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FORENSIC TOXICOLOGY AND DRUG RELATED CRIME INVESTIGATION: CHALLENGES AND RESPONSES

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Abstract

Forensic Toxicology became important for drug and poison detection, analysis, and interpretations in the criminal justice system. In modern India, with an increasing number of drug-related crimes ranging from narcotics trafficking, overdoses to drug-facilitated sexual assaults, and a high magnitude of scientific investigations has become an immediate need. Forensic toxicology, thus, helps determine the presence, quantity, and effects of an intoxicating substance in a biological sample, utilizing the latest advances in analytical techniques such as GC-MS (Gas Chromatography - Mass Spectrometry), LC-MS (Liquid Chromatography-Mass Spectrometry), and immunoassays. Yet, integration of toxicological evidence into legal proceedings is surrounded by challenges. Various considerations such as admissibility of evidence, chain of custody, and reliability of testimony by an expert sometimes tend to weigh heavily on the evidentiary value of toxicological reports in a country or state of law. Under the Narcotic Drugs and Psychotropic Substances (NDPS) Act, 1985, and The Bharatiya Sakshya Adhiniyam (BSA), 2023, such toxicological results are crucial for prosecution; yet, inappropriate procedural measures frequently diminish their probative significance. Also, the onset of synthetic and designer drugs has created newer challenges for forensic labs that are unable to match up with the fast turnaround of scientific innovations. This paper tries to understand forensic toxicology from a scientific and legal perspective in drug-related crimes, especially vis-a-vis the statutory provisions of Indian law and judicial pronouncements, along with comparative analysis drawn from other jurisdictions. It also highlights ethical issues regarding privacy and consent in toxicological testing and investigates requisite policy changes that will firm up forensic infrastructure in India. The study thereby ultimately asserts that the synergy between forensic science and criminal law is necessary for practically and fairly investigating, trying, and punishing in cases of drugs and toxic substances.

Keywords: Forensic Toxicology, Drug-Related Crimes, NDPS Act, Evidentiary Value, Criminal Justice

1. Introduction

Forensic toxicology is a most important discipline under the India's criminal justice system, which particularly focusing on detecting and analysing the effects of drugs, poisons and toxins on the human body to provide credible and admissible evidence in legal proceedings. The increasing rise in narcotics trafficking, drug abuse and drug-facilitated sexual assaults (DFSA) has intensified the need for advanced scientific expertise in the toxicological analysis. Recent data from the National Crime Records Bureau (NCRB) reveals that the drug-related crimes are increasing under the Narcotic Drugs and Psychotropic Substances Act, 1985 (NDPS Act), which stressed the forensic toxicology's vital role in the investigations and court processes.[397]

The scope of toxicology extends beyond the narcotic crimes to cover accidental poisonings, overdoses, custodial deaths which are linked to intoxication and driving under influence. The

[397] National Crime Records Bureau, *Crime in India 2022 Report*, Vol. 1, Ministry of Home Affairs (2023).

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effective medico-legal investigations mostly rely on the accurate scientific analysis of the biological samples, such as blood, urine, hair, semen, and tissues.[398] However, still our India deals with many major challenges including limited forensic infrastructure, case backlogs, shortage of skilled professionals and the difficulty in detecting novel synthetic drugs and New Psychoactive Substances (NPS).[399]

The evidentiary value of the toxicological findings is tightly linked to adherence to statutory safeguards. The NDPS Act which remains as the primary law that regulates the narcotic substances, prescribing stringent penalties for offenses like, from possession to trafficking.[400] The new criminal laws – the Bharatiya Sakshya Adhiniyam (BSA) 2023[401], Bharatiya Nyaya Sanhita (BNS) 2023, and Bharatiya Nagarik Suraksha Sanhita (BNSS) 2023, have updated the legal framework by stressing the importance of expert testimony, certification for electronic records, mandatory forensic involvement in serious crimes and mandatory audio-video recording of search and seizure processes.[402]

Though we have legal advances, forensic toxicology in India still faces ethical challenges like privacy concerns, potential false positives, over-criminalization debates and uneven accessibility of advanced testing facilities.[403] This paper critically examines the forensic toxicology's scientific and legal dimensions in cases related to drug-related crimes, considers judicial precedents and proposes new policy reforms to strengthen the collaboration between the forensic science and criminal law.

2. Scientific Foundations of Forensic Toxicology

2.1 Forensic Toxicology

Forensic toxicology is an application of scientific disciplines to address questions that are arising in legal contexts. It involves the identification and interpretation of drugs, poisons, and other toxic substances and their effects on the human body. In drug abuse cases, the chemical testing of biological samples are accepted as an unbiased method to determine drug intake.[404] The drug testing plays an important role in criminal justice, for both to monitor an on-going drug use and to evaluate the degree of damage caused by the single or combined substances that might cause death. Medico-legal investigations mostly rely on toxicological evidence to conclude cause and manner of death, especially in cases of unexplained death occurring at places like the residences, hotels or public spaces.[405] The indicators such as empty medication packs or drug paraphernalia[406] found at scenes assist in establishing drug involvement.

2.2 Pharmacokinetics in Toxicology: The ADME Model

Fig: 1

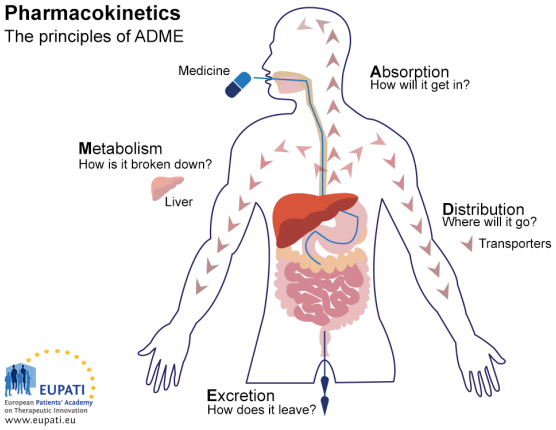

Image courtesy: https://toolbox.eupati.eu/glossary/pharmacokinetics/

a) **Absorption** – It refers to the pathway through which a chemical or toxic agent is absorbed into the bloodstream, such

[398] R. N. Karmakar, *Forensic Medicine and Toxicology* (6th edn, Academic Publishers, 2021) 455.
[399] Directorate of Forensic Science Services, *Annual Report 2022-23*, Ministry of Home Affairs (2023).
[400] Narcotic Drugs and Psychotropic Substances Act, 1985, ss 8, 21, 27, 35.
[401] Bharatiya Sakshya Adhiniyam, 2023, ss 39–45, 61–63.
[402] Bharatiya Nyaya Sanhita, 2023, s 113; Bharatiya Nagarik Suraksha Sanhita, 2023, s 176(3).
[403] Law Commission of India, *277th Report on Wrongful Prosecution (Miscarriage of Justice): Legal Remedies*, 2018.
[404] Barry Levine, *Principles of Forensic Toxicology*, Ch 3, p.31 (2006).
[405] M. Yadav & A. Tiwari, 'Forensic Toxicology and Its Relevance with Criminal Justice Delivery System', (2017) 4(4) *Forensic Research & Criminology International Journal* 122.
[406] US Department of Justice, National Drug Intelligence Center, *Drug Paraphernalia: Questions and Answers* (NDIC, pdf) https://www.justice.gov/archive/ndic/pubs6/6445/6445p.pdf (accessed 31 August 2025).

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as ingestion via the digestive tract (stomach), inhalation through the respiratory system (nose), injection (direct entry into the bloodstream), or dermal exposure (contact with the skin or eye).[407]

b) **Distribution** – Once a drug has been absorbed into the tissues of the body, this forms a distribution from one part of the body to another part of the body or organs through the bloodstreams. For example, alcohol quickly crosses the blood–brain barrier, which explains its rapid psychoactive effects.[408]

c) **Metabolism** – The toxins or drugs begin to breakdown into the body which usually occurs in the liver. It can be used in identifying both the parent drug and its metabolites in toxicological examinations.[409]

d) **Excretion – It is the process of eliminating or removing the drug or toxin from the body, by way of** urine, but also via breath, sweat, hair, or feces (stool). The rate of elimination or removal is important in establishing the time since consumption, particularly relevant in cases of DUI (driving under influence).

Our Indian forensic laboratories are often struggling with advanced toxicological techniques because of limited software and inadequate expertise, though the **scientific reliability of ADME principles** makes them essential in court proceedings.

2.3. Biological Samples (Matrices) in Toxicology

Fig: 2

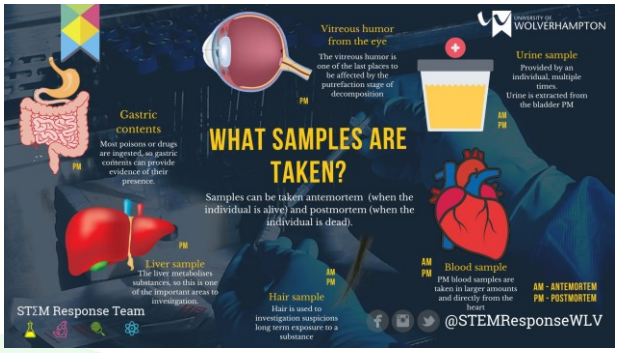

Image Courtesy: https://www.google.com/url?sa=i&url=https%3A%2F%2Fx.com%2FSTEMResponseWLV%2Fstatus%2F1281566341414043648&psig=AOvVaw0NBFMTG7bTnPjvKXUp6QMy&ust=1756884195922000&source=images&cd=vfe&opi=89978449&ved=0CBgQjhxqFwoTCKiGmefFuY8DFQAAAAAdAAAAABAE

a) **Blood** – It gives direct information about the drug or alcohol presence at the time of collection itself. It is used in cases of drug overdose, drunken drive and DFSA. It is the duty of the medical practitioner to collect the sample by using sterile vacutainer tubes, so thus the sample won't get clot and it also helps it from getting degraded. The tubes must be sealed, labelled with the name of the case details and should be stored in refrigeration (2-8°C).

b) **Urine** – It is easier to collect in larger quantity, which has longer detection than the blood, useful in workplace drug test and NDPS cases. It has to be collected in sterile, dry, screw capped containers and the collected sample has to be stored in refrigerator.

c) **Saliva (oral fluid)** – It shows recent drug use, and it is used in roadside testing for driving under influence. The samples are collected in absorbent pads or buccal swabs from the tongue and inside of the cheek; the samples are sealed in airtight kits and refrigerated.

d) **Hair & Nails** – It provides long-term record of drug intake like weeks to months, especially useful in DFSA cases where the blood and the urine samples

[407] R. N. Karmakar, *Forensic Medicine and Toxicology* (6th edn., Academic Publishers, 2021) 455.
[408] B. K. Sharma, *Textbook of Forensic Medicine & Toxicology* (14th edn., Elsevier, 2020) 512.
[409] Directorate of Forensic Science Services, *Manual on Forensic Toxicology* (Ministry of Home Affairs, 2022) 23–29.

are delayed. The hair has to be cut close to the scalp and around 100 hairs (approx.) and nails clipped using sterile tools, collected samples has to be stored, sealed and labelled in paper envelopes.

e) **Vitreous humor & tissues** – In case of decomposed bodies, the vitreous fluid (eye fluid) and the solid tissues from the liver and kidney are tested since the blood is degraded. The fluid is collected using syringe during autopsy by the forensic pathologist and stored in sterile tubes under refrigeration.

Under the **Section 105 of the BNSS 2023**, the law made the chain-of-custody and audio-video recording of seizure and collection to be followed strictly, to make the collected evidence admissible under the court of law.[410] And every sample has to be sealed and labelled (case number, signature of the officer) and then documented in seizure memo or form.

2.4. Analytical Techniques in Toxicology

Modern toxicological testing includes various techniques:

a) Gas Chromatography–Mass Spectrometry (GC–MS)

In this method the samples (blood, urine, and seized drug powder) is being vaporized. The Gas Chromatography separates compounds by instability and contact with the column and Mass Spectrometry then attacks molecules with electrons, fragments them and then measures their mass-to-charge ratio, producing a unique "fingerprint." This gives both qualitative (identity) and quantitative (amount) results.

For Example: On 2017, the Delhi police seized 10 grams of a brown powder that look like heroin. Heroin field test kits gave no results; probably due to adulterants like chalk powder. By using GC-MS method the components are separated and confirmed the presence of heroin at 2.5 grams. This makes the difference between the small and commercial quantity matters for Section 21 of the NDPS Act. The GC-MS report was accepted by the court for conclusively proving possession of narcotics.[411]

b) Liquid Chromatography–Tandem Mass Spectrometry (LC-MS/MS)

In this method the samples are dissolved in liquid and then passed through a chromatography column under high pressure. The compounds are then separated based on polarity and interaction with column material. The Tandem MS detects in two stages: the first mass analyser selects a parent ion; the second fragments it further for precise identification. This allows detection of even trace amounts of non-volatile or heat-sensitive drugs, e.g., synthetic opioids.

For Example: In Hyderabad (2021), two students fainted shortly after eating chocolates suspected to be drugged. The analyses carried out immediately after their collapse failed to reveal the substance. On their second attempt, using LC-MS/MS, the toxicologists identified carfentanil and acetylfentanyl in the blood samples in the nanogram range. The earlier kits could not detect these potent synthetic opioids, but LC-MS/MS could confirm their presence. The discovery facilitated the emergency medical response as well as the NDPS prosecution of the traffickers supplying deadly designer opioids.[412]

c) Immunoassay

In this method which works on antigen–antibody binding principle. The antibodies are coated on test strips that react with drug molecules (antigens) in urine, saliva, or blood. If the colour changes or glows fluorescence that indicates a positive result. It is fast and less expensive but are prone to false positives/negatives, so confirmatory tests (GC–MS, LC-MS/MS) are mandatory for court.

For Example: During the Bengaluru music festival in 2019, the police carried out roadside urine immunoassay tests. One of the drivers tested positive for a specific type of drug called benzodiazepine. He stated the drug was from a medical prescription. The driver used diazepam, which was later confirmed using GC-MS;

[410] Bharatiya Nagarik Suraksha Sanhita, 2023, s. 105.

[411] Sharma BR, *Forensic Science in Criminal Investigation & Trials* (6th ed., 2020), p. 412.

[412] UNODC, *Synthetic Opioids in South Asia*, 2022.

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diazepam is a controlled substance when used without a prescription. In this case, the immunoassay was used for quick screening and GC-MS for confirmatory evidence, which is admissible in court.[413]

d) High-Performance Liquid Chromatography (HPLC)

In this method the samples are dissolved in a liquid and then pushed through a tightly packed column under high pressure. The separation starts to occur based on interactions with stationary phase and solvent polarity. Then detectors like UV or mass spectrometer, helps to identify and quantify compounds. This method is excellent for non-volatile drugs and biological samples where concentration is very low.

For Example: On 2019 in Kerala, the overdose theory aroused regarding a custodial death was investigated. Viscera samples, which included the liver, kidney, and stomach contents, were tested with HPLC and showed toxic diazepam levels, (10µg/mL in blood). The evidence from the toxicology showed that the death was from a drug overdose and not from custodial assault, which led the investigation to focus on the possibility of illegal drug administration.[414]

Though Indian forensic science labs struggle to meet international **NABL** accreditation and ISO standards, gaps still exist across regions in quality and infrastructure.[415] **Section 39 - 45 of the Bharatiya Sakshya Adhiniyam, 2023** (BSA) stressed the admissibility of forensic expert opinion and grounds of opinions in validated techniques for making the evidence as reliable in the court of law.[416]

2.5. Types of Drugs under forensic toxicology

Forensic toxicology in India encounters a broad spectrum of substances and some of the particular types of drugs are:[417]

a) **Opioids** – The NDPS Act, 1985 specifically lists heroin, morphine and opium as substances of concern. The "Golden Crescent"[418] is a known source region for the Indian market, and heroin purity is considered in sentencing.[419]

Fig: 3 Opium

Image Courtesy: https://narcoordindia.gov.in/narcoordindia/Periodicals/1732276895-3313-DOC-ncb-annual-report-2023-24.pdf

Fig: 4 Heroin

Image Courtesy: https://narcoordindia.gov.in/narcoordindia/Periodicals/1732276895-3313-DOC-ncb-annual-report-2023-24.pdf

b) **Cannabis derivatives** – Ganja, resin or gum made from ganja and bhang are consumed widely. Their seizure rates are high in cases involving students and urban areas.[420]

Fig: 5 Cannabis or Ganja

Image Courtesy: https://narcoordindia.gov.in/narcoordindia/Peri

[413] Karnataka State Police, *Drug-Impaired Driving Report*, 2020.
[414] Pillay VV, *Modern Medical Toxicology* (5th ed., 2019), p. 302.
[415] Narcotic Drugs and Psychotropic Substances Act, 1985, ss. 2, 21–27; see also discussion on Golden Crescent, Bardale, *Principles of Forensic Medicine and Toxicology*, (2011).
[416] Bharatiya Sakshya Adhiniyam, 2023, ss. 39–45.
[417] Rajesh Bardale, *Principles of Forensic Medicine and Toxicology* (1st edn, Jaypee Brothers Medical Publishers Pvt Ltd, 2011), ISBN 978-93-5025-493-6.
[418] The Golden Crescent, comprising Afghanistan, Iran, and Pakistan, is a key global hub for opium production, directly impacting Indian states like Jammu and Kashmir, Punjab, Rajasthan, and Gujarat due to their proximity to the Indo-Pakistan border.
[419] NDPS Act, 1985, ss. 2, 21–27.
[420] Narcotics Control Bureau (NCB), *Annual Report, 2022*.

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odicals/1732276895-3313-DOC-ncb-annual-report-2023-24.pdf

Fig: 6 Charas or Ganja gum anja resin

Image Courtesy: https://narcoordindia.gov.in/narcoordindia/Periodicals/1732276895-3313-DOC-ncb-annual-report-2023-24.pdf

c) **Cocaine and stimulants** – The use of cocaine, MDMA and amphetamines appears to be limited to urban centres and is showing a marked increase in metro seizures.[421]

Fig: 7 Cocaine

Image Courtesy: https://narcoordindia.gov.in/narcoordindia/Periodicals/1732276895-3313-DOC-ncb-annual-report-2023-24.pdf

d) **Hallucinogens** – There is some concern over LSD blotters and psilocybin mushrooms as they are a subject of legal scrutiny despite their scarcity.[422]

Fig : 8 LSD Blotter

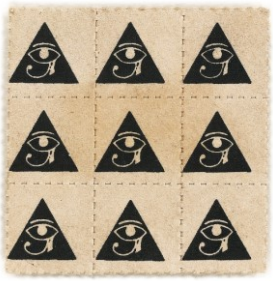

Image Courtesy: https://en.m.wikipedia.org/wiki/LSD#/media/File%3AEye_of_horus_blotter_art.jpg

Fig: 9 Psilocybin mushrooms

Image Courtesy: https://illinoisrecoverycenter.com/treatment/hallucinogens/psilocybin-mushrooms/

e) **Prescription drugs** – Benzodiazepines (diazepam, alprazolam) are implicated in drug-facilitated crimes; codeine-based syrups and tramadol are omnipresent in abuse circuits, paving way for tramadol's inclusion in the NDPS in 2018.[423]

f) **Synthetic drugs** – The FSLs face challenges in the identification of newer drugs, such as synthetic cannabinoids, cathinones (mephedrone), and fentanyl analogues.[424]

Fig : 10 Synthetic Drugs

[421] Ibid.
[422] Ibid.
[423] Ministry of Finance Notification S.O. 1761(E), 26 Apr. 2018.
[424] NCB, *Drug Seizure Data 2021–23*.

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Image Courtesy: https://narcoordindia.gov.in/narcoordindia/Periodicals/1732276895-3313-DOC-ncb-annual-report-2023-24.pdf

2.6. Challenges in Modern Toxicology

1. Synthetic substances are difficult to identify.
2. State Forensic Science Laboratories (FSLs) faces backlogs, which weaken value of reports.
3. Shortage of toxicologists with advanced analytical training.
4. Unlike other countries, our India lacks uniform protocols.

The BNSS's integration requiring forensic specialists and the BSA's expert testimony standards will become effective only if scientific issues are solved via investment and reform.[425]

3. Forensic Toxicology in Drug-Related Investigations

3.1 Post-mortem Toxicology

It involves examining biological samples like blood, urine, liver, kidney, vitreous humor and other tissues which are collected during the autopsy, to detect drug or poison and determine the cause of death. The samples should be collected and preserved properly to maintain the integrity of the evidence, as delays or mishandling can affect the test results and its admissibility in the court of law. In Indian courts the reports of the forensic toxicologist are essential in death investigation which is involving overdoses, poisoning or suspicious circumstances. However, if the proper certification and the chain-of-custody are not followed the evidence cannot be accepted as an admissible in the court of law.

- ***Anant Chintaman Lagu v. State of Bombay (1959)*** – In November 1956, Laxmibai (victim) travelled by train with Dr.Lagu. During or shortly after the journey Dr.Lagu allegedly administered an unrecognised poison or drug which cause the death of the victim. The body of the victim cannot be found, so due to that no autopsy was done. Though the medical evidence was insufficient and inconclusive, the prosecution stated a strong web of circumstantial evidence. The evidence showed that the Dr.Lagu had a motive and took actions to escape a post-mortem and also made false and inconsistent statements to the police after the disappearance of the victim. Dr.Lagu was charged under Section 302 of Indian Penal Code, as well as forgery, cheating and misappropriation. The Supreme Court upheld the conviction by stating *corpus delicti* and ruled that a death could be either natural or due to poisoning, the accused's (Dr.Lagu) behaviour before and after the death shall be considered. In this case Dr.Lagu's actions pointed towards an unnatural cause of death.[426]
- ***Toofan Singh v. State of Tamil Nadu (2021)*** – Toofan was arrested by NCB officials for offences under the NDPS Act, 1985. During the interrogation a confession was recorded under Section 67 of the act, where he admitted that he had possession and transported the narcotic substances. The special court convicted Toofan and the Madras High Court upheld the judgment of the special court. But before the Supreme Court two questions arose, (i) whether officers under the NDPS Act qualify as "Police officer" under the section 25 of the Indian evidence act and (ii) whether confessions recorded under section 67 are admissible as evidence. By 2:1 majority the court held that the NDPS officers are effectively "Police officers" for purposes of Section 25 and confessions made to them are inadmissible. The

[425] BNSS, 2023, s. 176 (mandatory forensic involvement in serious offences).

[426] *Anant Chintaman Lagu v State of Bombay* AIR 1960 SC 500, [1959] INSC 150 (14 December 1959) https://www.latestlaws.com/latest-caselaw/1959/december/1959-latest-caselaw-150-sc/#:~:text=He%20also%20attempted%20to%20evade,were%20referenced%20and%20relied%20upon (accessed 30 August 2025).

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judgment stressed that such confessions violates Article 20(3) Right against self-incrimination and Article 21 Right to privacy and fair trial. But later held that NDPS Officers lack complete police power under CrPC and hence the confessions under Section 67 shall be admissible.[427]

- ***Yusuf v. State (2023),*** In this case the Supreme Court of India issued an acquittal due to the absence of an authorised Magistrate and found out that the samples have not been certified during the trial proceedings, despite the accused being in possession of 20 kilograms of heroin. This issue relates to the NDPS Act, 1985, and emphasises that every quantity demands compliance with due procedure. The seizure was done without the required presence of a Magistrate under Section 52A (2)[428], and the samples were not certified in accordance with Section 52A(3)[429], which rendered the trial defective. The Court further stated that statutory procedures, when not followed, diminish the evidentiary value of narcotics toxicological findings, even if the quantity seized is large.[430] To forensic toxicologists and investigators, this case underlined the compulsory need for seizure, sample collection, preservation and certification to be followed strictly so thus the evidence shall become admissible.

3.2 Drug-Facilitated Sexual Assault (DFSA)

In Kerala on 2020, a minor rape survivor has alleged said that she was sexually abused by 38 people after her release from an rescue centre in Kerala. The local police said that on Monday 33 of the 38 accused have been arrested. That 17 year old girl narrated an ordeal during counselling session at the Nirbhaya centre few days ago. The girl stated that she was first raped on 2016, when she was only 13 years old. At that time the police have filed a case under the POCSO Act and the girl was moved to a shelter home of the same district. On 2017 the same girl was allowed to go home but soon after she approached the police accusing that a neighbour sexual assaulted her. The officials said that she was allowed to go to home and live with her mother and brother during the lockdown on 2020, but soon after she went missing after her release from the centre., later the victim was traced.[431]

Fig 11: Adding drugs with an motive to sedate the victim.

Image Courtesy : https://dfsa-toxicology.uoguelph.ca/

DFSA involves the use of drugs or intoxicants to incapacitate (weaken) the victim to commit sexual offences. In such cases, forensic toxicology plays an important role in detecting the presence of those incapacitating agents, such as benzodiazepines, alcohol and other sedatives. In DFSA cases, the major challenges are delay in reporting, delay in collection of biological samples (blood, urine, hair) and victim's testimony. The courts often stress about

[427] *Toofan Singh v State of Tamil Nadu* (2021) 4 SCC 1 (SC) https://lawbhoomi.com/toofan-singh-vs-state-of-tamil-nadu/ (accessed 30 August 2025).
[428] Section 52A of the NDPS Act, 1985 - Disposal of seized narcotic drugs and psychotropic substances
[429] Ibid.
[430] Yusuf v. State, Supreme Court of India
[431] DNA Web Team, 'Shocking! Minor Rape Survivor Sexually Abused by 38 Men' *DNA India* (19 January 2021) https://www.dnaindia.com/india/report-shocking-minor-rape-survivor-sexually-abused-by-38-men-2869026 (Last accessed on 31 August 2025).

timely collection of biological samples in DFSA cases.

3.3 Drug Trafficking & Consumption Cases

Drug trafficking involves illegal trade, distribution and sale of substances that are controlled under the NDPS Act, 1985. In consumption cases which refers to consuming or possessing drugs for personal use. The NDPS Act establishes strict statutory presumptions that equate the possession of illegal drugs with knowledge and intent, and it is the duty of the accused to rebut the burden of such presumption. With the help of forensic toxicology we can able to identify the difference between the mere possession, trafficking and personal consumption. It also helps in accurate finding the type of drug and quantity, which is essential for stating the nature of offense and punishment for it.

4. Legal & Evidentiary Framework in India

In India's criminal justice system, forensic toxicology is as critical as its scientific accuracy and its compliance with legislative and procedural provisions. The investigations related to drugs are governed by the NDPS Act of 1985, whereas the Bharatiya Sakshya Adhiniyam (BSA) 2023, Bharatiya Nyaya Sanhita (BNS) 2023, and Bharatiya Nagarik Suraksha Sanhita (BNSS) 2023 have modernized the evidentiary laws to focus on expert participation, chain-of-custody, and electronic record authentication.

4.1 NDPS Act, 1985

Under Section 8 of the NDPS Act which states about the prohibition of use, consumption, sale, purchase, manufacture, production, possession, transport, warehousing, and import or export inter-State or India, of narcotic drugs and psychotropic substances except for the medical or scientific use and, Section 35 of the act creates a presumption of a culpable mental state regarding the possession of such drugs and psychotropic substances, and it is the duty of the accused to prove his rebut by disproving possession or knowledge of the drug.[432] The courts often stick with, strict adherence to the rules on seizure, collection of samples, and medical reporting is indispensable and even the slightest non-compliance can lead to the collapse of the prosecution's case.

4.2 Bharatiya Sakshya Adhiniyam (BSA), 2023

The BSA which updated the law of evidence and integrates laboratory reports as a type of electronic record under Section 61-63[433]. It also strengthens the admissibility of expert testimony under Section 39 and the requirement of certification for such electronic records, including laboratory and digital evidence.[434] As a result, the forensic toxicology reports can be recognised as legally reliable and credible in the court of law.

4.3 Bharatiya Nyaya Sanhita (BNS), 2023 & Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023

The BNSS, 2023 legislation makes the engagement of forensic experts' compulsory for investigations involving serious crimes punishable with a minimum of seven years of imprisonment or more **(Sec. 176)**.[435] Section 105 of the BNSS, includes the process of conducting search of place or taking possession of any property, which includes preparing list of all the things seized while doing search and seizure and the witness should sign the list and such process shall be recorded in both audio and video electronic means with mobile phone and the police officer should forward such records to the concerned jurisdiction Magistrate, to uphold the credibility and admissibility of the evidence in the court.[436] Such practices greatly improve on the old IPC/CrPC, which did not offer any procedural protection for scientific evidence.

4.4 Chain of Custody in India

All toxicological samples must be handled properly, from the collection to laboratory analysis. If the samples are improperly sealed, improperly transported or delayed in transport,

[432] NDPS Act, 1985, ss. 8 & 35.

[433] Bharatiya Sakshya Adhiniyam, 2023, ss. 61-63 (Electronic or digital record; Special provisions as to evidence relating to electronic record; Admissibility of electronic records.)

[434] Bharatiya Sakshya Adhiniyam, 2023, ss. 39 (Opinions of Experts)

[435] BNSS, 2023, s. 176 (mandatory forensic involvement in serious offences).

[436] BNSS, 2023, s. 105 (Recording of search and seizure through audio video electronic means..).

the evidentiary value shall be reduced heavily. Courts often pointed out that weak or improperly handled toxicology evidences and reports can cause acquittal, even if the scientific analysis is accurate, for example, *Yusuf v. State (2023)*.[437] Thus it is important in paying attention to documentation and compliant video, is crucial for forensic evidence to survive in the forensic examination.

5. Ethical, Policy, and Reform Considerations in Forensic Toxicology

Forensic toxicology in India faces many scientific and legal challenges and also ethical and policy dilemmas. The main concerns include **consent in drug testing**[438] in *Selvi v. State of Karnataka (2010)*[439], whether in workplace, custodial or medical settings, and high **risk of misuse or false positives** in NDPS prosecutions[440]. Still there are debates between the public health and criminalization, stating whether drug users should be punished or rehabilitated. The main suffering includes inadequate **infrastructure,** forensic laboratories, trained toxicologists and uneven lab distribution across states.

Recommendations:

1. By giving the Forensic Science Laboratories (FSLs) more space and accrediting them with National certification Board for Testing and Calibration Laboratories (NABL) certification.
2. By enforcing **BNSS compliant of video recording and chain-of-custody procedures**.
3. By amending the NDPS provisions for **synthetic substances and novel psychoactive substances**.
4. Uniform **toxicology reporting standards under BSA, 2023,** should be adopted.
5. By **training police and prosecutors** in handling scientific evidence must be prioritized.

Our efforts to implement these measures will improve the accuracy and admissibility of toxicology evidence, ensuring procedural fairness, and supporting a coordinated approach to public health and criminal justice in India.

6. Conclusion

Forensic toxicology plays an important role in India's criminal justice system, by bridging the scientific investigation and legal adjudication. While with the rise in drug-related crimes which are ranging from narcotics trafficking, overdoses, to drug-facilitated sexual assaults, so it is urgent need in the accurate detection, analysis, and interpretation of drugs and toxins in biological samples have become essential. Forensic laboratory methods like GC–MS, LC–MS/MS, immunoassays, and HPLC make it possible to accurately identify and count biological samples like blood, urine, hair, and tissues. It is important to collect and keep these samples carefully so that the evidence can be trusted and used in court.

The legal framework, particularly the NDPS Act, 1985, which governs the mere possession, trafficking and consumption of narcotic substances, which stressed the procedural compliance for sample collection and reporting. New criminal laws like the Bharatiya Sakshya Adhiniyam (BSA) of 2023 and Bharatiya Nagarik Suraksha Sanhita (BNSS) of 2023, which strengthened the evidentiary value of toxicology by stressing the importance of expert testimony, electronic record certification and mandatory forensic involvement in serious crimes and offences. But the matter of consent, false positives, public health, inadequate forensic infrastructure, all together raise new ethical and policy challenges for the integration of toxicology into legal matters. The issues regarding repeated deaths due to illicit liquor and drug trafficking in schools highlighted the social risk which is interlinked with scientific and legal matters.

[437] Ibid.
[438] Article 20(2) – Protection against self-incriminating & Article 21 – Right to life and personal liberty includes right to privacy.
[439] *Selvi v. State of Karnataka (2010)* – Narco-analysis and polygraph are held unconstitutional and violation of fundamental rights.
[440] Ibid.

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By making strict reforms and by strengthening the forensic laboratories, improving the reporting systems and ensuring NABL accreditations, law enforcement training and uniform procedures. As forensic toxicology is governed by scientific, legal and ethical principles, it must present evidences that are dependable, trustworthy, and ethically sourced. In the end, integrating science, law, and policy serves an all-encompassing model that guarantees equity, justice, and public security in India's drug-related investigations.