questions, Taj Corridor, etc., and in various Disproportionate Assets Cases, unabashedly continue in active public life, since the society salutes them with all smartness instead of stigmatizing and singing sayonara for them.

One does not even ponder over the fact that for acquiring illegal wealth, such 'Noble' souls have to commit a number of serious crimes like criminal misappropriation, criminal breach of trust, frauds, perjury, cheating, forgery, offences under Corruption Act, conspiracy, tax violations of various kinds, like stamp duties, income tax, sometimes Customs Act, so on and so forth. It is not a hyperbole to say that the nouveau nobles are the most dangerous criminals, living as parasites on public money and aiming for El Dorado all for themselves. If we are to follow the laws of the USA, these persons would get such a cumulative punishment that they would never come out of jail in their lifetime. But, in our country, befitting the dangerous dichotomy, a number of such nobles, who should have been found secure in the confines of jails, are enjoying the security of black cats at a great public expense.

Voluntary Vigilantism v. Winking Vigil

Further, there is a glaring discriminative justice by the society. If a poor man, mostly due to compulsions of hunger and squalling poverty and sickness at home, is caught committing a petty crime, he may be meted out the roughest treatment by the very same person who loots the treasury silently. Even though the loss is petty, he can incite the mob for giving the criminal a lynch-justice.

As against this voluntary vigilantism, there is not even a winking vigil against the corrupt. Instead, there is complicity and compliance for various reasons. Sadly, such people are always found on the podia sermonising on eroding ethics and corrosive corruption in the society. Instead of feeling ashamed of shaking hands with such persons, we tend to queue up for this "grand" event. Even the venerated *Godmen* or *Bhagwans* honour them with a prominent place in the front rows and publicly shower them with special blessings by presenting *gold rings* produced from thin air, while blessing the common man with the cheapest ash or *'bhibhuti'*. A sanguine sage worth his robes, would use his *talisman of tapasya* to change the treacherous traits of his *'corrupt' clients;* or would at least command such *bolshoi 'bhakts'* to reform themselves before they enter the portals of his sanctified premises.

Comparisons are odious. But, it will be an eye-opener if one makes the incomparable comparison of the loss to society through conventional crime and through corruption. It is common knowledge that even a small increase in property offences in a place results into a huge uproar, questions in the assembly, calling of explanations from the police and rolling of heads, though the total loss may not be more than a few lakhs, and all the offences may have been committed by a few gangs for beating hunger and sickness in their families. Moreover, it is the experience of any Police Officer that, given a chance of honourable livelihood, most of these criminals, barring a few recidivists, would not indulge in these shameless acts. Yet, for the society, they are criminals.

As against these crimes committed due to dire needs, we find a surprisingly large section of the society, driven by avarice, adopting foul means for easy money through the abuse of power and authority vested with them. Quietly, a public servant may work out a kickback of some crores of rupees in one single deal by colluding with a contractor. Or, he may simply extort in every single case and accumulate his collections. He may also take his fixed percentage of bribe in every developmental work. The loss to the country in terms of development is unimaginable. Corruption intervenes in investment, both foreign and domestic, and hampers our efforts to be a global economic power. Yet, we do not mind.

Furthermore, the dichotomy in treating the "corrupt" as 'Nobles', tragically, confuses young

minds. They do not realize that no honest public servant can ever construct multi-crore complexes, and that such vulgar display of wealth is only a disgraceful manifestation of the extent of infection of corruption, shameless *swindling of public wealth,* and the number of crimes he had committed, though unpunished, during his career. He is only exposing his salacious sagacity in building his ephemeral empire which, in all certainty, will end up in litigations among his progeny.

They commit crimes against the society. Yet, they are not antisocial! They swindle the wealth of the nation and may endanger the security of the country. Yet, they are not antinational! For the society, they are honourable gentlemen! They are the nouveau nobles!

This disgraceful dichotomy of discriminative treatment by the precocious society eludes a fair explanation.

Efforts Galore

Government is not devoid of concerned and conscientious people. Indeed, for a tangible flight against this menace, serious efforts have been repeatedly made, almost once in every two decades. During the Second World War period, when some cases of amassing wealth through ill-gotten means were detected, a Criminal Law Ordinance, 1944, was promulgated to attach such wealth and also to declare illegal the transactions of transfers of such wealth. Delhi Special Police Establishment came into existence as an enforcing agency. In the same breath, the Prevention of Corruption Act was enacted in 1947.

However, all the initial efforts drew a blank, and by the time of the China War, corruption among the political class had reached an alarming level (as per the standards of the day!), compelling the Government of India to appoint a Committee under K. Santhanam, MP, for suggesting ways and means to tackle it. In addition to various suggestions, the Committee emphatically recommended amendment to the definition of the expression "Public Servant" in Section 21 of the Indian Penal Code so as to include Ministers and Parliamentary Secretaries and also said, "Next to the Ministers, the integrity of MPs and MLAs will be a great factor in creating a favourable social climate against corruption..."

In furtherance of the recommendations of the Santhanam Committee, the Prevention of Corruption Act, the IPC, the Cr.P.C. and other related Acts were amended. The Administrative Reforms Committee had been appointed to find out ways and means to eliminate administrative delays and other factors, which lead to corrupt practices. Finally, in the year 1964, Anti-Corruption Laws (Amendment) Act was passed, which considered overcoming the shortcomings in:

- Prevention of Corruption Act 1947;
- The Criminal Law Amendment Act 1952;
- The IPC, 1860;
- The Code of Criminal Procedure, 1898;
- Delhi Special Police Establishment Act, 1946; and
- Criminal Law Amendment Ordinance 1944, in order to make them more effective and to ensure more speedy trial of cases.

This enactment was followed by two more amending Acts:

(i) Criminal Law (Amendment) Act, 1966 and

(ii) Anti-Corruption Laws (Amendment) Act, 1967.

The high-profile agency of CBI also took shape in this laborious exercise.

Disillusionment & Hurdles

Though, all these efforts set the systems in motion and created machineries and mechanisms to mount a counter-attack on corruption that was already brimming with confidence over its successful penetrations, another two decades were more than adequate for the fighting machinery to get completely overwhelmed with the deluge of corruption. There was total disillusionment and it was realized that social and political conditions of India had undergone a considerable change from bad to worse and the menace of corruption and bribery was uncontrollable. The laws and the machineries were lagging behind when the virus was forging ahead in its new forms and mutations, with a more vigorous penetrating power. There were no speedy trials for teaching the 'corrupt' strong lessons, and instead, the judicial drags came up as a heavy hurdle. Therefore, the Prevention of Corruption Act, 1988, was enacted with all the best of intentions and abilities of the Legislators.

Various vigilance machineries of the Central Government and its agencies, and the Vigilance and Anti-Corruption Agencies of State Governments and their agencies, had already

been created from time to time. Finally, the Central Vigilance Commission (CVC) was also established as a statutory authority. They have all been trying their hands in this mighty war, but with only occasional successes in a few cases, and prominently unsuccessful in causing any major dent to the malicious systems.

Any Redemption?

Unfortunately, the laws and the machineries have proved to be a mismatch in the fight against this pernicious virus. All their efforts were stultified and stymied by the virus that has replicated from over the years, penetrating all the vital organs of the body of the Government, leaving honesty a little space. Originally, Section 5, the premier part of the P.C. Act of 1947, was intended only for a period of 'three years', with the optimistic belief that corruption could be controlled within that period. But, with the feeble attempts not resulting in any success, it was substituted with the words 'five years' in 1950, and again, with the words 'ten years' in 1952. Ultimately, when the realization of the real monstrous potential of the fast-spreading disease dawned on the policy-makers, the Section had to be made permanent in 1957, with a fight-to-finish strategy. But it was found that, like the job reservation policy, ten years of persistent efforts and even the subsequent steadfast campaigns still did not produce any results. By the sixties, the situation was considered to be very grave warranting new solutions again.

However, after a thorough assessment, while recommending various measures, Santhanam came out with a really redeeming declaration that most of the bureaucracy was not at all corrupt, and that they would certainly be able to take care of the few corrupt elements among the politicians. Parliament obliged by taking action on the recommendations of Santhanam Committee. But, in the course of time, even these efforts also belied the expectations and the onslaught of corruption, became much more virulent, prompting Rajiv Gandhi to remark in the eighties that not even fifteen paise per rupee were reaching the defined place of development. Thus, after another quarter of a century, the country was compelled to enact a more potent Act in the present form in 1988.

Another two decades have passed by and yet, the results are still eluding the society. The Act is systematically being made impotent by the *Omnipotent, and now Omnipresent, Nobles.*

Licence Raj & Committed Bureauerany

All those who are familiar with the administrative history of the country, vouchsafe for the fact that, in the severe downhill slide of probity, the onset of emergency was the landmark year. The concept of bureaucracy as 'committed' to the Government and not to the Constitution emerged, dividing them into "my officer", and "his officer" by the powers-that-be. There has also been a great awakening among the political class about their own powers and their potential in making quick riches with strong allegiance of 'committed' bureaucracy. The Licence Raj and the 'committed' bureaucracy set the new culture of corruption in motion. As a result, in place of a cathartic 'change' foreseen by Santhanam, corruption has only catalysed the proliferation of 'committed' bureaucrats.

Further, with the 'weapons of mass destruction' of transfers, and victimization, dangerously dangled and unscrupulously employed by those in authority, truly honest bureaucrats have become an endangered category. And, with the powers of the executive usuriously usurped by the policy-makers, subtly slashing initially and crudely crushing in course of time, the erectile strength of the steel of bureaucracy has eroded to give place to the might of malleability. Thus, bureaucrat guiding the political authority in following the rules for governance is a thing of the past; diktats of the political authority now act as determinants of the matrix of governance. As a consequence, evaporation of the Rule of Law has steadily become an effervescent reality and the constitutionally- created institution of the Executive has only become a precarious precipice. A new order has emerged, in which political and bureaucratic corruptions have become complementary to each other. Many scandals have surfaced. And, quite many have never seen the light of the day.

Election & Corruption

Though the reasons are many, perhaps, expensive elections are one of the real causes ·of political corruption, The corporate sector has had a big role in this regard; yet, it is the criminalization of politics that has totally exacerbated the situation, since criminalization and corruption are intricately intertwined. Undoubtedly, with the induction of criminals into the system, corruption has become the norm in governance by decimating the glorious values and allegiance to law prescribed by the Constitution.

While people launder illegal money with the aid of layering systems, criminals launder themselves with the aid of politics. Finding it an authentic route to respectability, criminals and cronies are joining the jay-walk in droves. In addition, in connivance with those in power, touts and henchmen create extra centres of power for collective looting and collective sharing. The marshy mangroves of criminals have, thus, proliferated in the governing systems. This dangerous degeneration has been emphatically exposed when the nexus between the corrupt politicians, bureaucracy, businessmen and the criminals was clearly brought out in the Hawala scam and the Vohra Committee report.

After all, a corrupt public servant is also a criminal. With both the junior and senior public servants drawing their immunity and protection from the same source of power, everyone turns a Nelson's eye towards the other wrongdoer. The moral authority to curb corruption thus waning, they close ranks and tacitly agree for collective looting. Percentages are fixed as commissions as per the rank and role of an employee, like in the engineering Sections. Perhaps, for them, such collective action is a new culture and a new order, not a crime.

Further, even though the Heads of Departments are primarily accountable for controlling delinquencies within their departments, they weirdly watch the degeneration and loot, either due to complicity or cowardice. Their eerie silence is mysterious. Even if criminal cases are made in dozens, no action is taken against the HoD and the charge of vicarious responsibility is only invoked for selective victimization.

Under these circumstances, the invasion of corruption is far and wide, and deep, as can now be gauged with the yardstick of the ratings of Transparency International, the Berlin-based International NGO. Their Corruption Perception Index (CPI) of 1998 ranked India at 66 in the list of 85 countries.

No Redemption in Sight

In spite of all the efforts there is no redemption. In the wake of the announcement of the Hon'ble Prime Minister for "Zero Tolerance" of corruption in 1999, N. Vittal, the then CVC, in all sincerity, set a goal for him to see that before he handed over charge on September 2, 2000, India's rank improved to at least 40, if not 30. However, all his efforts were in vain since instead, there was only a decline in the CPI. By 2002, we were placed at 71 in the list of 102 countries, compared to the rank of 69 out of 90 in the previous survey. Even the CPI score (in a scale of 10) came down from 2.8 in the previous survey to 2.7 in 2002.

As regards those responsible for the state of affairs, Peter Eigen, the then Chairman of TI said, "Corrupt politics elites in the developing world working hand-in-hand with greedy business people and unscrupulous investors, are putting private gain before the welfare of citizens and the economic development of their countries." Regarding the disastrous consequences, the then Vice-Chairman Tunku Abdul Aziz said, "Corruption continues to deny the poor, the marginalized, and the least educated members of every society the social, economic and political benefits that should properly accrue to them, and benefits that are taken for granted in societies that have managed to shake off the yoke of corruption."

Though, these remarks aptly apply to India as well, we are notoriously nonchalant, and have no inclination or pride in emulating the good practices in the countries with a CPI score of higher than 9, like Finland (9.7), Denmark (9.5), New Zealand (9.5), Iceland (9.4), Singapore (9.3) and Sweden (9.3). In the latest ranking of 86 out of 180 countries, we only take solace in the fact that there are about 100 other countries which are worse in the ratings.

Not surprisingly, the Hon'ble Prime Minister's call for "Zero Tolerance" of corruption had no takers even among the Chief Ministers of States ruled by the same political party, whereas the "zero size" target of Bollywood queen Kareena Kapoor may have a million followers.

It needs real vigorous efforts. But, in place of a positive corrective action, we find only mercenary machinations of many Governments in making their machineries of anti-corruption and vigilance either toothless or using them as tools to browbeat those who oppose their diktats. Postings in these agencies are converted as PAPs (posting at a premium), depriving the systems of the moral authority to enforce the law of anti-corruption. They only promote the principle of selective amnesia and impartial actions are never solicited. Even in our wildest dreams, we cannot think of a situation in our country like that in the USA, where Obama invited a small provincial officer Sgt Crowley to the White House for beer, by calling as outstanding officer, when the Police Officer

had publicly accused the President of being "way off base" in calling the police action as "stupid" in the episode of a Harvard Professor. Objective commitment to law in our country is a rarity.

On the contrary, the corrupt within the Government are extremely powerful and can even meddle with law-making itself. Before the P.C. Act, 1988, came up for enactment, the "Single Directive" was first subtly introduced through an administrative measure, so that no action could be initiated against senior Government servants, without prior approval of the concerned Ministry. A gaping hole was thus created as an escape route for the "committed" bureaucrats. When the Supreme Court decided against the "Single Directive" in the PIL in *Vineet Narain's Case*, it was again firmly embedded in the CVC Act through enactment. Vexatious and malicious prosecutions, no doubt, need to be curbed, particularly against those who are vulnerable in decision-making. But, at the same time, there should not be any undue protection for the corrupt.

Similarly, corrupt people with clouts take refuge in the subterfuges carefully knit into the systems. One glaring subterfuge is the sanction for prosecution required under the Prevention of Corruption Act. It is beyond anyone's comprehension why such a sanction is needed in case of somebody, who is caught red-handed while taking bribe, or when he accumulates wealth disproportionate to his known sources of income. Such crimes are committed in his individual capacity and not in the official discharge of his duties. Moreover, when the concerned agencies act on the evidence collected, the question of malicious or vexatious prosecution also does not arise. The systems are indeed so designed.

Thus, the simple sum up is that the genome of recalcitrant corruption remained intact and the anticipated 'change' has not come about. Focus on punishment as a method has not produced the desired effect. Focus on preventive vigilance and transparency also has not brought out the desired change. Pledges and publicity have not added a wee bit to the conscience of the corrupt. CPI has only deteriorated. And, there is no redemption so far. Perhaps, a pragmatic proactive approach may be the answer.

A Pragmatic Approach

In our search for new alternatives in this war, the path-breaking approach of Tehelka comes first in the list. When Tehelka.com opened up a new vista in March, 2001 with its Operation Westend, it created quite a sensation. This exposure of potential corruption in an important field like defence purchases, shocked the people, and rattled the political class. Now, in the BMW case, the Supreme Court, while upholding the judgement of Delhi High Court convicting the Counsel for Contempt of Court, appreciated that the NDTV telecast had rendered valuable service to the important public cause of protecting and salvaging the purity of course of justice, and exposed the conspiracy to undermine the BMW trial. Capturing incriminating evidence and exposing the corrupt is the plain lesson.

When technology provides various means to capture concrete evidence to prove the guilt of the accused with great certainty, anti-corruption agencies need to utilize its benefit to the fullest, particularly when there are constraints in enhancing manpower resources and their skills and commitments. Since Delhi is a corruption-ridden State, within the meagre resources available, some measures have been initiated in the recent past by the ACB. Technology was put to considerable use.

Initially, in order to ward off motivated complaints in trap cases, voice-recording with the help of mobile phones was introduced in the beginning of 2008. Only after a convincing recording about the demand, etc. was available, traps were organized. This introduction of audio, and later, video-recordings, in the course of time, became a revolutionary measure. In all traps, and other cases, it served many a purpose:

- Motivated cases are prevented.
- Evidence of demand and acceptance, even intimidation and extortion, are available through their conversations.
- Evidence of bribe already paid under compulsion is retrieved through further conversations.
- Gang operation becomes visible.
- Even on 'demand' we can make cases.
- Using of the subordinates as linkmen or conduits by senior officers is evident.
- Frauds committed in conspiracy with private persons are clearly brought forth.

Over 50 cases have been registered with the help of the complainants and use of secret audio and

video equipments, and more frequently, mobile phones. Each case was worked out with a different script suiting the particular situation and gradually a new specialization of scriptwriting evolved. A few examples are cited below to highlight the exposure of different modus operandi of the corrupt operators.

Frauds

- ***Licensing fraud in Transport Department*** Touts and Motor Vehicle officers all over Delhi` have made a mockery of driving tests being conducted for issuance of licences. Secret video-recordings made over a period of one month exposed the farce of the tests. Vehicles moving at the most two to three inches with driving instructors accompanying in the same vehicle; coded system of applications being handled by touts and their nexus with officers; along with the approval and passing of bribes, were all captured. Instead of the MV Inspector, it was his favourite tout, who was conducting the farcical operation. In our raids, all the relevant documents along with the bogus entries, were seized. As many as 12 persons, including the Motor Licensing Officer, policeman and touts were arrested in the case. Our action and the attendant publicity compelled the Department to adopt some transparent methods.

- ***Desilting of drains in MCD:*** Annual desilting of drains to prevent waterlogging in Delhi is an exercise involving crores of rupees. The Municipal Corporation pays the contractor based on the tonnage of silt removed, transported and deposited at the dumping site in the outskirts of the city. Our secret video-recording established that no desilting had been done, and instead rubble, etc. from a nearby construction site was lifted on payment and deposited at the designated dumping site in collusion with the Engineers of MCD. On one single night, as many as 41 trucks loaded with rubble were moved from a nearby construction site and deposited at the dumping yard. The engineers at the weighbridges fraudulently showed in their computer records the quantum of slit brought by these trucks from the contracted drains. Thus, the contractor was entitled for payment for the silt as well as the transportation charges for 25 km per truck. Of course he was already drawing an amount for removing the rubble from the construction site from the private party. The entire modus operandi was captured in the recordings and in our raids bogus documents were seized. The concerned engineers and beldars as well as the private contractor, who all colluded in the fraud, were booked. Some corrective measures were later initiated by the MCD.

- ***Social Welfare Department:*** Funds allocated by the Government for running of various Homes were being systematically swindled for decades by the officials and private persons. The funds are meant for destitute women, children, beggars, lepers and so on. Constant endeavours by some NGOs to reveal the frauds through complaints, RTI, etc. could not bring about any change. Even the PILs in the High Court that resulted in certain directives to the department ended up only with vanishing of records and changing of the modus operandi. The frauds had been in operation for decades and even involved senior officers like Joint Secretaries and others and crores of rupees were misappropriated fraudulently. The administration was impervious. Based on various inputs from the NGOs and certain audio-recording conducted with their help, ACB could register three cases. The fraud was busted and it was found that virtually, a parallel Social Welfare Department was being run by a private person from his house, where the indents, notings, purchase processes, quotations from reputed agencies like Kendriya Bhandar, comparative statements, etc. were all fabricated to favour certain bogus suppliers by inflating the prices manifold. Generally, there were no supplies, undersupplies or low-quality supplies. Over a dozen accused, including two Joint Secretaries, Superintendents, and others were arrested with clinching evidence and all the fabricated records and recording systems were seized from the private person. This action of ACB, and extensive publicity antagonized many Government officials, since the Government was compelled to replace the decades-old fraudulent systems with relatively better methods.

Cases registered purely on demand of Bribe

- ***Municipal Corporation of Delhi:*** In a case of de-sealing of premises, a Deputy

Commissioner of MCD demanded Rs. 2 crore by using his Assistant Engineer as the middleman. Even though the Supreme Court's monitoring committee issued de-sealing orders, the officials of MCD did not relent. After proper evidence was collected about the demand, the conspiracy and the official favour that could be done, etc. through various recordings, the officials were arrested in the case.

Seniors using the Subordinates

- ***Engineers of MCD:*** Secret audio-recordings conducted with the help of the complainant contractor clearly revealed the demand of bribe on the part of the Assistant Engineer for clearing his bills. Similarly, the recording with the Executive Engineer, who was the authority to clear bills, revealed the nexus of both the officers and also, interestingly, about the coded language used for the bribe to be paid. The coded sentence: "Have you started the work?" means whether the bribe was already paid or not. Both the Engineers were arrested when the Assistant Engineer accepted Rs. 50,000/- as initial payment on behalf of both of them.
- ***SHO of Sarita Vihar:*** Audio-recordings clearly revealed that a Beat Constable and a Head Constable demanded Rs. 10,000/- from a poor man living in a *jhuggi* for his action of pruning a tree, threatening that a case would be registered for illegal felling and also that they were even paid Rs. 30,000/- earlier by another party in a similar case. The conversations recorded linked up the share for the SHO also. The role of the SHO was later confirmed in a separate recording with him. All of them were arrested after a trap was laid in which the beat police was caught red-handed, accepting the bribe. The conspiracy was very clearly evident.

Gang Operation

- ***Slum and JJ Department:*** In a simple civil dispute about a common wall involving two neighbours, the JJ Department was also a party for providing their comments to the court. The Kanungo, who was incharge of the area, went to the defendant's house along with three other Kanungos/Patwaris, who had no jurisdiction over this area, to overawe the defendant and his family with their authority, and demanded a bribe for giving a favourable report in the Civil Court. The video- and audio-recordings indicated how this pack of wolfs prowled together to intimidate a common man. They were caught red-handed accepting the bribe.

Retrieval of Evidence of Bribe already paid

- ***Case against policemen in Crime against Women Cell (CAW Cell):*** In a complaint of dowry harassment, a bribe of Rs. 15,000/- was already accepted from a person by applying all kinds of duress on him and his family. But, when there was a demand of another Rs. 10,000/- from the poor man with the threat that his two children aged 10 and 12 would also be implicated in the case of dowry harassment, he approached ACB full of tension and tears. A proper script was given to him, so that he could enter into dialogues with the officer and others, who were all involved in the matter. The audio-recordings made were full of evidence. The culprits shamelessly spoke about the money already accepted, the way it was shared among themselves, and the requirement of further money. A trap was laid and all the three officials, including a lady Head Constable who had originally brokered the deal, were caught.
- ***Case against the Special Staff of North-West District:*** A case of silver stolen from a jeweller in another district was handled by them when they stumbled upon a gang. A number of persons were arrested. But, in the process, some real culprits were let off and a few other jewellers were nabbed and after taking substantial amounts of bribes, some were kept out of the case, while the others were implicated. Apart from demanding and accepting huge amounts of bribe, a substantial portion of the sliver was swallowed. The recordings done from time to time revealed the roles of a number of Police Officers, including the ACP, with regard to raids conduced, amounts illegally collected and false recovery shown from places that were not even visited, etc. The recordings clearly indicated the amounts of bribes demanded and accepted overnight on the first day and subsequent days, and also regarding the illegal detention and torture of persons over long periods. The intention of the officers was not bonafide, as revealed from various recordings.

Conspiracy with Private Parties, Advocates, etc.

- ***Crime Branch Inspector:*** A high-profile Crime Branch Inspector of Deihl Police was arrested along with a Senior Advocate and other two policemen in a case of conspiracy, demand and acceptance of bribe. An amount of Rs. 26 lakh passed hands and it was the Advocate, who was the Police Counsel for many years, who acted as the conduit for the Inspector. The conversations were recorded in video- and audio-recordings with the help of the complainant, whose father was arrested in a murder case by the same Inspector, allegedly on framed charges. It was for helping him in the matter of bail and in diluting the charge-sheet that the illegal gratification was involved. All these accused spent considerable time in jail after their arrest by ACB.

- ***Case of Sangam Vihar PS:*** A Journalist was acting as a tout for the Sub-Inspector of a Chowki and his staff. With the help of the complainant, who was doing a legal business of scrap from a steel firm, audio-recordings were done to establish the link between the Journalist, the SI and his subordinates. There was a clear demand for a lump sum payment of Rs. 75,000/- and also for a monthly of Rs. 4,000/-. Since the complainant's premises were under seize by the policemen, he had no option but to make an initial payment of Rs. 60,000/- to the SI and another Rs. 20,000/- for the staff. The recordings helped us in retrieving the facts of earlier payments, which were made under duress. They were caught red-handed while accepting the balance amount of Rs. 15,000/-.

Institutionalized Corruption

- ***Case in New Delhl Municipal Corporation (NDMC):*** The help of the complainant, who was running a small eatery along with his regular floral business, was taken to conduct over 30 recordings over a period of one month. About 20 persons were the subjects of the video- and audio-recordings. They included officials of Police, Labour Department, Health, Sanitation, Water Supply, Enforcement of NDMC, etc, who were demanding and accepting their monthly illegal gratifications. Failing such payments, various kinds of harassments were meted out and goods were confiscated only to be released later on higher premiums. With very clear evidences available against 17 persons, all of them were arrested the same day in a single operation. The arrests and the extensive Media coverage created a very high impact in the State and the NDMC Administration was rattled.

- ***Traffic Police:*** Three-wheelers from U.P. are allowed to ply in Delhi very freely on a monthly payment of good amount of bribes. The local auto-rickshaws are, however, challaned for petty offences and regular demands are made by the police. A number of touts operate on behalf of the police. With the help of a complainant, video- and audio-recordings were made over a period of almost a month and the racket of institutionalized corruption was exposed. As many as 5 policemen and others were arrested.

A Glimpse of the Underworld of Corruption

Some parts of the transcripts of conversations of the accused persons in a few cases noted below provide us a glimpse of the underworld of corruption. But, for the use of technology, it would have been well-nigh impossible to collect such irrefutable evidences.

Case of Crime Branch

Inspector: "... because of this reason I have helped you much more than what is required and which cannot be done by others even if you pay rupees fifty lakh. And, you have paid only a very nominal amount." "Wherever I have to support you, I would be keeping quiet in the court."

Case of Sangam Vihar

Journalist to SI: "Sir, should I pay the amount to Anil (Ct), and would there be no problem?" SI says that there would be no problem.

Complainant to Journalist: "Sir, I do not have more than Rs. 60,000/- with me. Please manage with this amount since I cannot produce anymore. Don't pressurize me further." The Journalist says, "No, since the SI agreed only for one lakh he would not take anything less." And, he further adds, "Tell me when you will pay the balance amount? Is it tomorrow, or the day after? Be sure." SI, who was present, advised the complainant, "OK, pay it day after tomorrow."

Engineers' Case

Complaint to AE: "I will make your payment by taking some loan; as of now I have some amount and you may take it." The AE, while refusing to take the money, comments: "This is only a change, keep it with you." He adds, "You bring the total amount along with the previous balance of Rs. 40,000/-."

Complainant with EE: "Sir, AE was suggesting that I could pay your share also through him." The EE then tells the complainant, "You start the work first and then talk to me." (Records prove that there was no work pending to be started, and the complainant confirms that to start the work means to make the payment of bribe before the cheque is formally cleared for payment.)

Case of Transport Department

Constable narrates his conversation with the SHO, who posted him for the Transport Beat. He says: "I told him that I paid him lakhs of rupees. When he asked for details, I explained that I paid him for nineteen months @ Rs. 40,000/-, thus in all rupees eight lakh."

The rate for clearance of a licence was enhanced from Rs. 200/- to Rs. 500/-. The touts plead with the main tout, who works for the Inspector and conducts the tests, etc., "We have learnt that the Inspector is taking Rs. 200/- from some touts, whereas you are collecting Rs. 500/- from us." The main tout replies that he himself was paying Rs. 500/- per case since the Inspector would not discriminate in collecting money. He also says, "Since the MLO does not reduce the amount, the Inspector also cannot.... It is the MLO, who gets the major share."

NDMC case

One Enforcement Inspector 'X' of NDMC is a very well connected and powerful officer. Another Inspector speaks to the complainant: "Do the work of 'X' first." When the complainant said, "I paid the amount only on 10th of this month... it was of last month", he was advised to make payment to 'X' for the current month within a day or two. The complainant was alerted that in case of any message from 'X', no one would be able to help him. Therefore, "do his work first".

The inspector 'X' to the complainant: "For this month, make the payment on Monday and later, I will let you know through whom to make the payment in future."

One Constable (in the presence of another Constable) tells the complainant: "Pay us first, then pay the SHO and afterwards pay the Division Officer. Lastly, you can pay the Head Constable. One can run the shop only this way."

Assistant Labour Commissioner refused to take Rs. 500, and says: "No. Keep it with you. What can I do with this money? Forget about it. Even a Chaprasi would not take this petty amount."

Case against the Special Staff of NW district

Head Constable to the complainant (brother of arrested person): "Have you brought the full amount." The complainant says, "No, I have made arrangement for Rs. 1.25 lakh and am trying to arrange the remaining seventy-five thousand rupees."

When he confirmed that he was carrying only rupees ten thousand with him at that time, the HC responds, "This ten thousand was brought for what purpose? There was no need to bring this ten thousand. Sahab will object to it and others will also object to it... As I told you bring the total amount or at least bring 1.25 lakh (what you have arranged).

ACP: "...When this person (brother of the complainant) was brought here, the silver was not with him.... This man had to be illegally kept for four days with us since the other accused arrested were already handed over to the PS"... "This two lakh seventy thousand, which you are mentioning is like this, two lakh were taken first. Later, Rs. 50,000/- was taken in my name. Twenty thousand more were taken separately."

Case against Dy. Commissioner of MCD

Complainant to the DC in the ante-room of his office: "You are like my younger brother."

DC: "Yes, I am like your younger brother. I told him (AE) to be reasonable in doing your work. Sit with him for a couple of minutes and work It out." As soon as the DC leaves this ante-room, the AE enters with a briefing from the DC.

Complainant: "How much should be paid initially."

AE: "If you have to get your work done, there is nothing like initial or final. Whatever is the settled amount, it has to be paid."

Prior to this, a number of conversations took place in which a clear demand was made for Rs. 2 crore for de-sealing, at the rate of Rs. 1 crore

per motel, and attempts were made to scale down from this demand over a period. Subsequently, with the guidance of ACB, the officials were confronted with all these conversations again and they had agreed about these developments, which were captured in proper audio-recordings. Thus, the incriminating conversations, which were not recorded earlier, were retrieved in the subsequent recordings.

New Methods in conformity with Law

It is now certain that use of technology is inevitable in order to prove a case of conspiracy, demand and acceptance, intimidation, extortion, gang operations, etc. Courts have also endorsed their appreciation of our efforts by invariably rejecting bails of accused persons based on the convincing CDs and transcripts produced by us. There is no ambivalence about the admissibility of the evidence so collected.

The Apex Court in *Ziyauddin Burhanuddin Bukhari* v. *Brijmohan Ramdas Mehta,* AIR 1975 SC 1788 case clearly laid down that tape-recorded speeches were "documents as defined by Section 3 of Evidence Act", which stood on no different footing than photograph. Tape-recorded conversation is nothing but information stored on a magnetic Media.

In the same case, the Apex Court considered the value and use of transcripts recorded there at the time of transcription and the evidence of the makers of transcripts as certainly corroborative, because it goes to confirm what the tape-record contained. The court also made it clear that such transcripts can be used by a witness to refresh his memory under Section 159 of the Evidence Act and their contents can be brought on record by direct oral evidence in the manner prescribed by Section 160 of the Evidence Act. Thus, the importance of having a transcript of the tape-recorded conversation cannot be underestimated. The same ensures that the recording is not tampered with subsequently.

As for admissibility of such evidence, conditions were laid by the Apex Court in the case of *Ram Singh* v. *Col. Ram Singh,* AIR 1986 SC3, as under:

- The voice of the speaker must be duly identified by the maker of the record or by others, who recognize his voice. Where the maker has denied the voice, it will require very strict proof to determine whether or not it was really the voice of the speaker.
- The accuracy of a tape-recorded statement has to be proved by the maker of the record by satisfactory evidence, direct or circumstantial.
- Every possibility of tampering with or erasure of a part of a tape-recorded statement must be ruled out, otherwise it may render the said statement out of context and, therefore, inadmissible.
- The statement must be relevant according to the rules of the Evidence Act.
- The recorded cassette must be carefully sealed, and kept in safe or official custody.
- The voice of the speaker should be clearly audible and not lost or distorted by other sounds or disturbance.

Regarding identification of the taped voice, the court's directions are that proper identification of such voice is a *sine qua non* for the use of such tape recording. Therefore, the time and place and accuracy of the recording must be proved by a competent witness and the voice must be properly identified (Yusufalli Esmail Nagree).

Keeping in view the legal guidelines, over a period of one year, experience was gained and expertise developed to provide the most appropriate script to the complainant, to elicit and record the most required evidence from the accused persons, which would meet the needs of trial at a later stage. Further, new methods were evolved to strengthen the evidence collected. The CD is played before the accused and *Panchas*, and the conduct of the accused is recorded in a *Panchnama*. Usually, the accused is tense and repents for his actions. Similarly, the voice in the CD is got identified with the help of officials, who are in regular touch with the accused. As far as possible, video-recordings of the proceedings of the *Panchnamas* are made. Statements of *Panchas* are the additional evidences in the case. FSL opinion is sought in all cases to ascertain that the CD was not tampered with or doctored, and also for voice identification with the samples taken by them. The process of investigation has been simplified, since most of the required evidence is collected even before registration of the FIR.

Success of our Mission

Success in ACB case depends on the quality of evidence collected, and the utmost secrecy maintained till the time of registration and raids.

Use of technology for recordings gave us ample time for collection of adequate evidence before a case was registered. Further, since we adopted a method in which only the complainant and senior officers are privy to the matter until the FIR is registered, there is no chance of any leakage and the case is invariably successful. The evidence collected is so indisputably strong that the prosecution and ACB are very confident of the results of trial, when they are concluded. We only wish the trials are much faster, so that there is relief from this ordeal for the prosecuting agency, the victim, society, as well as for the accused.

A series of cases successfully registered in a range of notoriously corrupt departments, like the cases of Transport Department, MCD desilting fraud, SHOs, Crime Branch Inspector and Advocate, 17 persons of NDMC, Deputy Commissioners, scores of Engineers, Policemen, cases of Social Welfare Department, etc., resulting in the arrest of gangs of officials, particularly senior officers and their cronies, in each case in one go, created enormous impact in these departments as well as in the public.

Like the mythical *Brahmastra,* which is employed only against a leader and not against the foot soldier, the meagre resources of ACB were targeted against the seniors and gangs for causing the maximum impact. Reduction of lower-level corruption was only an attendant consequence. Thus, we could replace the system of sustenance on surrogate statistics with reliance on regal impact.

Judiciary as well as the Print and Electronic Media played a great role In support of the campaign. While the Judiciary was absolutely firm in rejecting bails, the Media gave extensive coverage. Transcripts and, at times, video-clippings were published/telecast with the objective of creating maximum awareness and deterrence. Since the material available in the recordings and incorporated in the FIR and sent to the court was very strong provable evidence about the certainty of the involvement of the accused, and since no false cases were possible in such a mechanism, the entire Media took up the cause with great zeal and commitment. If one has to wait for the final conviction for giving publicity, the impact would never be felt.

It was reported that for the first time, the presence of ACB, Delhi, was strongly felt and that over five decades of complacent, corruption was rattled and the systems were shaken. The fear of certainty of possible punishment in view of innovative recordings, coupled with the intense publicity causing a social stigma, worked out as the best method of treating deterrence. The credibility of ACB as an honest professional organization has etched in the minds of the public. While the honest people were rejoicing, the patrons of corruption were placed in a piquant situation, and for all the corrupt public servants, ACB was no longer a nursing nanny, but turned out to be a nasty nightmare.

The rating for good governance soured high for the Government. However, the corrupt segments and lobbies of such officials in the administration were the most worried lot, and as expected, they finally succeeded in bringing curbs on Press interactions and publicity to prevent exposure of the culprits. In order to kill the spirit of proactivity, they also ensured that no resources were provided to ACB, being aware that sustained activity is not possible without Government support. There were adverse comments of some helpless ("committed") officials in the administration that the work of ACB was only a publicity stunt. But, it was common knowledge that the contribution of ACB was due to a genuine effort with a missionary zeal against many odds and hurdles. The spirit of the officers, however, remained undaunted. "When I'm not thanked at all, I am thanked enough; I've done my duty and I've done no more", said Henry Fielding. One has to agree.

Conclusion

Ads and Notices against giving/taking bribes exhibited on premises of Government offices and the annual ritual of billboard signs and bumper stickers that read "Anti-Corruption Week" will not suffice. Pledges do not change mindsets. The insignificant results achieved so far have exposed the total inadequacy of various methods available with the different agencies dealing with prevention of corruption. Tehelka exposure has only reiterated it.

We need to learn a lesson from the systems in the village councils in tribal areas like Arunachal Pradesh, which impose punishments for various offences as per their customary laws. There the punishment is prompt and is considered as a social stigma. In social life too, the culprit is debarred from participation in some rites and rituals. The miserable life led by him works as the biggest deterrence for the other.

Therefore, apart from the methods already in place, it is the proactive element with the use of technology; and the bitter medicine of social quarantining and constant exposure of the corrupt, that is essential to bring relief to the silently suffering public. The agencies of ACBs, Vigilance and CVC need to be filled up with officers with proven traits of innovation, integrity and proactivity. PAPs have to stop. Trials should be virtually instant.

It goes without saying that the community's help is indispensable in the fight against corruption. But, they will participate in the task wholeheartedly without any inhibitions only when adequate faith is instilled in them. It is our experience in Delhi that sincere and genuine proactive efforts were fully endorsed by all cross-sections of people, since they found a breather and relief for the first time.

The adage of Edmond Burke, "The one thing necessary to the triumph of evil is that good men do nothing" applies to the good men in the Government, Media, Judiciary and Society. To drive the droves of criminals away from governance, good men have to join in larger droves in the movement. The Nation awaits the 'anti-corruption brigade', as a sincere citizen puts it. It is urgent, since seven decades is too long a period in this combat.

Otherwise, corruption will demolish the confidence of the few unpolluted individuals and the society will eventually have to pay the penalty. Plato said perfectly, "The penalty for wise men, who fail to participate in the Government, is to live under the Government of unwise men." ■

Notes for Contributors

Editorial objectives

The journal covers articles of general police interest as well as research papers based on empirical data pertaining to police work. Authentic stories of criminal case successfully worked out with the help of scientific aids and techniques are also published. Only original manuscripts are accepted for publication. Articles submitted to the journal should be original contribution and should not be under consideration by any other publication at the same time. A certificate to this effect should invariably accompany the article.

Areas covered include

Crime, criminology, forensic science, forensic medicine, police organization, law & order, cyber crime, computer crime, organized crime, white collar crime, organized crime, white collar crime, crime against women, juvenile delinquency, human resource development, police reforms, organizational restructuring, performance appraisal, social defence, correction/ prison administration, police housing, police training, human rights, insurgency, intelligence, corruption, terrorism, etc.

Review process

Every article received for publication is subject to the following review procedures:

- It is first reviewed by the editor for general suitability for publication.
- If it is found suitable, it undergoes a review process by a member of our Board of Referees.
- Based on the recommendations of the reviewers, the Editorial Board decides whether to accept the particular article as it is, or seek revision, or reject it.

Manuscripts requirement

The manuscripts should be submitted in duplicate in double line spacing with wide margins. Articles should ordinarily be between 2000 and 4000 words in length. Title of the article should be precise.

Authors should also supply an Abstract of 100-150 words with keywords. A copy of the article saved in floppy/CD in MS-Word may be sent in addition. Contributors are advised to be very brief in introducing the subject and devote most of the paper to the main theme. Authors should take care to ensure accuracy of the data and references. Quotes should be cited accurately from the original source, should not be edited and should refer to the page numbers of the original publication. Capitalzation should be kept to the minimum and should be consistent. British spellings should be used rather than American. The typed script may please be carefully scrutinized for typing errors before dispatch. A brief autobiographical note of the authors should also be supplied including full name, designation, postal and e-mail address, if any. Figures, charts and diagrams, should be kept to the minimum and good quality originals must be provided. At the end of the article a reference list and a short bibliography would enhance acceptability of the contribution. The contribution can also be e-mailed to the Editor in addition to being sent by post.

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BPR&D, MHA,
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editoripj@yahoo.co.in
Tel.: 091-11-24362402, 24365009/5010
Fax: 091-11-24362425, 24369825

RNI No. 4607/57

Published By: The Bureau of Police Research & Development, Ministry of Home Affairs,
Govt. of India, New Delhi and Printed at : Chandu Press, D-97, Shakarpur, Delhi-92 Ph.: 22526936