



RESEARCH PAPER

The Role of Forensic Chemistry in Criminal Justice System: Case Study of Apex Courts' Decisions

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ABSTRACT

Present article is written to analyze the role of forensic chemistry in the criminal justice system and need for legislation regarding regularization of chemical testing laboratories. This study also identifies the real condition of chemical forensic laboratories in Sindh. For research detailed case study of decisions of apex court and opinion of senior legal practitioners is obtained. Forensic chemistry is used to trace the presence of any chemical at the place of incident/crime scene. Techniques of forensic chemistry use to investigate recovered matters to determine the liability of criminal and civil nature. It also used in several criminal cases to determine liability of accused for example narcotics, toxicology cases, adulteration in food items and drug abuse etc. Chemical Examiner and Serologist Reports are admissible in evidence in to and also its opinion could be part of court file without examining them during trial (PLD 1972 Lah 109(DB)). In this research quoted its different types and which techniques are used in Pakistan and which are lacking.

Introduction

Forensics Chemistry in the court of law is for the purpose of analyzing the crime scene recoveries. Chemical analyst uses his skills through scientific, chemical principles to identify the chemical in sent articles. Forensic chemistry directly used in the field of law. By law enforcement agencies to provide information that could be used in court of law as evidence in criminal case. Forensic analytical chemistry used to discover information from physical form of evidence. In criminal cases, attempt to determine when and by whom the crime was committed expert opinion is always required. There are two other classifications of forensic chemistry.

Forensic environmental chemistry use to trace presence of any chemical at place of incident or crime scene. By utilizing techniques of chemistry for the purpose of investigation of environmental spills is an effort to determine liability of criminal

and civil nature. This subject easily could be divided into two areas on the basis of techniques used to determine liability: Chemical Fingerprint development and spatial association. Complex mixture of chemical or chemical isotopes is utilized to connect a spill or environmental release with sources present at place of incident. Geographical information system and geographical information system used to identify the exact location of noxious waste or pollution with all possible sources in physical space. It performs a key role in administration of justice (Boehm, P. D., Douglas, G. S., et al. (1997). Application of petroleum hydrocarbon chemical fingerprinting and allocation techniques after the Exxon Valdez oil spill

All non-biological materials and traces and evidences found at crime scene analyzed by Forensic chemist for the purpose of identifying unknown materials and match samples to known substances. They also **analyze** drugs/controlled substances taken from scenes and people in order to identify and sometimes quantify these materials.

For identification of Poisons first time were used by early Egyptians and ancient Greeks and Romans. ... Ancient Roman civilization had laws against poisoning to human in 82 B.C.E. Before the **development** of systematic, scientific criminal investigation, guilt **was** determined largely by circumstantial evidence and hearsay evidence.

In following cases report of chemical analyst is used as conclusive prove for awarding conviction or acquittal:

1. Narcotics cases
2. Chromatography of documents
3. Murder caused by poison/toxicity analysis (2014 SCMR 11)
4. Documents analysis by using chromatography
5. Drugs abuse test
6. Semen analysis
7. Percentage of alcohol
8. Unknown screening and doping

The Agencies That Send the Case Properties/Articles for Testing to Chemical Forensics Lab

In the office of chemical analyst from following different offices cases are received for chemical analysis of substances

1. Police Stations Cases of all police stations.
2. A.N.F Cases of Narcotics and Alcohol Strength.
3. Excise Cases of Narcotics and Alcohol Strength (whisky, Kachchi sharab, Kuppies, etc)
4. Army Cases of Toxicological/ Intoxication nature.
5. Air force Cases of Toxicological/ Intoxication nature.

6. Navy Cases of Toxicological/ Intoxication nature.
7. Coast Guard Cases of Narcotics and Alcohol Strength.
8. F.I.A Cases of Narcotics/Blood analysis(very rare).
9. Custom Cases of Narcotics.

Nature of Articles/Samples Received From Different Departments/Agencies

- In Murder------(Weapons,cloths etc)
- In Poison cases------(Body Viscera's)
- Zina cases------(Semen slides,Swab & cloths)
- Narcotics cases------(Heroin, Charas, Bhang, Opium, Cocaine)
- Excise------(Alcohol, Heroin, Charas)
- Food------(Water, Food, Juices, Milk)

Test Performed In Chemical Laboratory

The following sections in which they perform various tests in separate sections

Blood section

In this section they perform human blood detection and non-fire arm weapons detection.

Toxicology Section

In this section they identify different poisons in the human viscera's.

Semen Section

In this section they identify the presence of semen in swab in rape cases.

Narcotics Section/Drugs Abuse Test

Drug metabolites play a major role in identifying, confirming, and quantifying drugs of abuse. They are often the only remaining evidence of a rapidly metabolized drug, and their predictive fragmentation patterns provide much needed clues for identifying unknowns. Cayman Chemical offers Certified Reference Materials (CRMs) for many of the major metabolites of opiates and other illicit opioids, benzodiazepines, stimulants, and cannabinoids

Cayman Chemical is at the forefront of providing crime and toxicology labs with authentic reference standards for new and emerging drugs of abuse from ISO/IEC 17025:2005 and ISO Guide 34:2009 labs. More than 2,000 standards to identify, confirm, and quantify illicit opioids, cannabinoids, cathinones, amphetamines, phenethylamines, benzodiazepines, and other controlled

substances. Through direct communication with forensic toxicologists, crime labs, and health labs that are tasked with the identification of unknown samples, our product line is constantly evolving to meet emergent needs. Our online drug identification tools and downloadable GC-MS library are freely available to assist in the identification of unknown compounds, and our highly trained staff of chemists is equipped to quickly synthesize currently unavailable forensic standards. It is further divided in two following sections

Heroin opium section: where they identify heroin and opium.

Charas and Bhang section: where they identify charas and bhang.

Alcohol Section: where they identify different types of alcohol and strength of alcohol in whisky, bambhat etc. detect percentage of ethyl and methyl in alcohol

Food Section where they check quality of beverages, water, meat and other food items. It is examined in the food section and a report is sent to court. In our country adulteration in food items is very important and a burning issue in our country. It is done by black marketers, hoarders and profit makers. Adulteration and misbranding is an offence under Pakistan Penal Code and prevention of food adulteration act. Case sample of adulteration in milk is sent to public analyst for ounce which was deficient (1989 P.Cr.LJ 2467).

Food adulteration is presently a very important issue because it is not only decreasing quality of food but so also it is causing numerous bad effects and diseases in our society (Spink, J. and D.C. Moyer. 2011. Defining the public health threat of food fraud (Spink, 2011).

Bacteriology section Test conducted to detect bacteria's in water and food samples. Isolation of bacteria

Serology section: serology section deals with body serums like saliva, blood and DNA testing etc

Chromatography

High-performance liquid chromatography (HPLC), formerly referred to as high-pressure liquid chromatography, is a chromatographic technique that can separate a mixture of compounds and is used in biochemistry and analytical chemistry to identify, quantify and purify the individual components of the mixture. Tops from left to right are acetaminophen, anti-inflammatory medicine, and caffeine. Spectroscopy methods are valuable when the example being tried is unadulterated, or a typical combination. At the point when an incomprehensible blend is being dissected it must be separated into its individual parts. Chromatography procedures can be utilized to break separated blends into their segments considering each part to be investigated independently (Heftmann, & Hayden, 1952.).

Meagre layer chromatography (TLC) is a speedy option in contrast to more perplexing chromatography strategies. Attention can be utilized to examine inks and colors by extricating the individual components. This can be utilized to research notes or filaments left at the scene since each organization's item is marginally unique and those distinctions can be seen with TLC. The main restricting variable with TLC investigation is the need for the parts to be solvent in whatever arrangement is utilized to convey the segments up the examination plate. This arrangement is known as the versatile phase. The measurable physicist can contrast questions and known norms by taking a gander at the separation every segment travelled. This separation, when contrasted with the beginning stage, is known as the Recovery factor (Rf) for each removed component. If every Rf esteem coordinates a known example, that means that the obscure identity.

Elite fluid chromatography can be utilized to remove singular segments from a blend broken up in an answer. HPLC is utilized for non-volatile blends that would not be reasonable for gas chromatography. This is helpful in drug investigation where the drug is a mix drug since the parts would isolate, or elute, at various occasions considering the check of each component. The eluates from the HPLC section are then taken care of into different finders that produce a top on a chart comparative with its fixation as it elutes off the segment. The most widely recognized sort of locator is a bright obvious spectrometer as the most well-known thing of intrigue tried with HPLC, drugs, have UV absorbance.

Gas chromatography (GC) plays out a similar capacity as fluid chromatography, yet it is utilized for unstable combinations. In criminological science, the most well-known GC instruments utilize mass spectrometry as their detector. GC-MS can be utilized in examinations of pyro-crime, harming, and blasts to decide precisely what was utilized. In principle, GC-MS instruments can recognize substances whose focuses are in the femtogram . However, by and by, because of sign-to-commotion proportions and other restricting elements, for example, the age of the individual pieces of the instrument, the functional location limit for GC-MS is in the picogram . GC-MS is additionally fit for measuring the substances it identifies; scientists can utilize this data to decide the impact the substance would have on a person. GC-MS instruments need around multiple times a greater amount of the substance to measure the sum than they need essentially to distinguish it; the restriction of evaluation is regularly in the nanogram.

Literature Review

Provisions related to Chemical Expert Evidence

Article 59 QSO provides the admissibility of opinion of experts of any field of science and arts in any case and Article 164 of QSO provides that evidence become in existence due to modern devices could be admissible if its integrity is proven and not questioned by anyone.

In absence of a particular framework that specifically deals with scientific evidence, courts in Pakistan have to maneuver/plan to improve the available legal framework. Chemical testing is valued in the perspective of Art 164& 59 Qanoon-e-Shahadat Order 1984 ('QSO'). In these provisions it is provided that opinion of experts of any field related to arts, or science come in the domain of evidence relevant, however further provision states reasons for admissibility of several modes of evidence generated by scientific devices and technology. In the legal framework presently available, a chemical analyst report is considered as an expert whose opinion is acceptable before court. The laboratories developed for Chemical sample testing in Pakistan especially in Sindh are working to very Low standards and even they are using old methods and now the world is changed and modernized so they have to update them according to the new era (Ahmaed, 2020).

Forensic science has a key role in the criminal justice system framework everywhere on the earth (Petherick et al., 2010). Forensic overlooked in Pakistan for somewhat a while. The progressing fear mongering surrendered a wake call to the foundation and untiring endeavors were made for the setting up and legitimate working of the scientific lab to support investigation in criminal cases (Petherick et al., 2009). Since 2001, specialists have been patching up the legal science framework of the nation to help wrongdoing examinations. The National Forensic Science Agency (NFSA) was affirmed by the Executive Committee of the National Economic Council (ECNEC) as a self-governing body in 2002 having different branches of crime scene Investigation, follow science, addressed archives and computerized crime scene investigation (National Forensic Science Agency, n.d.). Its goal was to help set up other legal science research facilities the nation over and to give instructing and preparing offices all through Pakistan, which is still not accomplished. In Punjab region, Punjab Forensic Science Agency (PFSA) Act was passed in October 2007 for the foundation of the Forensic Science Agency which at last led to the foundation of the Punjab Forensic Science Agency in 2012 having fourteen offices under one rooftop. The offices incorporate sound video investigation, PC criminological unit, wrongdoing and passing scene, DNA and serology, scientific photography, opiates, toxicology, follow proof, polygraph, gun and apparatus marks, inactive fingerprints, pathology and addressed archives (Punjab Forensic Science Agency, n.d.). In Sindh area, Sindh Forensic Science Agency act was passed on August, 2017 yet so far no research center has been set up. DNA testing office accessible in Jamshoro, Sindh which gives look into just as legal DNA testing. Other than this, legislature of Sindh is putting forth attempts for foundation of Forensic DNA testing lab in Karachi University. Khyber Pakhtunkhwa police has set up Forensic Science Laboratory and Institute of Forensic Science in Peshawar on December, 2017 to give primer scientific offices and to overcome any issues between measurable mindfulness and criminal examination rehearses. In Balochistan region of Punjab, a demonstration was passed for the foundation of Balochistan Forensic Science Agency in August, 2015 however no criminological office has yet been set up. At present, NFSA and PFSA are giving numerous significant examination leads in different repulsive violations.

CASE LAWS

Table 1

S. No	Case Laws	Forensic Chemical Test Report	Final Decisions of Court
1	2007 SCMR 1487	Positive	Conviction Upheld
2	2007 SCMR 1435	Positive	Conviction Upheld
3	2008 SCMR 1254	Positive	Conviction Upheld
4	2017 Pcr.LJ 1652	Positive	Conviction Upheld
5	2016 SCMR 621	Positive	Conviction Upheld
6	2011 SCMR 624	Positive	Conviction Upheld
7	2010 SCMR 27	Positive	Conviction Upheld
8	2015 SCMR 308	Positive	Sentence Enhanced To Life Imprisonment
9	2015 SCMR 133	Positive	Bail Canceled Allowed By Lower Court
10	2007 SCMR 1671	Positive	Conviction Upheld
11	2010 SCMR 1962	Positive	Conviction Upheld
12	2009 SCMR 291	Positive	Accused arrested by police officer of rank ASI Bail allowed
13	2015 SCMR 279	Positive	Public witness not supported case of Police accused acquitted from charge
14	PLD 2020 Sc 132	Positive	Conviction Upheld
15	2017 SCMR 1874	Positive	Conviction Upheld

- 2020 SCMR 460 Shazia Bibi VS State Supreme court directed that three things should be mentioned in Forensic Report 1. Test applied 2. Protocol applied 3. Result of test. Otherwise forensic report is not reliable. Reliance was based on 2015 SCMR 1002(Ikramullah case), 2018 SCMR 2039(Kher ul basher case) and 2019 SCMR 930.
- PLD 2020 Sc 57 In this case Supreme court also given guide lines for chemical examiner Report that international standards should be applied and mentioned in report.
- 2020 SCMR 196 In this case Supreme court directed to follow rule(6) of CNS 2001 Rules.
- 2018 SCMR 2039 In this case Supreme court directed Federal Government that Qualification of Forensic Experts should meet international standards.
- "ALI MUHAMMAD Vs. The STATE" (PLD 2010 S.C 623) ACCUSED CAN CLAIM TO SEND whole recovery for chemical testing
- "Amer Zeb Vs. The State" (PLD 2012 S.C 380) In this case law supreme court gave guidelines for sending samples for chemical testing.
- THE STATE VS. AMJAD ALI" (PLD 2007 S.C 85) in this case law Supreme Court alleged that by sending already tested property for chemical testing the way to get acquittal by the accused is illegal. It was held that "Courts were to curb such clandestine modus operandi adopted to screen offenders and make sure that once a substance had been tested then extraordinary reasons were to exist before directing fresh examination of such substance."

- MUHAMMAD ASLAM (AMIR ASLAM) and others versus. DISTRICT POLICE OFFICER, RAWALPINDI and others”(2009 SCMR 141) In this case apex court also adopted the same view which was adopted in “PLD 2007 S.C 85”
- “ALI MUHAMMAD and another Vs. THE STATE” (2003 SCMR 54) “ In case the appellants’ defence would have been that contains of entire case property so recovered was not Charas they could have made an application to the trial Court or before the High Court for re-examination of the entire case property which was also produced in the trial Court as Article ‘A’ having not done so, such plea cannot be said to have merit and substance considering also that the said plea being plea of the fact, would require detailed enquiry and re-examination of the narcotic substance which cannot be gone into by this Court at this stage.”

Material and Methods

Methodology used in this article is quantitative and qualitative and idiosyncratic and, especially in the courts and in practice, the outcomes are often limited to the specific facts of the case. Survey is conducted through questionnaire filled online and by using Google forms questionnaire was designed and link shared by using whatsapp and validity of questionnaire is checked through applying cronbach alpha test. This is pure research by application. Topic of article is related to law and science hence opinion through questionnaire was obtained from experts of subject as lawyers, Judges, and chemical experts who are dealing with cases of narcotics and poisons in province of Sindh.

Results and Discussions

Table 2
Frequencies Statistics

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
N	Valid	38	38	38	38	38	38	38	38	38
	Missing	0	0	0	0	0	0	0	0	0

Table 3
Descriptive Statistics

	Mean	Std. Deviation	N
Q1	1.11	.509	38
Q2	1.66	.669	38
Q3	1.95	.868	38
Q4	2.08	.941	38
Q5	2.08	1.050	38
Q6	1.13	.578	38
Q7	1.16	.594	38
Q8	1.42	.793	38
Q9	1.63	.913	38

/VARIABLES=Q1 Q2 Q3 Q4 Q5 Q6 Q8 Q9/SCALE('reliability')
ALL/MODEL=ALPHA.

Table 4
Reliability: Scale: reliability
Case Processing Summary

		N	%
Cases	Valid	38	100.0
	Excluded ^a	0	.0
	Total	38	100.0
Reliability Statistics			
Cronbach's Alpha		N of Items	
.821		8	

Table 5

S.No	Questions	Yes	No	May Be	I Donot Know
1	Do you think that forensic chemical expert report is useful in criminal cases?	97.1%	2.9%	0%	0%
2	Do you think that notified forensic Labs perform tests quickly?	26.5%	47.1%	17.6%	8.8%
3	Do you think standard of chemical forensic Labs should be updated?	94.1%	2%	3.9%	0%
4	Do you think numbers of chemical forensic Labs should be increased?	97.2%	0%	2.8%	0%
5	Do you think that trained person in collecting forensic evidence should be member of investigation team?	61.5%	20%	14.7%	3.2%
6	Do you think that forensic sampling should be done by Lab Assistant as they are aware about procedure and protocols?	73.5%	14.7%	11.8%	0%
7	Do you ever visit chemical forensic Lab?	41.7	55.6	2.7%	0%
Total responses		38			

Discussion

In answer of this question majority of respondents agreed that report of chemical Examiner is important in criminal cases. It clearly shows that no doubt report of chemical expert is very important in criminal cases i.e murder, narcotics, food adulteration and burning to decide the matter. Majority of respondents agreed that a person who is expert in collecting forensic evidence should be member of investigation team and number of forensic Labs should be increased and updated with equipments and funds. Reliability of questionnaire is proven by cronbatch alpha test result which is 0.82.

Conclusion

On the basis of chemical expert reports the numbers of case accused persons are convicted. Forensic Lab was visited but all workers denied answering any question and the present condition of Karachi chemical expert Lab in service Hospital is not in good condition. Chemical Examiner who as a chemical expert conducts the analysis through a chemical test should be signed by him and not by any technician. Reporting by a chemical examiner should be in easy and understandable language and if any code or formula is used then its meaning may be specified in the report. In this field our Forensic Labs are not working on international even on nationally decided standards, and this situation is alarming for our Criminal Justice system.

Recommendations

1. For proper sampling any forensic lab technician must be part of the first responder's team and investigators team.
2. Number of designated laboratories should be increased for speedier investigation and trial.
3. Research in forensic science, applied forensic and basic forensic should be promoted and as well as translation and deployment of new techniques in forensic labs should be made sure.
4. In Pakistan forensic labs are not accredited yet so they continue to work towards rigorous accreditation of laboratories at all levels (federal, state, local, tribal), certification of scientists and other forensic science practitioners, and establishment and promotion of ethical standards for forensic scientists.
5. Provide education for law practitioners, scholars, and judges in forensic science methods and practice.
6. Develop outreach programs for the public that highlight the capabilities, limitations, and potential of forensic science.
7. People working in laboratory are not properly qualified they are only lab assistant experience and working on place of director and Assistant director post.

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- 2009 SCMR 291 SUPREME-COURT
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- 2010 SCMR 196
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- 2010 SCMR 27
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