SCIENTIFIC EVIDENCE IN CRIMINAL JUSTICE: A STUDY WITH SPECIAL REFERENCE TO NARCO-ANALYSIS

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ABSTRACT

Scientific evidence plays a crucial role in modern criminal justice systems by ensuring objectivity, accuracy, and reliability in the adjudication process. With the enactment of new criminal laws in India—namely the Bharatiya Nyaya Sanhita, 2023, Bharatiya Nagarik Suraksha Sanhita, 2023, and Bharatiya Sakshya Adhiniyam, 2023—the evidentiary framework has undergone significant transformation. The Bharatiya Sakshya Adhiniyam (BSA) emphasizes the use of forensic and digital evidence, thereby modernizing traditional evidentiary rules. However, controversial techniques like narco-analysis raise constitutional and ethical concerns. This paper critically examines the role of scientific evidence, evaluates the admissibility of narco-analysis, and analyses its compatibility with fundamental rights. It concludes that while scientific tools enhance truth-finding, narco-analysis remains legally restricted and constitutionally problematic.

Keywords: Scientific Evidence, Narco-analysis, Forensic Science, Self-Incrimination

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Introduction

The criminal justice system fundamentally rests on the principle that no individual should be punished without the establishment of guilt through credible and reliable evidence. Evidence serves as the backbone of criminal adjudication, guiding courts in determining the truth and ensuring that justice is administered fairly. Traditionally, the Indian legal system relied heavily on oral testimony and documentary evidence, which, although significant, were often susceptible to human error, bias, coercion, and manipulation. Eyewitness accounts, in particular, have frequently been criticized for their unreliability due to memory lapses, perception errors, and external influence.[3]

However, with rapid advancements in science and technology, the nature and scope of evidentiary practices have undergone a substantial transformation. The integration of forensic science into criminal investigations has introduced a higher degree of objectivity and precision. Techniques such as DNA profiling, fingerprint analysis, ballistic examination, and cyber forensics have revolutionized the process of evidence collection and evaluation.[4] These scientific methods not only enhance the accuracy of criminal investigations but also reduce the likelihood of wrongful convictions, thereby strengthening the credibility of the justice delivery system.

A significant milestone in this transformation is the enactment of new criminal laws in India, particularly the **Bharatiya Sakshya Adhiniyam, 2023**, which replaces the colonial-era **Indian Evidence Act, 1872**. This legislative reform marks a paradigm shift in the Indian evidentiary framework by aligning it with contemporary technological developments and the evolving needs of modern society.[5] The new law places greater emphasis on scientific and electronic evidence, recognizing them as crucial components in the pursuit of justice.

Under the Bharatiya Sakshya Adhiniyam, digital and electronic records are accorded enhanced evidentiary value, reflecting the increasing role of technology in everyday life and criminal activity. The law acknowledges the growing prevalence of cybercrimes and the necessity of incorporating digital evidence such as emails, server logs, metadata, and electronic

[3] Ratanlal & Dhirajlal, *The Law of Evidence* (27th edn, LexisNexis 2022) 45.
[4] K S Narayan Reddy and O P Murty, The Essentials of Forensic Medicine and Toxicology (34th edn, Jaypee Brothers 2017) 12–15.
[5] Government of India, Bharatiya Sakshya Adhiniyam, 2023, Statement of Objects and Reasons.

communications into the judicial process.[6] Furthermore, the Act encourages the use of forensic tools and expert analysis, thereby promoting a more scientific approach to investigation and adjudication.

Scientific evidence, including DNA profiling, cyber evidence, and forensic reports, has thus gained unprecedented prominence in criminal trials. Unlike traditional forms of evidence, scientific evidence is largely objective, testable, and capable of independent verification, making it highly reliable.[7] Its growing acceptance in courts has contributed significantly to improving the accuracy of verdicts and enhancing public confidence in the criminal justice system.

Nevertheless, the increasing reliance on scientific methods also raises important legal, ethical, and constitutional questions, particularly in relation to certain controversial techniques such as narco-analysis. While scientific evidence undoubtedly strengthens the justice system, it is imperative to ensure that its use remains consistent with fundamental rights and procedural safeguards.

In this context, the evolving evidentiary landscape under the new criminal laws reflects a careful balance between technological advancement and constitutional protection, aiming to create a more efficient, transparent, and just criminal justice system in India.

Concept of Scientific Evidence

Scientific evidence refers to evidence that is obtained through the application of scientific principles, methods, and techniques, which are capable of being tested, verified, and validated through empirical processes. Unlike traditional forms of evidence that rely primarily on human perception and narration, scientific evidence is grounded in objective analysis and systematic procedures, thereby enhancing its reliability and credibility in criminal adjudication.[8]

In the contemporary criminal justice system, scientific evidence encompasses a wide range of forensic and technological tools, including:

[6] Avtar Singh, Principles of the Law of Evidence (25th edn, Central Law Publications 2021) 678–682.
[7] S K Sharma, 'Role of Scientific Evidence in Criminal Justice System' (2019) 3 *Indian Journal of Criminology* 112.
[8] Ratanlal & Dhirajlal, *The Law of Evidence* (27th edn, LexisNexis 2022) 52.

- DNA profiling – used to establish identity with a high degree of certainty by analysing genetic material.
- Fingerprint analysis – based on the uniqueness of fingerprints for individual identification.
- Ballistics – involves the examination of firearms, bullets, and trajectory patterns to determine their source and use.
- Narco-analysis – a technique involving the administration of drugs to extract information from a semi-conscious subject.
- Polygraph tests – commonly known as lie detector tests, measuring physiological responses to assess truthfulness.
- Brain mapping (BEAP test) – used to detect recognition of stimuli by measuring brain wave responses.

These techniques have significantly transformed investigative processes by introducing scientific precision and minimizing reliance on subjective interpretations. Among these, DNA profiling is considered one of the most reliable forms of evidence due to its near-absolute accuracy, while other methods like polygraph tests and narco-analysis remain controversial in terms of admissibility and reliability.[9]

The increasing reliance on scientific evidence has been further reinforced under the Bharatiya Sakshya Adhiniyam, 2023, which recognizes the importance of forensic and electronic evidence in modern trials. The Act reflects a progressive shift towards incorporating technological advancements into the evidentiary framework, thereby strengthening the fact-finding function of courts.[10]

Scientific evidence is generally regarded as more dependable because of its objective and verifiable nature. It is based on established scientific principles that can be independently examined and cross-verified by experts. This reduces the possibility of human bias,

[9] K S Narayan Reddy and O P Murty, *The Essentials of Forensic Medicine and Toxicology* (34th edn, Jaypee Brothers 2017) 20–30.
[10] Government of India, Bharatiya Sakshya Adhiniyam, 2023.

manipulation, or error, which are often associated with oral testimony.[11] Moreover, such evidence plays a crucial role in corroborating other forms of evidence, thereby enhancing judicial accuracy and ensuring fair trial standards.

However, despite its advantages, scientific evidence is not entirely free from limitations. Issues such as improper collection, contamination, lack of expertise, and misuse of techniques can affect its reliability. Therefore, while scientific evidence significantly strengthens the criminal justice system, its application must be accompanied by strict procedural safeguards and expert scrutiny.[12]

Evolution under New Criminal Laws (2023)

The Indian criminal justice system has witnessed a transformative overhaul with the enactment of three landmark legislations: the Bharatiya Nyaya Sanhita, 2023 (BNS), the Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS), and the Bharatiya Sakshya Adhiniyam, 2023 (BSA). These statutes collectively replace the colonial-era framework consisting of the Indian Penal Code, 1860, the Code of Criminal Procedure, 1973, and the Indian Evidence Act, 1872. They came into force on 1 July 2024, marking a significant step towards modernizing and indigenizing India's criminal law system.[13]

This reform is not merely a legislative replacement but represents a broader shift in philosophy—from a colonial, procedure-heavy system to a more citizen-centric, technology-driven, and efficiency-oriented justice mechanism. The new laws aim to address contemporary challenges such as cybercrime, organized crime, digital fraud, and transnational offences, which were inadequately dealt with under the earlier legal framework.[14]

Among these statutes, the Bharatiya Sakshya Adhiniyam, 2023 assumes particular importance as it redefines the law of evidence in line with modern technological advancements. It seeks to bridge the gap between traditional evidentiary rules and emerging forms of digital and scientific proof, thereby strengthening the truth-finding function of courts.

[11] Avtar Singh, Principles of the Law of Evidence (25th edn, Central Law Publications 2021) 690.
[12] S K Sharma, 'Scientific Evidence and Its Evidentiary Value in Criminal Trials' (2020) 5 *Indian Journal of Law and Justice* 118.
[13] Government of India, *The Bharatiya Nyaya Sanhita, 2023; The Bharatiya Nagarik Suraksha Sanhita, 2023; The Bharatiya Sakshya Adhiniyam, 2023* (enforced from 1 July 2024).
[14] Ministry of Home Affairs, Criminal Law Reforms in India: A New Era (2023).

Key Changes in Evidence Law (BSA)

A major innovation under the Bharatiya Sakshya Adhiniyam is the recognition of digital and electronic evidence as primary evidence. Under the earlier regime, electronic records were often treated as secondary evidence, subject to technical requirements such as certification under specific provisions. The new law simplifies this framework by granting greater evidentiary status to electronic records, thereby facilitating their admissibility and reducing procedural hurdles.[15] This is particularly significant in an era where criminal activities increasingly involve digital platforms, online communications, and electronic transactions.

Another crucial development is the enhanced reliance on forensic investigation. The new framework emphasizes the use of scientific methods such as DNA analysis, cyber forensics, and biometric identification in the investigation of serious offences. This marks a shift away from confession-based investigations towards evidence-based policing, thereby minimizing the risks of coercion, custodial violence, and wrongful convictions.[16]

The Act also underscores the importance of technology-driven justice delivery. It promotes the use of digital tools in evidence collection, preservation, and presentation, including audio-visual recording of statements, electronic documentation, and online transmission of evidence. This not only improves efficiency but also enhances transparency and accountability in criminal proceedings. Furthermore, it aligns the Indian legal system with global best practices in the administration of justice.[17]

In addition, the Bharatiya Sakshya Adhiniyam seeks to streamline evidentiary procedures by simplifying rules related to admissibility and relevancy. By reducing technical complexities and procedural delays, the law aims to ensure faster disposal of cases without compromising fairness. This is particularly important in addressing the issue of pendency of criminal cases in Indian courts.

The new evidentiary framework also reflects a conscious effort to balance technological advancement with constitutional safeguards. While promoting the use of scientific evidence, it continues to uphold fundamental rights such as the right against self-incrimination and the right

[15] Avtar Singh, Principles of the Law of Evidence (25th edn, Central Law Publications 2021) 710–712.
[16] K N Chandrasekharan Pillai, *R V Kelkar's Criminal Procedure* (7th edn, Eastern Book Company 2016) 420.
[17] S Sarkar and M Sarkar, Sarkar's Law of Evidence (19th edn, LexisNexis 2022) 65.

to a fair trial.[18] This ensures that the adoption of modern investigative techniques does not lead to the erosion of civil liberties.

Overall, the evolution brought about by the new criminal laws signifies a paradigm shift towards a more scientific, efficient, and rights-oriented criminal justice system. By integrating forensic science and digital technology into the evidentiary framework, the Bharatiya Sakshya Adhiniyam, 2023 strengthens the pursuit of truth while maintaining the essential principles of justice, fairness, and due process.

Narco-Analysis: Meaning and Process

Narco-analysis is an investigative technique that involves the administration of certain psychoactive drugs—commonly known as "truth serums," such as sodium pentothal—to induce a semi-conscious or hypnotic state in an individual. In this altered state of consciousness, the subject is believed to have reduced capacity for deception and is more likely to disclose information that may otherwise be withheld during normal interrogation.[19] The technique is primarily used by investigative agencies to obtain leads, uncover hidden facts, or verify information in complex criminal cases.

The theoretical basis of narco-analysis lies in the assumption that the administered drug suppresses higher mental functions, including imagination and reasoning, thereby limiting the subject's ability to fabricate false responses. However, this assumption has been widely debated within both scientific and legal communities, as the reliability of such statements remains questionable.[20]

Procedure of Narco-Analysis

The process of narco-analysis is conducted under controlled medical supervision and typically involves multiple stages:

- Administration of sedative drugs: A qualified medical professional administers measured doses of drugs such as sodium pentothal intravenously, ensuring that the

[18] Constitution of India, arts 20(3) and 21.
[19] K S Narayan Reddy and O P Murty, *The Essentials of Forensic Medicine and Toxicology* (34th edn, Jaypee Brothers 2017) 305.
[20] Ibid 307.

subject reaches a sedated state without compromising safety.

- Induction of a hypnotic or semi-conscious state: The subject gradually enters a trance-like condition where cognitive resistance is lowered, and responsiveness to questioning increases.

- Interrogation by experts: A team comprising forensic psychologists, medical practitioners, and investigating officers conducts a structured interrogation. Questions are framed carefully to elicit relevant information without leading or influencing the subject.

- Recording and analysis of responses: The entire session is audio-visually recorded, and the responses are later analyzed by experts to extract useful investigative leads.[21]

Although narco-analysis may assist in uncovering concealed information, it is important to note that the subject is not in full control of their mental faculties during the procedure. As a result, the responses given may be influenced by suggestion, confusion, or imagination, thereby raising serious concerns about their accuracy and evidentiary value.[22]

Under the existing legal framework, including the Bharatiya Sakshya Adhiniyam, 2023, narco-analysis is not recognized as a reliable or admissible form of evidence. It is primarily treated as an investigative aid rather than a substantive method of proof. The results obtained from such tests cannot be directly used in court to establish guilt, although they may sometimes assist in discovering new facts or evidence relevant to the case.[23]

Furthermore, the use of narco-analysis raises significant constitutional and ethical concerns, particularly with respect to the right against self-incrimination and the right to personal liberty. The involuntary administration of such tests has been strongly criticized for violating fundamental rights, thereby limiting its acceptance within the criminal justice system.[24]

In essence, while narco-analysis may serve as a tool for facilitating investigation in certain cases, its scientific reliability, legal admissibility, and ethical validity remain highly contested.

[21] National Human Rights Commission, *Guidelines for Administration of Polygraph Test (Lie Detector Test) on an Accused* (2000).
[22] S K Sharma, 'Narco-Analysis and its Evidentiary Value in India' (2018) 4 *Indian Journal of Forensic Science* 92.
[23] Government of India, *Bharatiya Sakshya Adhiniyam, 2023*.
[24] Constitution of India, arts 20(3) and 21.

Consequently, it continues to occupy a controversial position within the broader framework of scientific evidence in criminal justice.

Legal Position of Narco-Analysis in India

The legal position of narco-analysis in India has been definitively settled by the Supreme Court in Selvi v State of Karnataka (2010)[25], where it was held that the involuntary use of such techniques violates Article 20(3) (right against self-incrimination) and Article 21 (right to life, personal liberty, and privacy). As a result, statements obtained during narco-analysis are considered inadmissible in evidence due to their involuntary nature and questionable reliability.

Under the Bharatiya Sakshya Adhiniyam, 2023, the emphasis is placed on voluntariness and reliability of evidence. Accordingly, narco-analysis results are not admissible as substantive evidence, though they may be used in a limited capacity as an investigative aid, subject to consent and procedural safeguards.

However, a narrow exception exists under the doctrine of discovery, wherein any material facts or evidence discovered as a direct consequence of such tests may be admissible in court. Nevertheless, the statements themselves remain inadmissible.

In essence, while narco-analysis may assist investigative agencies, its use is strictly restricted, and the Indian legal system prioritizes constitutional protections and fair trial principles over coercive scientific techniques.

Scientific Evidence vs Narco-Analysis

Scientific evidence and narco-analysis differ significantly in terms of reliability, admissibility, and constitutional validity within the criminal justice system. Scientific evidence, such as DNA profiling, fingerprint analysis, and forensic reports, is objective, verifiable, and based on established scientific principles, making it highly reliable and widely accepted in courts.[26]

In contrast, narco-analysis is a subjective investigative technique that relies on extracting information from a semi-conscious individual under the influence of drugs. Its reliability

[25] *Selvi v State of Karnataka* (2010) 7 SCC 263.
[26] K S Narayan Reddy and O P Murty, *The Essentials of Forensic Medicine and Toxicology* (34th edn, Jaypee Brothers 2017) 25–30.

remains questionable due to the possibility of false, suggestive, or distorted responses.[27]

Under the Bharatiya Sakshya Adhiniyam, 2023, scientific evidence is generally admissible and carries strong evidentiary value, whereas narco-analysis is not admissible as substantive evidence and is limited to being used as an investigative aid.

Further, scientific evidence is largely consistent with constitutional principles, while narco-analysis has been held to violate fundamental rights such as protection against self-incrimination and personal liberty, as affirmed in Selvi v State of Karnataka (2010).

In essence, scientific evidence strengthens the accuracy and fairness of the criminal justice system, whereas narco-analysis remains legally restricted, constitutionally questionable, and evidentially weak.

Role of Scientific Evidence in Modern Criminal Justice

The advent of new criminal laws in India, particularly the Bharatiya Sakshya Adhiniyam, 2023, reflects a clear shift towards the integration of scientific methods in the administration of criminal justice. The modern framework emphasizes the importance of forensic investigation in serious crimes, encouraging the use of techniques such as DNA profiling, cyber forensics, and biometric analysis to ensure more accurate and reliable outcomes.[28] This marks a departure from traditional reliance on oral testimony and confessions, which are often prone to error and manipulation.

Another significant development is the growing reliance on digital documentation of evidence. With the increasing prevalence of technology in everyday life, criminal activities frequently involve electronic devices and online platforms. The recognition and admissibility of electronic records, including emails, digital files, and audio-visual recordings, have strengthened the evidentiary process and improved the efficiency of investigations.[29]

The new legal framework also promotes the use of scientific methods to reduce wrongful convictions. By relying on objective and verifiable evidence, such as forensic reports and expert analysis, the justice system minimizes the risks associated with mistaken identity, false

[27] S K Sharma, 'Narco-Analysis and its Evidentiary Value in India' (2018) 4 *Indian Journal of Forensic Science* 92.
[28] Government of India, *Bharatiya Sakshya Adhiniyam, 2023*.
[29] Avtar Singh, *Principles of the Law of Evidence* (25th edn, Central Law Publications 2021) 715.

confessions, and unreliable eyewitness testimony. This contributes significantly to safeguarding the rights of the accused while ensuring that guilty individuals are accurately identified.[30]

Scientific evidence plays a crucial role in enhancing the accuracy of trials, as it is based on established principles that can be independently tested and verified. Unlike subjective forms of evidence, it reduces ambiguity and strengthens judicial reasoning.[31]

Further, it promotes transparency in the criminal justice process. The use of documented scientific procedures and expert opinions ensures that the process of evidence collection and analysis is open to scrutiny, thereby increasing public confidence in the system.

Additionally, scientific evidence contributes to the speed of justice delivery by streamlining investigations and reducing dependence on prolonged testimonial procedures. Efficient evidence collection and analysis help in expediting trials and addressing the issue of pendency of cases in courts.[32]

In essence, the incorporation of scientific evidence under the new criminal laws has significantly strengthened the criminal justice system by making it more objective, efficient, and reliable, while also aligning it with constitutional principles and global best practices.

Critical Evaluation

While the new criminal laws, particularly the Bharatiya Sakshya Adhiniyam, 2023, mark a progressive shift towards the incorporation of scientific evidence in criminal justice, several practical and structural challenges continue to hinder their effective implementation.

One of the primary concerns is the lack of adequate forensic infrastructure in India. Despite the growing emphasis on forensic investigation, there exists a significant shortage of well-equipped laboratories, modern technology, and timely forensic services. This often leads to delays in analysis and adversely affects the speed and efficiency of criminal trials.[33]

[30] K N Chandrasekharan Pillai, R V Kelkar's Criminal Procedure (7th edn, Eastern Book Company 2016) 425.
[31] Ratanlal & Dhirajlal, *The Law of Evidence* (27th edn, LexisNexis 2022) 60.
[32] S Sarkar and M Sarkar, Sarkar's Law of Evidence (19th edn, LexisNexis 2022) 72.
[33] Ministry of Home Affairs, *Report on Modernisation of Forensic Infrastructure* (2022).

Another major issue is the inadequate training of police personnel in handling scientific evidence. Proper collection, preservation, and documentation of forensic material require specialized skills and technical knowledge. In the absence of sufficient training, there is a risk of contamination or mishandling of evidence, which can weaken its evidentiary value in court.

The misuse of investigative techniques also raises serious concerns. While scientific tools are intended to enhance objectivity, their improper or coercive use can lead to violations of fundamental rights. Techniques such as narco-analysis, polygraph tests, and brain mapping, when used without strict safeguards, may undermine the principles of fairness and due process.

Further, there is a growing concern regarding the over-reliance on technology without adequate safeguards. Blind dependence on scientific evidence without proper scrutiny, expert validation, and judicial oversight may result in errors or misuse. Scientific evidence, though reliable, is not infallible and must be carefully evaluated in conjunction with other forms of evidence.

In this context, narco-analysis deserves specific criticism. Despite its limited utility as an investigative aid, it fails to meet the standards of legality and constitutionality laid down by the judiciary. As held in Selvi v State of Karnataka (2010), such techniques violate the right against self-incrimination and personal liberty, and therefore cannot be relied upon as substantive evidence.

In conclusion, while the new criminal laws represent a forward-looking approach by emphasizing scientific evidence, their success largely depends on effective implementation, institutional capacity, and adherence to constitutional safeguards. Without addressing these challenges, the potential benefits of scientific advancements in criminal justice may not be fully realized.

Suggestions and Recommendations

In order to effectively harness the potential of scientific evidence within the criminal justice system, several reforms and measures are necessary to address the existing gaps and challenges.

Firstly, there is an urgent need to strengthen forensic infrastructure across the country. The establishment of well-equipped forensic laboratories at regional and district levels, along with the adoption of advanced technologies, will significantly enhance the efficiency and reliability

of scientific investigations. Timely forensic analysis is essential for ensuring speedy trials and reducing case backlogs.

Secondly, capacity building and specialized training of police personnel must be prioritized. Investigating officers should be adequately trained in the scientific collection, preservation, and handling of evidence to prevent contamination and ensure admissibility in courts. Regular workshops and collaboration with forensic experts can improve the overall quality of investigations.

Thirdly, strict legal and procedural safeguards must be implemented to prevent the misuse of scientific techniques. Investigative methods such as narco-analysis, polygraph tests, and brain mapping should only be used in exceptional circumstances, with the informed consent of the individual and under judicial supervision. This will help in protecting fundamental rights and maintaining the integrity of the justice system.

Further, there is a need to promote the use of reliable scientific methods, such as DNA profiling and cyber forensics, which have higher evidentiary value and greater acceptance in courts. Emphasis should be placed on evidence-based investigation rather than confession-based practices.

Additionally, the judiciary must be equipped with adequate technical knowledge and expert assistance to properly evaluate scientific evidence. Judicial training programs and the appointment of expert witnesses can ensure accurate interpretation and prevent over-reliance or misinterpretation of technical data.

Lastly, a balanced approach must be adopted to ensure that the increasing reliance on technology does not undermine constitutional safeguards. The principles of fair trial, personal liberty, and protection against self-incrimination must remain paramount, as reaffirmed in Selvi v State of Karnataka (2010).

In conclusion, while scientific evidence holds immense potential to transform the criminal justice system, its effective utilization requires a combination of infrastructural development, legal safeguards, and institutional capacity building. Only then can the objectives of accuracy, efficiency, and justice be fully achieved.