

Role and Evidentiary Value of Forensic Toxicology in NDPS Cases: A Critical Study of Procedural Compliance and Judicial Interpretation

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Abstract

Forensic toxicology has become the scientific fulcrum of prosecutions under the Narcotic Drugs and Psychotropic Substances Act, 1985 (NDPS Act), because the prosecution must prove not only the recovery of a substance but also that it is a notified narcotic drug or psychotropic substance in a particular quantity and purity. The Forensic Science Laboratory (FSL) report and related toxicological evidence therefore often make the difference between conviction and acquittal, while at the same time functioning within a legal regime that is both draconian in its sentencing structure and highly technical in its procedural safeguards. Indian courts, especially the Supreme Court and various High Courts, have repeatedly underscored that strict compliance with statutory provisions, standing orders on seizure and sampling, and chain-of-custody norms is indispensable in NDPS trials, and that lapses in these respects can seriously erode or even destroy the evidentiary value of forensic toxicology reports.

This paper critically examines the dual role of forensic toxicology in NDPS cases, as a powerful incriminating tool and as a vulnerable point of challenge, by analysing the statutory framework, the NDPS (Seizure, Storage, Sampling and Disposal) Rules, 2022, the erstwhile standing orders on sampling, and key judicial decisions including *Noor Aga v. State of Punjab*, *Thana Singh v. Central Bureau of Narcotics*, and *Hira Singh v. Union of India*. It argues that courts have moved toward a calibrated approach: while recognising the indispensability of expert opinion in establishing the nature of the contraband, they also insist on rigorous procedural compliance as a constitutional counter-weight to the NDPS Act's reverse onus and stringent penalties.

The study adopts a doctrinal and analytical methodology based on close reading of statutes, rules, standing orders and case law, supplemented by contemporary academic and practitioner commentary on forensic evidence in NDPS trials. It concludes that although forensic toxicology has high evidentiary value, inconsistent investigative practices, under-resourced laboratories and divergent judicial approaches to procedural lapses generate legal uncertainty, and it proposes reforms relating to accreditation of laboratories,

standardisation of toxicological protocols, digitised chain-of-custody systems and clearer judicial standards for the consequences of non-compliance, all framed in the context of the accused's Article 21 rights.

Keywords: NDPS, Article 21, Forensic Science Laboratory, Forensic Toxicology, Evidentiary Value

Introduction

The NDPS Act is widely recognised as one of India's harshest criminal statutes, prescribing severe minimum sentences, restricting bail, and placing a reverse burden of proof on the accused once foundational facts such as possession and recovery are established. For offences involving "commercial quantity", punishment may extend to twenty years' rigorous imprisonment, while even "small quantity" offences carry non-trivial imprisonment terms, making evidentiary accuracy and fairness particularly critical. In such a setting, forensic toxicology does not merely corroborate ocular testimony; it is often the only scientifically reliable basis to conclude that the seized material is indeed a narcotic drug or psychotropic substance, and in what quantity and purity, thereby directly influencing both conviction and sentencing. [12]

At the same time, the Supreme Court has repeatedly emphasised that given the NDPS Act's draconian nature and its reverse onus clause, procedural safeguards must be "strictly construed and scrupulously observed" so that scientific rigor is matched by procedural fairness. The Court's directions in *Thana Singh v. Central Bureau of Narcotics*, (2013) 2 SCC 590, for expediting NDPS trials and regulating re-testing, as well as its insistence in *Noor Aga v. State of Punjab*, (2008) 16 SCC 417, on an unbroken chain of custody, show that forensic toxicology evidence is acceptable only when embedded in a robust procedural framework. This paper situates the evidentiary value of forensic toxicology within this tension between the NDPS Act's severity and constitutional guarantees of fair trial. [1, 2]

Scope and limitations

The present study is confined to the Indian legal context, focusing on the NDPS Act, the NDPS (Seizure, Storage, Sampling and Disposal) Rules, 2022, and judicial decisions of the Supreme Court and selected High Courts, and therefore does not engage in comparative analysis with foreign drug control regimes or international conventions beyond incidental references. Within this jurisdictional frame, the paper concentrates on the role and evidentiary value of forensic toxicology in relation to seizure, sampling, chain of custody, quantity and purity determination, and default bail, and does not address other important aspects of NDPS law such as confessional statements under section 67, search and arrest without warrant, or rehabilitation of addicts, except where tangentially relevant. The study relies on reported judgments, accessible secondary literature and publicly available commentary, and is limited by potential gaps in reporting and by the evolving nature of case law, particularly with respect to the pending reconsideration of *Hira Singh* and recent judgments addressing the 2022 Rules.

Another limitation arises from the nature of doctrinal research itself: while it allows for careful analysis of legal texts and judicial reasoning, it does not capture empirical dimensions such as the actual functioning of FSLs, the frequency of procedural lapses at ground level, or the lived experiences of undertrials and investigators. Although some empirical insights can be drawn from case volumes and court observations about overloaded laboratories and systemic delays, a fuller understanding of forensic toxicology's role in NDPS enforcement would require interdisciplinary fieldwork and quantitative data, which lie beyond the scope of this purely doctrinal and analytical paper.

Research methodology

This research employs a doctrinal and analytical methodology, grounded primarily in the study of statutes, rules, standing orders and judicial decisions, supplemented by critical examination of academic literature, practitioner articles and official or semi-official guidelines relating to forensic toxicology and NDPS

enforcement. The primary materials include the text of the NDPS Act, 1985, the NDPS (Seizure, Storage, Sampling and Disposal) Rules, 2022, and leading Supreme Court decisions such as Noor Aga, Thana Singh and Hira Singh, along with selected High Court rulings and relevant circulars and standing orders on sampling, storage and disposal of seized drugs. Secondary materials comprise peer-reviewed articles on forensic testing and expert opinion in NDPS cases, practitioner guides on challenging FSL reports, and commentaries on reverse burden, quantity calculation and procedural safeguards under the Act.

The analytic method involves synthesising these sources to identify themes, doctrinal trends and points of tension, particularly in relation to the evidentiary value of forensic toxicology under varying degrees of procedural compliance. Case law is read not only for its holdings but also for its implicit assumptions about science, procedure and fairness, and is juxtaposed with practitioner accounts to understand how legal doctrine translates into forensic practice. The study consciously refrains from generating empirical data or conducting statistical analysis of case outcomes, focusing instead on normative assessment of the adequacy and coherence of current legal standards governing forensic toxicology in NDPS cases.

Doctrinal-analytical approach

Within the doctrinal-analytical framework, particular attention is paid to the way courts interpret statutory provisions such as sections 52A and 55 of the NDPS Act and the 2022 Rules in light of overarching constitutional principles, especially Article 21 and the right to fair trial. For example, the Supreme Court's construction of chain-of-custody requirements in Noor Aga and its directions in Thana Singh to improve forensic infrastructure are treated as evidence of a judicial effort to reconcile the Act's severity with the need for procedural and scientific integrity, rather than as isolated procedural rulings. Similarly, the doctrinal shift from E. Micheal Raj to Hira Singh on quantity calculation is examined not merely as a matter of statutory interpretation, but as part of a broader discourse on proportionality, culpability and the role of toxicology in sentencing, as reflected in both judgements and critical commentary.

The analytical lens also extends to evaluating internal coherence and predictability: the study assesses whether judicial distinctions between fatal and curable lapses in sampling or chain of custody are grounded in clear principles, and whether the standards applied by different benches are sufficiently consistent to guide investigators and defence counsel. Where contradictions are identified—for instance, in divergent views on the mandatory or directory nature of standing orders or on the consequences of delay in FSL reporting—they are highlighted as doctrinal gaps that warrant clarification through future Supreme Court pronouncements or legislative intervention. This approach allows the paper to move beyond mere description toward a reasoned critique of the current legal position.

Forensic toxicology defined

Forensic toxicology may broadly be described as the the application of toxicological and analytical chemistry techniques to legal questions involving drugs, poisons and related substances, including the identification, quantification and interpretation of narcotic and psychotropic substances in seized material or biological samples. In NDPS prosecutions, forensic toxicologists routinely perform screening and confirmatory tests—such as colour tests, thin-layer chromatography and gas chromatography–mass spectrometry—to determine whether the substance is a scheduled drug and to assess its purity. These technical opinions, when issued from accredited laboratories and by qualified experts, acquire legal relevance through statutory channels such as Section 39 (1) BNS, 2023 (section 45 of the Indian Evidence Act, 1872) and section 329 BNSS, 2023 (section 293 of the Code of Criminal Procedure, 1973), which together enable courts to receive expert opinions and, in specified circumstances, dispense with the need to examine the expert in person. [16]

Because NDPS offences are defined in terms of specified drugs, psychotropic substances and thresholds of quantity, the toxicologist's determination of the exact chemical identity and percentage of the offending drug within a mixture has direct legal consequences, particularly after the Supreme Court's decision in *Hira Singh v. Union of India*, (2020) 20 SCC 272, which held that in the case of mixtures, punishment depends on the total weight of the mixture containing the drug. Recent scholarship on forensic testing of narcotic drugs and psychotropic substances underscores that expert reports gain evidentiary value when laboratories are accredited, protocols are standardised, and reports clearly indicate the tested substance's classification under the NDPS Act, but that lapses in these respects are not uncommon in practice. [3]

NDPS legal framework

The NDPS Act criminalises a wide range of activities involving narcotic drugs and psychotropic substances, including production, possession, sale, purchase, transport, import, export and use, with punishments calibrated to the "small", "intermediate" and "commercial" quantities notified under section 2 and the relevant Central Government notifications. The 2001 notification on quantities and the subsequent 2009 clarification, whose interpretation was settled in *Hira Singh*, created a structure in which quantitative thresholds, often determined solely through FSL analysis, decisively affect whether section 37's stringent bail restrictions apply and whether the accused faces mild or extremely severe punishment. In addition, sections 35 and 54 of the Act embody a reverse burden of proof, allowing courts to presume culpable mental state and illicit possession once basic facts are established, thereby heightening the stakes of accurate and reliable scientific evidence from seizure through laboratory analysis. [18, 20]

Procedurally, sections 42, 50, 52, 52A, 55 and 57, and, after 2022, the NDPS (Seizure, Storage, Sampling and Disposal) Rules, 2022, collectively regulate search, seizure, sampling, inventory preparation, safe custody and disposal of seized contraband, all of which form the factual foundation upon which forensic toxicology operates. Section 52A in particular empowers the Central Government to notify procedures for drawing representative samples and certifying inventories, and historically this space was occupied by Standing Orders 1/88 and 1/89, which laid down detailed sampling norms and have been repeatedly treated by courts as benchmarks for assessing procedural compliance in NDPS cases. Judicial decisions have evolved from viewing these standing orders as merely administrative to increasingly treating substantial non-compliance as undermining the evidentiary value of the FSL report and, in appropriate cases, as fatal to the prosecution. [13]

Expert opinion in evidence

Under section 39 (1) BSA, 2023, the opinion of persons specially skilled in foreign law, science, art or identity of handwriting or finger impressions is a relevant fact, and Indian courts have consistently construed this provision to encompass forensic toxicologists and other FSL experts. Section 329 BNSS, 2023, further provides that certain government scientific experts' reports may be used as evidence in any inquiry, trial or other proceeding without calling the expert, although the court retains discretion to summon and examine the expert when necessary for the ends of justice. Within NDPS trials, these provisions together enable the FSL report to be treated as primary documentary evidence of the nature of the seized substance, while leaving open to the defence the possibility of challenging its accuracy, methodology or chain-of-custody assumptions either by cross-examining the expert or by leading contrary evidence.

Several High Courts have emphasised that given the specialised nature of NDPS offences, which involve technical determinations regarding chemical composition, it is ordinarily impermissible to convict in the absence of a forensic or chemical analyst's opinion confirming that the seized material falls within the NDPS schedules. For instance, a decision of the Jammu & Kashmir High Court reported in 2021 held that no person can be tried or convicted for an NDPS offence solely on the basis of oral testimony without there being a

report from a chemical analyst or scientific expert establishing that the substance is a narcotic drug or psychotropic substance, thereby underscoring the centrality of expert opinion in such prosecutions. Conversely, the Delhi High Court in *Kishan Lal v. State* has clarified that the investigating agency may file a police report under section 173(2) CrPC even without the FSL report, and the Magistrate may take cognisance, although the ultimate conviction cannot usually be sustained without expert confirmation, demonstrating how procedure allows for investigative flexibility while still tying final adjudication to forensic evidence. [10, 11]

Chain of custody norms

The evidentiary value of forensic toxicology in NDPS cases rests not only on the validity of laboratory techniques but also on the integrity of the chain of custody from seizure to analysis. The concept of chain of custody—defined in forensic literature as the continuous, documented control, transfer and analysis of physical evidence from the moment of collection until its presentation in court—aims to ensure that the sample analysed is demonstrably the same as the substance seized from the accused, without opportunity for tampering, substitution or contamination. Indian courts have frequently applied this concept in NDPS prosecutions, requiring the prosecution to show, through seizure memos, malkhana registers, forwarding memos and seal impressions, that the seized packets were sealed properly, stored in safe custody, and transmitted to the FSL intact and without unexplained gaps.

In *Noor Aga v. State of Punjab*, (2008) 16 SCC 417, the Supreme Court stressed that in view of the NDPS Act's stringent provisions and reverse burden clauses, the prosecution must strictly prove the chain of custody and that any reasonable doubt regarding tampering or substitution of samples would entitle the accused to acquittal. Similarly, decisions analysed in practitioner commentary have shown that courts scrutinise the evidence of police officials, malkhana in-charge and FSL officers to see whether seals remained intact, whether seal numbers tally, and whether the sample parcels received at the FSL match the description in seizure and forwarding documents, with discrepancies often leading to rejection of the FSL report as unreliable. This jurisprudence reflects a recognition that scientific validity is meaningless if the sample itself cannot be confidently linked to the alleged recovery. [1]

Sampling and standing orders

Before the advent of the 2022 Rules, Standing Order No. 1/88 and 1/89 issued by the Central Government and the Narcotics Control Bureau laid down detailed instructions regarding drawing of samples from seized narcotic drugs and psychotropic substances. These standing orders generally required that samples be drawn at the place of seizure in the presence of accused and independent witnesses, that each package or container be separately numbered and sampled, that samples of specified minimum quantities be drawn in duplicate, and that they be sealed and documented with seal impressions and inventories, thereby seeking to ensure that the sample sent to the FSL is truly representative of the bulk. Numerous High Court and Supreme Court decisions have referred to these orders while evaluating whether the prosecution established proper sampling, particularly in cases involving multiple packets, varied lots or mixed consignments. [14]

Advocacy literature and case digests illustrate that failure to adhere to these standing orders has often led courts to grant bail or acquit, especially where the prosecution drew a single sample from multiple packets, took very small quantities from only a portion of the bulk, or failed to prepare duplicate samples, thereby undermining representativeness and the accused's right to seek re-testing. For example, Allahabad High Court orders have granted bail where large quantities of ganja were allegedly seized but sampling was not done as per the 1989 standing order, and the Supreme Court in decisions such as *State of Rajasthan v. Sahi Ram* has treated non-representative sampling as creating serious doubt about the prosecution case. Through

this jurisprudence, standing orders—though not statutory—have effectively become quasi-mandatory benchmarks for assessing the reliability of forensic toxicology evidence in NDPS trials.

NDPS 2022 Rules

The Narcotic Drugs and Psychotropic Substances (Seizure, Storage, Sampling and Disposal) Rules, 2022, notified on 23 December 2022, now provide a consolidated statutory framework governing seizure, storage, sampling and disposal of seized material, and have superseded earlier standing orders to the extent of inconsistency. These Rules set out procedures for seizure and storage, specify how representative samples are to be drawn, prescribe formats for inventories and panchnamas, and regulate disposal through Drug Disposal Committees, thereby codifying at the rule-making level many of the safeguards earlier contained in standing orders and case law. Importantly, Rule 14 has been interpreted by practitioners and commentators to require that FSL reports be forwarded to the Magistrate within fifteen days of receipt of the sample, though courts have cautioned against treating this as an absolute time-bar leading automatically to acquittal or default bail.

Recent Supreme Court deliberations, as discussed in contemporary legal commentary, have considered whether failure to furnish the FSL report within the fifteen-day period prescribed in the Rules could entitle the accused to default bail under section 167(2) CrPC, with the Court generally indicating that while the Rules are mandatory in spirit, modest deviations justified by practical constraints should not by themselves vitiate prosecutions so long as prejudice is not demonstrated. Nonetheless, the introduction of the 2022 Rules has strengthened the normative framework for forensic toxicology by giving statutory backing to detailed procedures for sampling, chain of custody, and timely reporting, thereby making procedural compliance more traceable and judicially enforceable.

FSL reports and delay

Delay in sending samples to the FSL or in receiving and producing the FSL report has emerged as a recurrent issue in NDPS prosecutions, affecting both evidentiary reliability and the undertrial's right to speedy trial. In *Thana Singh v. Central Bureau of Narcotics*, the Supreme Court, moved by the plight of an accused who had languished in jail for over twelve years awaiting trial, issued comprehensive directions to expedite NDPS trials, including improving forensic laboratory infrastructure, regulating re-testing practices, and avoiding unnecessary delays in obtaining and producing FSL reports. The Court recognised that chronic delays in forensic analysis, coupled with the NDPS Act's stringent bail provisions, could effectively result in punishment before conviction, thereby offending Article 21.

At the same time, courts have differed on the precise legal consequences of delay in furnishing FSL reports. While some decisions—particularly in the context of the 2022 Rules—have treated unexplained delays as weakening the prosecution case and, in extreme situations, as a ground for default bail or acquittal, other decisions have held that modest delay, without evidence of tampering or prejudice, does not automatically render the FSL report inadmissible or unreliable. The Supreme Court's general approach has been to strike a balance: delay is a relevant factor in assessing the overall credibility of the prosecution, especially when combined with chain-of-custody defects, but is not a standalone ground to discard otherwise cogent expert evidence absent concrete prejudice.

Quantity and purity analysis

The question whether quantity for sentencing should be determined by the actual drug content or the entire mixture containing neutral substances has been one of the most contentious issues in NDPS jurisprudence, directly implicating the role of forensic toxicology. In *E. Micheal Raj v. Intelligence Officer, NCB*, the Supreme Court had earlier held that when drugs are mixed with neutral substances, punishment should be based on the pure drug content, thereby making determination of purity percentage through sophisticated

toxicological analysis essential for categorising the quantity as small or commercial. However, in *Hira Singh v. Union of India*, (2020) 20 SCC 272, a three-judge bench overruled *E. Micheal Raj* and held that where a mixture of narcotic drug or psychotropic substance with one or more neutral substances is seized, the entire weight of the mixture, including neutral material, must be considered for determining whether the quantity is small or commercial. [3, 6]

This shift significantly altered the evidentiary landscape: while purity analysis remains relevant for understanding the potency and market value of the seized substance, quantity categorisation for sentencing now depends primarily on the total weight rather than the percentage of active drug, reducing the direct sentencing impact of purity testing. Nonetheless, High Courts such as the Meghalaya High Court, and more recently the Delhi High Court while clarifying that carriers like towels or bedsheets cannot be included in the weight, have reiterated that *Hira Singh* requires consideration of the total weight of the drug-neutral mixture, thus continuing to place forensic laboratories at the centre of identifying which components constitute the mixture and which are mere carriers. Contemporary commentary notes that the Supreme Court has agreed to revisit *Hira Singh* in light of concerns that counting neutral substances may punish beyond actual culpability, a development that, depending on the outcome, may once again elevate the legal significance of purity-oriented toxicological analysis.

Default bail and FSL

The interplay between the requirement of completing investigation within statutory time under section 167(2) CrPC and the timing of FSL reports has generated complex litigation in NDPS cases. Some petitioners have argued that investigation cannot be treated as complete for the purposes of filing a charge-sheet without the FSL report, and therefore the accused becomes entitled to default bail if the report is not obtained within the prescribed period; this argument draws on High Court decisions emphasising that NDPS offences cannot properly be tried without expert opinion regarding the seized substance. However, courts such as the Delhi High Court in *Kishan Lal* have held that while the FSL report is vital for conviction, it is not a condition precedent for filing the police report under section 173(2) CrPC and for the Magistrate to take cognisance, thereby denying default bail solely on this ground.

Recent Supreme Court deliberations, as reflected in academic and blog commentary, suggest a nuanced position: the Court has considered whether failure to furnish the FSL report within the fifteen days contemplated by the 2022 Rules' Rule 14 should have consequences for default bail, but appears inclined to treat the Rule as directory in terms of time while mandatory in spirit regarding the requirement of obtaining and producing forensic analysis. This approach attempts to reconcile the practical difficulties of over-burdened FSLs with the accused's right to liberty, indicating that defence lawyers must frame delay in obtaining FSL reports not abstractly but as part of a broader argument about systemic delay, prejudice and violation of Article 21.

Reverse burden and safeguards

A central reason why courts view procedural compliance and forensic rigor as so crucial in NDPS cases is the Act's incorporation of reverse burden provisions, particularly sections 35 and 54, which permit presumptions of culpable mental state and illicit possession once foundational facts are proved. Scholarly analysis of the NDPS Act's reverse-onus clause highlights that because these presumptions effectively shift part of the burden onto the accused, any dilution of procedural safeguards or reliance on questionable forensic evidence can lead to convictions on the basis of shaky foundations, thereby threatening the presumption of innocence and the right to fair trial under Article 21. In *Noor Aga*, the Supreme Court explicitly recognised this tension, holding that in view of such reverse burden provisions, the prosecution's

initial obligation to prove foundational facts, including chain of custody and proper sampling, must be discharged with corresponding stringency.

Commentators analysing forensic evidence in NDPS trials have described this as a paradox: while the Act is draconian and pro-prosecution in its substantive and evidentiary presumptions, courts have responded by insisting on meticulous compliance with procedural safeguards and by sometimes acquitting accused persons where doubts arise from non-compliance, even if contraband was physically found. Forensic toxicology, situated at the intersection of these dynamics, becomes both a powerful instrument for the State and a fertile ground for defence challenges, making the quality and transparency of forensic processes crucial to maintaining the constitutional balance.

Judicial view on compliance

Judicial interpretation across the Supreme Court and High Courts reveals a spectrum of views on the consequences of non-compliance with procedural requirements relating to forensic toxicology, ranging from treating them as directory to viewing certain violations as fatal. In *Union of India v. Mohanlal*, (2016) 3 SCC 379, for example, the Supreme Court emphasised the need for strict adherence to procedures for sampling and safe custody under section 52A and related instructions, although it stopped short of laying down that every infraction would vitiate the trial, thus highlighting a trend towards substantial rather than hyper-technical compliance. Cases such as *Noor Aga* and several later High Court decisions have, however, taken a stricter view where the non-compliance goes to the root of chain of custody or representativeness of samples, acquitting accused when the prosecution failed to dispel reasonable doubt about tampering or substitution. [4]

Legal digests of NDPS case law show that courts are more likely to treat lapses as fatal where core safeguards—such as sealing, documentation of seal impressions, maintenance of malkhana registers, or forwarding of samples under proper seal—are violated, as contrasted with minor discrepancies in weight or clerical errors in documentation, which are often overlooked as non-prejudicial. The jurisprudence thus reflects an underlying principle: courts will insist on strict compliance with procedural requirements that directly bear on the integrity and identity of the sample tested by the toxicologist, while treating peripheral or technical deviations with greater tolerance.

Non-compliance and acquittals

A significant body of case law illustrates situations in which courts have rejected FSL reports and acquitted accused persons due to serious procedural lapses related to forensic toxicology, particularly in chain of custody and sampling. In *Noor Aga*, the Supreme Court found the prosecution's case unreliable due, inter alia, to doubts about the chain of custody and failure to produce samples in court, emphasising that in NDPS cases, the prosecution must prove beyond reasonable doubt that the seized substance was the same as that analysed by the FSL and produced at trial. Practitioner articles also catalogue decisions where courts have discarded FSL reports because of broken seals, mismatched seal numbers, failure to send samples promptly, or discrepancies between seizure and FSL descriptions, treating such defects as undermining the very foundation of expert findings.

For example, the Supreme Court in *Jitendra v. State of M.P.*, (2004) 10 SCC 562, reversed a conviction where storage rules under section 55 were not followed, and in *Valsala v. State of Kerala*, (1993) 2 SCC 613, the Court noted that non-production of seized material in court weakened reliance on the FSL report. High Court decisions such as *Vijay Jain v. State of M.P.*, (2013) 14 SCC 527, and *State of Rajasthan v. Sahi Ram*, (2019) 10 SCC 649, similarly illustrate that when the prosecution fails to convincingly establish an unbroken chain of custody, or when sampling is non-representative, courts are willing to give the benefit of doubt to

the accused, effectively negating the evidentiary value of toxicological findings. This line of cases underscores that FSL reports, though crucial, are not immune from scrutiny and can be rendered worthless if the procedural bedrock is shaky. [5, 7, 8, 9]

Representative sampling issues

Representative sampling is a recurring theme in judicial scrutiny of NDPS cases, particularly those involving multiple packets or large consignments. Courts have frequently held that where the seizure consists of numerous packets, it is unsafe to draw a sample from only a few or from the top layer and treat it as representative of the entire bulk, because it cannot be assumed that each packet contains the same substance or exhibits the same purity. In *State of Rajasthan v. Sahi Ram*, the Supreme Court observed that non-representative sampling can create significant doubt about whether the entire seized quantity was a narcotic drug, thereby entitling the accused to acquittal or at least to exclusion of untested portions from quantity calculations.

Practitioner analyses also highlight litigation over whether samples should be drawn from each packet separately in commercial-quantity cases and whether composite sampling is permissible, with courts tending to insist that each packet or homogeneous lot be sampled and sealed, especially when the seized quantity hovers around threshold levels. Furthermore, failure to prepare duplicate samples has been criticised because it deprives the accused of the opportunity to seek re-testing by another laboratory, a safeguard that assumes particular importance when there are doubts about laboratory procedures or the integrity of the sample. These controversies demonstrate how the seemingly technical act of sampling directly affects both the scientific validity of toxicological conclusions and the fairness of the trial.

Retesting and duplicate samples

The issue of re-testing and duplicate samples connects directly to the defence's ability to challenge FSL findings and to the courts' managerial role in controlling delays. In *Thana Singh*, the Supreme Court expressed concern that frequent applications for re-testing, often filed strategically by the defence, contributed to delays in NDPS trials, and it laid down guidelines restricting re-testing to exceptional circumstances where serious defects or contradictions in the original analysis were demonstrated. The Court emphasised that re-testing should not become a routine means of protracting proceedings, but at the same time acknowledged that in appropriate cases, it may be necessary to ensure fairness, particularly when the original test is *prima facie* flawed.

In *Laxmi Nagappa Koli v. Narcotic Control Bureau*, the Supreme Court set aside a High Court order directing a third test of seized samples where two earlier FSL reports had clearly indicated that heroin was not detected, holding that such repeated testing served no useful purpose and contravened the spirit of *Thana Singh*. Meanwhile, practitioner commentary has underscored that failure to draw and preserve duplicate samples, as contemplated in standing orders and good practices, weakens the prosecution case by depriving the accused of a meaningful opportunity to seek re-testing in cases where the initial FSL report is suspect. This jurisprudence reveals a delicate balance: courts seek to prevent abuse of re-testing while recognising that the availability of preserved, properly sealed duplicate samples is a key safeguard in a system that places heavy reliance on forensic toxicology.

Courts on minor discrepancies

Not all inconsistencies relating to forensic toxicology are treated as fatal; courts have drawn a distinction between serious procedural lapses and minor discrepancies that do not go to the root of the matter. Case digests indicate that High Courts, including the Allahabad High Court, have held that minor discrepancies in the weight of samples sent to the FSL, as compared with the weight recorded at the time of seizure, may not

by themselves undermine the prosecution, especially when the difference can reasonably be attributed to the use of different scales or to moisture loss. Similarly, clerical errors in describing the colour or appearance of the sample, when otherwise corroborated by unimpeached seizure and chain-of-custody evidence, are often treated as curable irregularities rather than grounds for acquittal.

Judicial commentary therefore suggests a trend toward a substance-over-form approach in evaluating the evidentiary value of FSL reports: while courts insist on strict compliance with core safeguards related to sampling, sealing and custody, they are prepared to overlook non-prejudicial, non-fundamental irregularities. This approach aligns with the Supreme Court's broader admonitions against allowing hyper-technical objections to derail prosecutions where the overall evidence is reliable, even as it simultaneously underscores that lapses directly affecting sample integrity or identity will continue to be treated with utmost seriousness. For defence counsel, this means that challenges to FSL evidence are likely to succeed only when they can convincingly show that non-compliance could realistically have led to tampering, substitution or misidentification.

Evidentiary weight of FSL

Judicial practice shows that once the court is satisfied that seizure, sampling and chain of custody are properly established, the FSL report is typically accorded substantial, sometimes decisive, evidentiary weight in NDPS trials. In such cases, the expert's conclusion that the seized material is, for instance, heroin, ganja, or a specified psychotropic substance is often treated as conclusive on that point unless the defence adduces expert evidence or elicits concessions in cross-examination that render the opinion doubtful. Courts apply the general principle that expert opinion is advisory but highly persuasive, especially when coming from government laboratories staffed by qualified toxicologists and following recognised protocols.

At the same time, decisions such as those surveyed in empirical and doctrinal studies point out that courts retain ultimate responsibility for evaluating expert evidence; they may reject an FSL report if its reasoning is opaque, if methodology is not adequately described, or if the opinion is inconsistent with other evidence on record. For example, if the FSL report merely notes that the sample contains a "nitrogen-bearing organic compound" without clearly stating that it is a notified narcotic drug or psychotropic substance, courts have sometimes found such reports insufficient to ground conviction. Thus, while FSL reports are central to NDPS adjudication, their evidentiary weight is contingent on both procedural pedigree and substantive quality.

Defence strategies on FSL

Practitioner literature reveals that challenging FSL reports has become a sophisticated and central defence strategy in NDPS cases, often involving combined attacks on procedural compliance, laboratory methodology and statutory interpretation. Common grounds include non-compliance with section 52A and standing orders regarding sampling and certification; breaks or unexplained gaps in chain of custody; inordinate delay in sending samples to the FSL; improper storage conditions; lack of duplicate samples; and contradictions between seizure memos, forwarding notes and FSL descriptions regarding weight, colour or packaging. Defence counsel also frequently invoke section 293 CrPC to demand the presence of the FSL expert for cross-examination, particularly when the report is terse or when they suspect methodological flaws.

Articles aimed at practitioners emphasise that successful challenges to FSL reports often depend on meticulous scrutiny of paperwork, including malkhana registers, sample seals, and FSL acknowledgment receipts, and on leveraging precedents such as Noor Aga, Jitendra, Valsala and Sahi Ram, which have treated serious procedural lapses as undermining the prosecution case. Another emerging line of argument concerns the absence of purity percentage in FSL reports, which, though less critical for quantity categorisation after

Hira Singh, may still be relevant for sentencing discretion and for assessing whether the seized material is a “preparation” or a different scheduled substance, thus offering defence counsel additional avenues to contest the adequacy of toxicological analysis.

Critical appraisal of jurisprudence

A critical appraisal of the judicial treatment of forensic toxicology in NDPS cases reveals both strengths and weaknesses. On the positive side, the Supreme Court’s insistence in Noor Aga and subsequent cases that the prosecution must strictly prove chain of custody and adherence to procedural safeguards, and its directives in Thana Singh to improve forensic infrastructure and regulate re-testing, reflect a conscious attempt to preserve fair-trial values in a harsh statutory regime. High Courts’ willingness to reject FSL reports when sampling is non-representative or seals are tampered further demonstrates that courts do not treat expert evidence as infallible and are alert to the risk of misuse or sloppiness in enforcement.

However, the case law is not entirely consistent, and accused persons often face uncertainty regarding the precise consequences of specific types of non-compliance. Some benches have treated standing orders as substantially mandatory, while others have regarded them as merely directory; some have granted default bail or acquittal for delay or minor irregularities, while others have insisted on demonstrating concrete prejudice. Furthermore, the shift from E. Micheal Raj to Hira Singh on quantity calculation has reduced the sentencing relevance of purity analysis without necessarily leading to corresponding refinements in toxicological reporting, thereby raising concerns—highlighted in recent commentary—that the law may punish beyond culpability when neutral substances are counted without nuanced consideration of drug content. Overall, the jurisprudence has moved toward higher expectations of forensic and procedural rigor, but doctrinal clarity on the threshold between curable and fatal lapses remains a work in progress.

Suggestions^{16,17,18,19,20}

First, it is recommended that all forensic laboratories handling NDPS samples be mandatorily accredited to recognised national or international standards, with regular external audits of their procedures, equipment and reporting formats, so that courts can place justified reliance on FSL reports without having to repeatedly scrutinise basic methodological soundness in each case. Such accreditation should include standardised protocols for narcotic and psychotropic substance analysis, clear templates for reporting that explicitly state whether the substance is covered under the NDPS schedules, and compulsory mention of methodology and, where relevant, purity percentage, as suggested by academic studies and practitioner critiques of current reporting practices. Accreditation would not eliminate all errors, but it would furnish an institutional guarantee of minimum scientific quality, thereby enhancing both prosecutorial effectiveness and defence confidence.

Second, investigative agencies should receive structured training in NDPS-specific forensic and procedural requirements, including practical modules on representative sampling, sealing, documentation of seal impressions, maintenance of malkhana registers, and timely forwarding of samples to FSLs in line with the 2022 Rules. Training curricula should explicitly draw on judicial pronouncements such as Noor Aga, Thana Singh and Sahi Ram, and on standing orders and rules, so that officers understand that non-compliance can lead to the FSL report being discarded and to acquittals, undermining the very objective of stringent drug control. Additionally, agencies should be encouraged to adopt digital chain-of-custody systems—using bar-coding, electronic logs and secure digital signatures—to reduce opportunities for tampering and to generate auditable trails that can be readily produced in court.

Third, legislative or Supreme Court clarification is desirable on key doctrinal ambiguities, particularly regarding the mandatory versus directory nature of specific procedural requirements and the precise

consequences of non-compliance or delay. For instance, the Court could, either in the pending reconsideration of Hira Singh or in an appropriate NDPS case, issue authoritative guidelines categorising various violations—such as failure to draw duplicate samples, moderate delay in sending samples, or minor discrepancies in weight—into those that ordinarily vitiate the trial, those that merely weaken the prosecution, and those that are presumptively curable, thereby promoting uniformity and predictability across jurisdictions. Such guidelines should be framed with explicit reference to Article 21, recognising that in a regime of severe penalties and reverse burden, any systemic ambivalence about forensic and procedural standards disproportionately harms the accused.

Fourth, policymakers should consider measures to reduce the volume of cases reaching trial by diverting minor drug users to treatment and de-criminalising or de-prioritising certain low-harm substances, thereby freeing scarce forensic resources to focus on serious trafficking cases, as some scholars and reform advocates have suggested. While such substantive reforms extend beyond the narrow remit of forensic toxicology, they bear directly on laboratory workloads and turnaround times, and hence on the timely and thorough analysis of samples in cases that genuinely implicate public safety and organised crime.

Finally, courts at all levels should continue to apply a principled, evidence-sensitive scrutiny to FSL reports, neither accepting them unquestioningly nor rejecting them mechanically on technicalities, but instead carefully assessing whether procedural lapses could realistically have led to tampering, misidentification or mischaracterisation of the seized substance. This calibrated judicial posture, grounded in precedents like Noor Aga and Thana Singh and informed by evolving scientific standards, offers the best prospect of ensuring that the role and evidentiary value of forensic toxicology in NDPS cases remain aligned with both effective drug control and the constitutional promise of fair trial and due process.

Conclusion

The analysis undertaken in this paper shows that forensic toxicology occupies a pivotal, yet precarious, position in NDPS prosecutions: pivotal because FSL reports typically provide the only scientific basis to identify the seized material as a scheduled drug and to categorise its quantity, and precarious because the evidentiary value of such reports is highly sensitive to procedural compliance in seizure, sampling, storage and chain of custody. Supreme Court decisions such as Noor Aga and Thana Singh, together with a rich body of High Court jurisprudence, have signalled that the draconian nature of the NDPS Act and its reverse-onus provisions demand enhanced procedural rigour and scrupulous adherence to safeguards, thereby elevating the standards governing forensic toxicology beyond those that might suffice in ordinary criminal cases. At the same time, the Court's decision in Hira Singh to treat the entire mixture as relevant for quantity, and its pending reconsideration, reveal ongoing doctrinal flux in the manner in which toxicological findings are translated into sentencing consequences.

The jurisprudence indicates an emerging consensus that serious lapses in sampling, sealing, preservation or chain of custody can render FSL reports unreliable and, in appropriate cases, justify acquittal, whereas minor discrepancies in weight or description, absent evidence of tampering, are treated as non-fatal. Defence strategies have accordingly focused on meticulous scrutiny of procedural compliance and chain-of-custody documentation, often successfully undermining prosecutions where investigative practices fall short of prescribed standards. Yet, despite these advances, inconsistencies remain in judicial approaches to standing orders, statutory rules and the consequences of delay, and systemic issues such as overloaded laboratories, inadequate training and variable quality of reporting continue to threaten the robustness and fairness of NDPS adjudication. Overall, forensic toxicology in NDPS cases serves as both an indispensable evidentiary tool and a litmus test for the criminal justice system's commitment to scientific accuracy and constitutional due process.

REFERENCES

1. Noor Aga v. State of Punjab, (2008) 16 SCC 417.
2. Thana Singh v. Cent. Bureau of Narcotics, (2013) 2 SCC 590.
3. Hira Singh v. Union of India, (2020) 20 SCC 272.
4. Union of India v. Mohanlal, (2016) 3 SCC 379.
5. State of Rajasthan v. Sahi Ram, (2019) 10 SCC 649.
6. E. Micheal Raj v. Intelligence Officer, Narcotic Control Bureau, (2008) 5 SCC 161.
7. Jitendra v. State of M.P., (2004) 10 SCC 562.
8. Valsala v. State of Kerala, (1993) 2 SCC 613.
9. Vijay Jain v. State of M.P., (2013) 14 SCC 527.
10. Kishan Lal v. State, 2007 SCC OnLine Del 1322.
11. No person can be tried under NDPS Act without expert opinion: HC, Daily Excelsior (Jan. 22, 2021), <https://www.dailyexcelsior.com/no-person-can-be-tried-under-ndps-act-without-expert-opinion-hc/>.
12. Narcotic Drugs and Psychotropic Substances Act, 1985.
13. Narcotic Drugs and Psychotropic Substances (Seizure, Storage, Sampling and Disposal) Rules, 2022.
14. Standing Order No. 1/88, Procedure for Drawal of Samples (Gov't of India, Dep't of Revenue, 1988).
15. Standing Order No. 1/89, Disposal of Seized Narcotic Drugs and Psychotropic Substances (Gov't of India, Dep't of Revenue, 1989).
16. S. K. Verma, Forensic Testing of Narcotic Drugs and Psychotropic Substances, 41 J. Indian Acad. Forensic Med. (2026).
17. P. C. Sharma, Expert Opinion in NDPS Cases: A Study, New L. C. Pune (research paper, Bharati Vidyapeeth Deemed Univ., 2020).
18. Forensics, Fairness, and Failure: The NDPS Act's Relentless Pursuit of Technicalities, NLIU L. Rev. Blog (Feb. 6, 2025), <https://nliulawreview.nliu.ac.in/blog/forensics-fairness-and-failure-the-ndps-acts-relentless-pursuit-of-technicalities/>.
19. Forensic Evidence and Procedural Safeguards in NDPS Trials: Calibrating Scientific Rigor with Constitutional Rights, Law Audience (Sept. 30, 2025), <https://www.lawaudience.com/forensic-evidence-and-procedural-safeguards-in-ndps-trials-calibrating-scientific-rigor-with-constitutional-rights/>.
20. Evaluating the Reverse Onus Clause and Reformative Aspect in NDPS Act, 1985, Int'l J. Legal Res. & Analysis (2024).