



ORIGINAL RESEARCH ARTICLE

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**Capturing Substantial Truth Through Scientific Examination by the Polícia Científica e de
Investigação Criminal (PCIC) on Evidence of Narcotics Crimes in The Laboratory**¹*Domingos Franklin Soares, ²Luis Soares Bareto, ³Armindo Moniz Amaral¹* Graduate Program Master of Law Science^{2,3} Lecturer of Law Faculty, UNPAZ**ARTICLE INFO**

Article History:

Received 6th February 2026Received in revised form 7th
February 2026Accepted 3th March 2026Published online 18th March 2026

Key word: Narcotics Evidence, Forensic Examination, Polícia Científica de Investigação Criminal (PCIC), Timor-Leste, Chain of Custody, ISO/IEC 17025, Forensic Capacity Building, Quality Assurance, Legal Framework, Drug Crime Enforcement.

**ABSTRACT**

Law enforcement against narcotics crimes depends critically on accurate, objective, and scientifically grounded evidence. In Timor-Leste, however, the use of scientific evidence via forensic laboratories remains constrained by significant operational, technical, and institutional obstacles. This study examines the current practice and challenges of scientific examination of narcotics evidence by the Polícia Científica de Investigação Criminal (PCIC) and develops a reconstructed model for an ideal forensic examination process tailored to the Timorese context.

Using an empirical approach, the research investigates three core questions: (1) What procedures does the PCIC employ for scientific examination of narcotics evidence? (2) What principal challenges impede the PCIC's forensic work? and (3) How can the forensic examination process be reconstituted to meet legal, scientific, and practical demands? Data were gathered through direct observation of laboratory workflows, structured interviews with PCIC personnel and relevant stakeholders, review of internal operating procedures and case files, and comparative analysis of regional and international forensic standards and best practices.

Findings reveal that PCIC's scientific examinations fulfill dual roles: providing evidentiary material for prosecutions and acting as a strategic mechanism to ensure substantive justice through impartial scientific fact-finding. The laboratory's procedures encompass evidence receipt and chain-of-custody management, presumptive and confirmatory chemical analyses, physical and documentary examinations, documentation and reporting, and expert testimony. While procedural foundations exist, significant gaps reduce effectiveness: limited analytical capacity (specialized instrumentation and reagent shortages), human resource constraints (insufficiently trained analysts, high workload, retention issues), weaknesses in quality assurance and accreditation, logistical and infrastructure deficiencies (inadequate facilities, evidence storage, and security), fragmented interagency coordination, and insufficient legal/regulatory frameworks to govern forensic standards, admissibility, and independence.



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INTRODUCTION

The Democratic Republic of Timor-Leste is a newly independent nation, restored in 2002 as an independent state, and regulated by its constitution. Article 1 of its Constitution states that the Democratic Republic of Timor-

Leste is a democratic, sovereign, independent, and united state, based on the rule of law, the will of the people, and respect for human dignity.

As stated in Article 1, Timor-Leste is not only determined to end colonialism and occupation but also marks the beginning of a new journey as a sovereign nation.

As an independent nation in the 21st century, Timor-Leste must face various complex challenges, ranging from economic development, education, health, and infrastructure to law enforcement and security. One particularly prominent challenge and a particular concern in the context of law enforcement is narcotics crime, which is a transnational crime with serious multidimensional impacts on social stability and security.

As a newly independent nation with a highly strategic geographical location, Timor-Leste sits between two regions with high drug trafficking rates: Southeast Asia and Oceania (particularly Australia). This location makes Timor-Leste not only a potential destination country but also a transit point for international drug trafficking.

In this context, it is crucial to understand how Timor-Leste, as an independent nation in the 21st century, must accept, understand, and address these challenges. Like most newly independent nations, Timor-Leste is focused on strengthening institutions, developing its legal system, and enhancing human resource capacity. However, amidst this nation-building process, the phenomenon of drug abuse has emerged. This could become a serious obstacle if not addressed systematically and comprehensively.

Politically, Timor-Leste has demonstrated its commitment to being part of the global community in combating transnational crimes such as narcotics. This is evidenced by Timor-Leste's collaboration with various international organizations such as the United Nations Office on Drugs and Crime (UNODC), INTERPOL, and neighboring countries such as Indonesia and Australia in drug countermeasures. With its political decision to engage with international organizations, Timor-Leste recognizes that its territory is not immune from the challenges of crime, particularly drug crimes. Therefore, it must build a strong and integrated legal and institutional system to address this issue.

In recent years, the Timor-Leste police, through the National Police of Timor-Leste (PNTL) and the Criminal Investigation Police (PCIC), have uncovered a number of cases involving narcotics, including marijuana, methamphetamine, and other psychotropic drugs. One of the most recent cases involved several foreign nationals who were caught bringing drugs into Timor-Leste at Nicolau Lobato International Airport in Dili. There have also been cases involving Timor-Leste citizens as users or small-scale dealers. These facts indicate that Timor-Leste is not only a transit point but is also beginning to shift to a region where drug consumers are concentrated, particularly among the younger generation.

In addition to the above facts, a report from the UNODC (United Nations Office on Drugs and Crime) states that Timor-Leste needs to improve its institutional capacity to address drug crimes due to the increasing risk of smuggling, along with growing international relations and open trade routes. Furthermore, Timor-Leste's geographic location, which shares a land border with the province of East Nusa Tenggara (Indonesia), also presents a challenge for drug smuggling to and from Timor-Leste.

To prevent and eradicate drug trafficking, Timor-Leste has formulated Law No. 2/2017 concerning the Law on Drug Trafficking and Illicit Drug Use (which regulates the prohibition and sanctions for the possession and distribution of prohibited substances). However, in practice, law enforcement is often hampered by a lack of scientific evidence, weak coordination between agencies, and the suboptimal availability of forensic laboratories for comprehensive examination of narcotics evidence.

Timor-Leste believes that transnational crime requires a special response. Therefore, through Law No. 15/2014 concerning the Organization of the Scientific and Criminal Investigation Police, Timor-Leste established the Criminal Investigation Police (PCIC), the primary forensic institution responsible for analyzing drug evidence. This institution plays a role in identifying chemical substances, quantifying narcotics, and producing laboratory reports that serve as the basis for legal considerations in

investigations and trials. Although its implementation still faces limitations in human resources, laboratory equipment or instruments, and training, the existence of the PCIC marks a step forward in strengthening the country's scientific evidence system.

The purpose of a laboratory is to analyze evidence suspected of containing narcotics, psychotropic substances, or precursors. This involves determining the type of drug, its purity, its concentration, and its physical form (powder, liquid, tablet, etc.). To determine whether a substance belongs to Class I, II, or III according to the Narcotics Classification according to Lei No. 2/2017.

Based on advanced technological methods and tools used in the analysis process, such as Gas Chromatography-Mass Spectrometry (GC-MS), it is the primary tool for identifying narcotic substances. Substances are separated in gas chromatography and then identified based on their molecular mass. Examples: Detecting methamphetamine, heroin, cocaine, and ecstasy.

In an era of rapid technological development, new forms of crime continue to emerge with a high level of complexity. Modern crimes such as cybercrime, transnational human trafficking, narcotics crimes, terrorism, and digital-based money laundering exhibit different patterns and *modus operandi* compared to conventional crimes. This development demands a more innovative, focused investigative approach based on high technical and scientific capabilities.

In the criminal justice system, the search for truth has two important dimensions: formal truth and substantive truth. Formal truth is the truth produced through legal procedures as stipulated in statutory regulations. However, in the context of just law enforcement, formal truth is insufficient. A search for substantive truth is necessary, namely the ultimate truth that reflects the actual events behind a crime. Substantive truth requires objective, scientific evidence, free from intervention or manipulation, to ensure that justice is upheld based on facts that are legally and morally accountable¹.

Evidence in criminal acts plays a vital role, not only as a probative element but also as the basis for forming convictions by law enforcement officers, public prosecutors, and judges. In the context of narcotics cases, for example, the validity of a substance as a narcotic, its type, and its concentration, can only be proven through scientific examination in a forensic laboratory. This process is the primary domain of the PCIC, which is tasked with identifying, testing, and analyzing substances using standardized scientific methods, such as gas chromatography, spectrophotometry, or other methods. The results of this examination are then presented in a valid scientific report and become one of the main pieces of evidence in court.

During the trial, laboratory test results are presented in a laboratory test report (LHPL), detailing the analytical methods used, the findings, and the expert's scientific interpretation. This report constitutes valid scientific evidence under criminal procedure law and carries strong evidentiary weight because it is based on objective and measurable methods. Furthermore, laboratory experts can also appear as expert witnesses in court to provide additional explanations regarding the analysis results and answer questions from the panel of judges, prosecutors, and the defendant's legal counsel. The presence of these expert witnesses helps clarify technical aspects that may be difficult for law enforcement officials without a scientific background to understand².

On the other hand, the success of law enforcement is largely determined by the quality of evidence presented during the trial. In narcotics cases, chemical evidence must undergo a process of identification and scientific verification in a forensic laboratory. This is crucial because substantial (material) truth can only be obtained through scientifically and legally valid examination methods. In this regard, the Criminal Investigation Police (PCIC) plays a crucial role as the institution authorized to analyze narcotics evidence. The results of these

¹Ferry Kurniawan Goenawi, "The limits of authority between police investigators in enforcing drug crimes," *Badamai Law Journal*, 4.2 (2020), p. 314.

²Muhammad Arif (Islamic University of Kalimantan), "Duties and Functions of the Police in Their Role as Law Enforcers According to Law Number 2 of 2002 Concerning the Police," *Al-Adl: Journal of Law*, 13.1 (2021), p. 91.

laboratory tests will form the basis for the criminal justice process, particularly during the evidentiary stage in court ³.

THE METHOD

In this study, the researcher used empirical research. Empirical research is a type of research based on direct observation, experience, or experimentation of real-world situations. This means that researchers collect real, verifiable data from the phenomenon being studied, not just theory.

The word "empirical" itself comes from the Greek word "empeiria," meaning experience. Therefore, this study emphasizes evidence obtained from real-life experiences or direct observation. Therefore, the researcher uses two variables ⁴

2.1 Independent Variable

This variable is often referred to as a variable, stimulus, predictor, or antecedent. In Indonesian, it is often referred to as a free variable. An independent variable is a variable that influences or causes changes in or the emergence of a dependent variable.

2.2 Dependent Variable

Often referred to as output, criteria, or consequence variables. In Indonesian, it is often referred to as a bound variable. A bound variable is a variable that is influenced or becomes a consequence due to the presence of an independent variable ⁵.

With the explanation of the variables above, the researcher uses a theoretical approach such as:

2.2.1 Deductive theory.

Deductive theory is a thinking approach that begins with a general premise or existing theory, then derives a more specific conclusion or hypothesis, which is then tested through data or observation ⁶.

2.2.2 Inductive theory.

Inductive theory is a thinking approach that begins with specific/empirical facts or data, then draws general conclusions or forms theories based on patterns found in the data ⁷.

2.2.3 Functional theory, also often called functionalism theory.

Functional theory, or functionalism theory, is an approach in the social sciences (particularly sociology and anthropology) that views each element in society as having a specific function in maintaining social balance, order, and stability.

RESULTS AND DISCUSSION

3.1 Initial Analysis

Visual inspection is the initial stage of identification in the laboratory after narcotics evidence has been officially received. This stage serves to describe the physical characteristics of the evidence before conducting chemical or instrumental tests, with the aim of determining its condition, type of packaging, and any possible deviations from chain of custody procedures ⁸.

3.2 Visual Inspection Steps

The proliferation of drug crimes in various countries, including Timor-Leste, has become a major challenge to law enforcement and public protection. Globally, drug trafficking and abuse not only impact public health but also pose serious threats to social and economic stability and national security. In this context, efforts to eradicate drug crimes require an effective, accountable, and scientifically proven law enforcement system that can be legally accounted for. One institution that plays a central role in law enforcement against drug crimes in Timor-Leste is the Polícia Científica e de Investigação Criminal (PCIC), particularly through its forensic laboratory, which serves as the frontline in examining narcotics evidence.

In the modern criminal justice system, strong and objective evidence is the primary foundation for determining the substantial truth of a case. This aligns with the principle of due process of law, which requires every legal process to be based on scientifically verifiable facts. Therefore, forensic laboratories play a vital role in ensuring that all evidence obtained from narcotics crimes can be systematically examined, analyzed, and documented in accordance with applicable standard operating procedures (SOPs). Thus, laboratory test results not only serve as valid evidence in court but also serve as the basis for judges in making fair and proportionate decisions.

The ideal condition for law enforcement against narcotics crimes is integrity and accuracy at every stage of evidence examination. Every piece of evidence entering the laboratory must undergo a series of rigorous examination procedures, from visual inspection of the outer packaging, seals, and labels, to a physical examination of the contents of the evidence itself. This process aims to ensure that the evidence examined is truly the same as that found at the crime scene (TKP) and has not been altered, damaged, or contaminated during handling. Furthermore, complete and accurate documentation at every stage of the examination is essential for maintaining the chain of custody, ensuring that the evidence retains its probative value in court.

However, in practice, the PCIC faces various factual challenges in examining narcotics evidence in the laboratory. One major challenge is the potential for errors or omissions during the visual inspection process, such as discrepancies between the data on the outer packaging and the chain of custody form, damage to the seal, or incomplete documentation at each stage of the inspection. Furthermore, limited human resources, facilities, and laboratory infrastructure can also impact the quality and accuracy of the test results. This situation can lead to a decline in public and law enforcement confidence in laboratory test results and potentially weaken the prosecution's position in court.

Referring to the standard operating procedures implemented by the PCIC, the visual inspection of narcotics evidence involves several important stages. First, the outer packaging is inspected by noting the type of packaging (e.g., cardboard box, plastic, aluminum foil, cloth bag, etc.), checking the physical condition of the packaging for tears, holes, or signs of opening and re-closing, and checking the label, registration number, seal, and signatures on the packaging. The data on the outer packaging is then compared with the chain of custody form to ensure the authenticity and integrity of the evidence received by the laboratory.

The next stage is an inspection of the seals and labels on the packaging. At this stage, laboratory personnel must ensure that the seals are intact and show no signs of being altered or tampered with. Intact seals are then documented through photographs from various angles for evidentiary purposes. If a damaged seal is found, the officer must record the statement "seal segment not intact" in the inspection report. This process is crucial to maintain the integrity

³ Astria Puspitasari and Diya Ul Akmal, "The Evidential Strength of Forensic Laboratory Results as Evidence in Narcotics Crimes," *Justitia et Pax*, 38.2 (2022), pp. 147–81.

⁴ Yogi Yogi Abrian, "An Empirical Approach in Legal Anthropology as a Form of Development of Legal Anthropology," 2022, p. 10.

⁵ Sugiono, "Educational Research Methods: Quantitative, Qualitative, Combination, D&D and Educational Research," 2nd Edition, Alfabeta Publisher, Bandung, p. <https://www.scribd.com/document/709919745/research-methods-13.1> (2021), p. 91.

⁶ M.H Muhammad Syahrum, S.T., "Legal Research Methodology: Normative and Empirical Research Studies, Proposal Writing, Thesis and Dissertation Reports," Dotplus Publisher: First Edition, January 2022, p. <https://books.google.tl/books?hl=id&lr=&id=Hnfcia>

⁷ Mayang Mustika Dewi and Salminawati, "The Theory of Truth Based on the Perspective of Islamic Philosophy and Science," *Journal of Social Research*, 1.4 (2022), pp. 254–60.

⁸ Marlina Kristiyani and Vieta Imelda Cornelis, "Law enforcement against perpetrators of narcotics crimes in the jurisdiction of the Surabaya City Police Department," *Binamulia Law*, 12.1 (2023), pp. 201–11.

of the evidence and prevent manipulation or substitution of evidence during handling

After inspecting the outer packaging and seals, the next stage is an inspection of the inner packaging. The process of opening the outer packaging must be carried out in accordance with SOPs and witnessed by at least one witness from the laboratory. At this stage, the officer records the number of The physical examination of narcotics evidence involves observing the physical form (e.g., fine powder, crystals, plant fragments, tablets, capsules, or liquids), recording the color using a color standard such as the Munsell Color Chart to ensure consistency, and noting any distinctive aromas or odors (e.g., marijuana, chemicals, or solvents). Furthermore, the evidence must be weighed to record its gross weight, which is an important parameter in the evidence process in court (Source: 1).

All stages of the examination must be fully documented through photographs at every stage, from the outer packaging, seals, inner packaging, and finally the evidence itself. Each photo must include a ruler or measuring scale for reference, and all photo or video files must be saved with a file name that includes the evidence registration number. Systematic and structured documentation is crucial for maintaining transparency, accountability, and the integrity of the laboratory examination process.

Factual conditions in the field indicate that several obstacles remain in the implementation of the visual inspection SOP in the Timor-Leste PCIC laboratory. Several cases have shown discrepancies between the data on the outer packaging and the chain of custody, damage to seals that was not promptly documented, and a lack of photographic documentation at various stages of the examination. These conditions can raise doubts about the authenticity and integrity of evidence and open the door to lawsuits or objections from the defendant in court. Therefore, efforts are needed to improve and strengthen the capacity of the PCIC laboratory to consistently and accurately implement the visual inspection SOP.

Possible solutions to address these issues include improving the training and competency of laboratory personnel in implementing the visual inspection SOP, strengthening the documentation and reporting system, and conducting regular evaluations and audits of the laboratory's SOP implementation. Furthermore, utilizing information technology in data management and evidence documentation can be a strategic step to increase the efficiency and accuracy of the examination process. Thus, the PCIC laboratory can play an optimal role in supporting the law enforcement process for narcotics crimes in Timor-Leste, while ensuring that substantial truth can be revealed through objective and accountable scientific examination.

Based on the above description, this research is crucial to conduct in-depth to examine how the visual examination process of narcotics crime evidence in the Timor-Leste PCIC laboratory can contribute to uncovering substantial truth through scientific examination. This research is expected to make a tangible contribution to strengthening the law enforcement system in Timor-Leste, particularly in the aspect of establishing evidence for narcotics crimes based on scientific principles, accountability, and transparency.

3.3 Preliminary Test (presumptive test).

Preliminary test, or presumptive test, is an initial examination of narcotics evidence to identify the possible type of substance based on chemical reactions or specific physical properties. The results of this test are indicative and cannot be used as definitive evidence in court, but rather as a basis for confirmatory analysis.

3.4 Types of Preliminary Tests

The global proliferation of drug crimes has become a crucial issue that demands serious attention from various parties, including law enforcement agencies and scientific institutions. In the modern era, drug trafficking and abuse not only impact public health but also pose serious threats to social

stability, the economy, and national security. Countries around the world, including Timor-Leste, face significant challenges in eradicating increasingly complex drug crimes, both in terms of the perpetrators' modus operandi and the types of substances circulating in the community. In the context of law enforcement, valid and scientifically accountable evidence is key to the criminal justice process, particularly in drug cases, which often involve evidence with physical and chemical characteristics that are difficult to identify with the naked eye.

As drug cases increase in complexity, the need for accurate and reliable scientific examination methods becomes increasingly urgent. Laboratory examination of drug evidence aims not only to identify the type of substance found but also to ensure its purity, concentration, and the possibility of the presence of other substances that could affect the analysis results. In this regard, the role of forensic institutions such as the Polícia Científica e de Investigação Criminal (PCIC) in Timor-Leste is vital. As the institution responsible for the scientific examination of criminal evidence, particularly narcotics, the PCIC is required to implement strict standard operating procedures and utilize sophisticated scientific instruments to produce valid data that can be used as evidence in court.

Laboratory examination of narcotics evidence essentially consists of several stages, starting with preliminary tests and continuing with confirmatory analysis using modern scientific instruments. Preliminary tests are divided into two main types: simple physical tests and simple chemical tests (colorimetric tests). Simple physical tests are conducted by observing the physical characteristics of the evidence, such as odor, color, texture, or melting point. For example, a white crystalline powder can indicate the presence of methamphetamine or cocaine, while dried leaves can lead to the identification of marijuana. The advantage of this method is its non-invasive and rapid nature. However, its weakness lies in its very limited level of accuracy, making it unable to be used as the sole basis for determining the type of narcotic (Source: 1).

Furthermore, simple chemical testing, or colorimetric tests, are performed by reacting evidence samples with specific reagents to produce a characteristic color change. For example, the Marquis Reagent can produce a purple color in methamphetamine or opium/heroin, the Scott Test produces a blue color in cocaine, and the Duquenois-Levine Test produces a purple color in marijuana. The advantage of this method is its speed, affordability, and ease of implementation, both in the field and in the laboratory. However, its main weakness is its non-specific nature, as other substances other than narcotics can also produce similar color changes, potentially leading to false positive results (Source: 1).

Given the limitations of preliminary testing, a further stage, a confirmatory analysis, is required to definitively confirm the identity of the substance being tested. This stage begins with sample preparation, which is crucial for maintaining the integrity of the evidence. At this stage, laboratory personnel take a small, representative sample of the evidence, ensure it is free from contamination, and assign a unique code to each sample to maintain its identity. All equipment and reagents used must be sterile or clean, and personnel are required to wear personal protective equipment (PPE) such as gloves, masks, and goggles to avoid exposure to hazardous substances and ensure work safety. The primary objective of this stage is to maintain sample integrity so that subsequent test results are accurate and scientifically reliable (Source: 1).

The procedure for carrying out confirmatory analysis includes several important steps: (a) sample preparation by ensuring the evidence is not contaminated and taking a representative sample; (b) using reagents according to instructions while still observing the use of personal protective equipment;

(c) observing and documenting reaction results, either by recording color changes or photographing them if possible; and (d) recording the complete chain of custody on the laboratory form, including the personnel's identity and the date of examination and sample codes. Recording this chain of custody is crucial to ensure that each stage of the examination can be traced and held legally accountable (Source: 1).

The final stage of laboratory examination involves the use of modern scientific instruments for confirmatory analysis. The primary objective of this stage is to definitively identify the type of narcotic substance, determine its purity, and support evidence in court. Common instruments used in narcotics laboratory examinations include Gas Chromatography-Mass Spectrometry (GC-MS), which boasts high levels of accuracy and sensitivity in detecting and identifying chemical compounds. The use of this instrument enables laboratories to produce test results that are not only accurate but also scientifically and legally accountable (Source: 1).

In the context of law enforcement in Timor-Leste, the existence of the PCIC, as the institution authorized to scientifically examine criminal evidence, particularly narcotics, is crucial to ensuring a fair and objective judicial process. The PCIC is required to continually update laboratory examination methods and technology in line with developments in forensic science and technology. Furthermore, the implementation of strict standard operating procedures and ongoing training for laboratory personnel are key factors in maintaining the quality of examination results. Therefore, laboratory test results conducted by the PCIC can serve as a strong basis for evidence in court, thus assisting judges in making informed and fair decisions.

However, various challenges remain in the implementation of laboratory examination of narcotics evidence in Timor-Leste. These include limited human resources with forensic competencies, limited adequate laboratory facilities and equipment, and the need for updated regulations and examination standards to align with international developments. Therefore, ongoing efforts are needed from the government, law enforcement agencies, and educational institutions to improve the capacity and capabilities of forensic laboratories in Timor-Leste, particularly the PCIC, to meet the increasingly complex challenges of drug crimes in the future.

Based on the above, it can be concluded that scientific examination of narcotics evidence in laboratories plays a highly strategic role in supporting law enforcement in Timor-Leste. Through the application of systematic examination methods, the use of sophisticated scientific instruments, and the implementation of strict standard operating procedures, PCIC is expected to be able to produce accurate, valid, and legally accountable data and information. Thus, research on "Capturing Substantial Truth Through Scientific Examination By The Policia Cientifica E De Investigação Criminal (PCIC) On Evidence Of Narcotics Crimes In The Laboratory in Timor-Leste" is very relevant to be carried out, in order to provide a real contribution to the eradication of narcotics crimes and strengthen the criminal justice system in Timor-Leste.

3.5 Gas Chromatography-Mass Spectrometry (GC-MS)

In an era of globalization and rapid technological advancement, the distribution and abuse of narcotics is one of the greatest challenges faced by various countries around the world, including Timor-Leste. Narcotics crimes not only impact public health but also have broad implications for social stability, the economy, and national security. Therefore, law enforcement efforts against narcotics crimes are crucial for maintaining public order and well-being. In this context, the role of law enforcement agencies, particularly the Criminal Investigation Police (PCIC), is vital in ensuring that law enforcement processes are conducted fairly, objectively, and based on reliable scientific evidence.

One of the most crucial aspects of law enforcement against narcotics crimes is the examination and analysis of evidence in the laboratory. Evidence obtained from arrests, searches, and seizures must undergo a series of scientific examinations to confirm the substantial truth of the alleged crimes. Laboratory examinations not only aim to identify the type and content of narcotics but also to provide legal certainty that can be used as a basis in judicial proceedings. In this regard, the use of precise and accurate scientific methods is key to producing valid and admissible evidence in court.

One scientific method currently widely used in narcotics evidence examination is Gas Chromatography-Mass Spectrometry (GC-MS). This method is known for its high level of accuracy and sensitivity in identifying various types of narcotic compounds, making it highly relevant for application in the context of law enforcement in Timor-Leste. GC-MS is a combination of two analytical techniques: gas chromatography (GC) and mass spectrometry (MS), which work synergistically to separate and identify chemical compounds in a sample. In the process, GC separates sample components based on their volatility and interaction with the chromatography column, while MS analyzes the mass of the ions formed to specifically identify compounds.

The working principle of GC-MS begins with the sample preparation stage, where the sample to be examined must be dissolved in a solvent according to established procedures. The sample is then injected into the GC apparatus. In the next step, the chromatography column is heated, allowing the volatile components to vaporize and move through the column. Each separated component is then detected by MS, where the molecules are ionized, their mass-to-charge ratio (m/z) is measured, and the results are compared with reference spectra to confirm the identity of the compounds present in the sample. This process enables highly specific identification of various types of narcotics, even in very small quantities.

The primary advantage of the GC-MS method lies in its ability to perform specific identification of various types of narcotics with a very high level of sensitivity and accuracy. This is crucial in the context of law enforcement, where the accuracy of laboratory test results can be a determining factor in the evidentiary process in court. Furthermore, GC-MS is also capable of detecting narcotic compounds with similar chemical structures, thus minimizing the possibility of misidentification. Therefore, the use of GC-MS in the examination of narcotics evidence at the Timor-Leste PCIC laboratory can significantly contribute to law enforcement efforts based on substantial truth.

However, the use of the GC-MS method also has several limitations that must be considered. One major limitation is that this method can only be used to analyze volatile or vaporizable compounds. Non-volatile or difficult-to-vaporize compounds cannot be analyzed effectively using GC-MS, requiring other analytical methods to identify them. Furthermore, the sample preparation process in the GC-MS method requires great care and precision, as errors at this stage can lead to sample damage or inaccurate analysis results. Therefore, strict standard operating procedures (SOPs) and adequate training for laboratory analysts are necessary to ensure scientifically and legally reliable test results.

In the context of Timor-Leste, the challenge in law enforcement against drug crimes lies not only in the technical aspects of laboratory testing, but also in the availability of competent human resources and laboratory facilities. Adequate laboratory facilities, as well as an effective coordination system between various relevant institutions. The PCIC, as the institution responsible for the scientific examination of evidence, plays a strategic role in ensuring that each examination process is conducted in accordance with international standards. This is crucial for maintaining the integrity of examination results and enhancing public and judicial trust in laboratory analysis results.

Furthermore, the increasingly complex *modus operandi* of narcotics crimes demands innovation and capacity building in laboratory examination technology. The use of GC-MS as a primary method for analyzing narcotics evidence is an appropriate step to address this challenge. However, for examination results to contribute optimally to the law enforcement process, ongoing efforts are required to improve human resource competency, maintain and develop laboratory facilities, and update SOPs in line with scientific and technological developments.

Another issue that requires attention is the possibility of sample contamination or damage during the examination process. This can occur due to negligence in sample preparation, the use of improperly calibrated equipment, or uncontrolled laboratory environmental factors. Therefore, it is crucial for the PCIC to implement a strict laboratory quality management system, including documentation, reporting, and evaluation of examination results. Thus, every analytical result can be scientifically validated and used as valid evidence in court.

In an effort to increase the effectiveness of narcotics evidence examination, collaboration between the PCIC and other institutions such as the police, prosecutors, and courts is also crucial. Good coordination between various parties will ensure that each stage of the law enforcement process runs synergistically and in an integrated manner. Furthermore, the exchange of information and experience between institutions can enrich the knowledge and skills of laboratory analysts in addressing various challenges.

Based on the above description, it can be concluded that the examination of narcotics evidence in the Timor-Leste PCIC laboratory using the Gas Chromatography-Mass Spectrometry (GC-MS) method plays a crucial role in supporting law enforcement processes based on substantial truth. This method's superior accuracy and sensitivity make it the primary choice for narcotics evidence analysis. However, to ensure that the examination results truly contribute to the judicial process, ongoing efforts are required to improve human resource competency, maintain laboratory facilities, and implement strict SOPs and a sound quality management system. Thus, it is hoped that the use of the GC-MS method by PCIC can provide a rational and effective solution in facing the challenges of law enforcement against narcotics crimes in Timor-Leste.

3.6 Report Preparation

In today's modern era, drug crime has become one of the greatest challenges facing many countries worldwide, including Timor-Leste. The distribution and abuse of narcotics not only impact public health but also threaten social and economic stability and national security. Therefore, efforts to eradicate drug crimes are a top priority for the government and law enforcement officials. A crucial aspect of the law enforcement process for drug crimes is the provision of valid and scientifically accountable evidence in court. In this context, the role of forensic institutions, particularly the *Polícia Científica e de Investigação Criminal (PCIC)* in Timor-Leste, is vital in conducting scientific examinations of drug evidence in the laboratory.

In general, the law enforcement process for drug crimes requires strong and objective evidence to prosecute perpetrators fairly and in accordance with applicable laws. The evidence referred to is not limited to witness testimony or the suspect's confession, but must also be supported by scientific evidence obtained through forensic laboratory examinations. These examinations aim to determine the type, physical form, weight, and active substance content of evidence suspected of being narcotics. The results of these laboratory tests are then presented in an official report, which serves as an important document for investigators and the court in the evidentiary process.

In practice, preparing a laboratory report is a crucial stage because it will become an official document used by investigators and the court as scientific evidence. Laboratory reports must be compiled systematically, accurately, and accountably presented. Every finding contained in the report must be based on objective examination results and in accordance with applicable scientific standards. Thus, laboratory reports serve not only as an aid in the investigative process but also as a basis for consideration by judges in deciding cases in court.

At the beginning of the laboratory report, a summary of the test results is presented concisely, clearly, and systematically. This summary aims to provide investigators or the court with an overview of the test results without having to read all the technical data. The presentation of the summary of examination results must be objective, accurate, and scientifically accountable. This is crucial so that interested parties can quickly understand the essence of the laboratory examination results and take the necessary steps in the law enforcement process.

Furthermore, the laboratory report also includes an identification section containing information regarding the type of narcotics examined, the physical form of the evidence (e.g., powder, tablets, liquid, or dried leaves), net and total weight, unique identification code or registration number, and the physical condition of the evidence upon receipt (e.g., damaged, damp, or intact packaging). This information is crucial to ensure that the evidence examined is truly the evidence relevant to the case at hand. Furthermore, accurate identification can also prevent errors or manipulation of evidence during the examination and trial process.

The examination methods used in the laboratory must also be described in detail in the report. The type of analysis performed, such as confirmatory testing, Gas Chromatography-Mass Spectrometry (GC-MS), or Fourier Transform Infrared Spectroscopy (FTIR), must be clearly stated. In addition, the report must also include the reference method or standard used, for example, the laboratory's Standard Operating Procedure (SOP) or the international standard from the United Nations Office on Drugs and Crime (UNODC). If additional methods were used for confirmation or verification, this must also be stated in the report. An explanation of the examination method is crucial to ensure that the results obtained are truly valid and can be scientifically justified in court.

The main results of the laboratory examination are then presented in the main examination results section. This section contains information on whether the examined evidence tested positive for narcotics, the type of active substance contained and its concentration (if measurable), notes on the presence of any mixtures or additives, and a summary of other relevant observations such as suspicious color, odor, or texture. The presentation of examination results must be objective and based on the facts found during the laboratory analysis process. Thus, laboratory examination results can provide a strong basis for further investigation. Investigators and the courts in assessing the material truth of the case being handled.

At the end of the laboratory report, a conclusion is presented, which is a firm statement based on the results of the scientific examination. The conclusion must be presented factually, not based on opinion, and emphasize the scientific findings obtained during the examination process. For example, the conclusion might read: "Based on the results of the laboratory examination, the sample received was proven to contain methamphetamine with a total weight of 15 grams." Clear and concise presentation of the conclusion is crucial to avoid doubt or differing interpretations among stakeholders in the law enforcement process.

In the context of law enforcement in Timor-Leste, the PCIC, as the forensic institution responsible for conducting scientific examinations of narcotics evidence in the laboratory, plays a highly strategic role. The PCIC is not only tasked with conducting laboratory analysis but also ensuring that each stage of the examination is conducted in accordance with scientific standards and applicable procedures. Thus, the examination results produced by the PCIC can serve as a strong basis for the investigation and trial of narcotics cases in Timor-Leste.

However, in reality, various challenges remain in the laboratory examination of narcotics evidence in Timor-Leste. Among the main challenges are the limited number of competent human resources in forensics, the limited availability of adequate laboratory facilities, and the need to improve operational standards and laboratory accreditation so that test results can be recognized internationally. Furthermore, there are still challenges in coordination between the PCIC and other law enforcement agencies, such as the police and the prosecutor's office, in handling narcotics cases.

The actual situation on the ground shows that there are still cases where laboratory test results do not fully meet the expected scientific standards. This can impact the evidentiary process in court, where judges require strong, scientifically sound evidence to decide cases. Therefore, ongoing efforts are needed to improve the capacity and capabilities of the PCIC in conducting laboratory examinations of narcotics evidence, both through human resource training, improving laboratory facilities, and developing operational standards that align with international standards.

As a rational solution to these problems, it is necessary to strengthen the role of the PCIC in the scientific examination of narcotics evidence in the laboratory. This strengthening can be achieved through improving human resource competency, procuring modern, standard-compliant laboratory equipment, and developing a systematic, accurate, and accountable reporting system. Furthermore, improved coordination between the PCIC and other law enforcement agencies is necessary to ensure effective and efficient handling of narcotics cases.

Therefore, the research on "Capturing Substantial Truth Through Scientific Examination by the Polícia Científica E De Investigação Criminal (PCIC) on Evidence of Narcotics Crimes in the Laboratory in Timor-Leste" is highly relevant. This research is expected to make a tangible contribution to improving the quality of laboratory examination of narcotics evidence in Timor-Leste, thereby supporting a fair, objective, and evidence-based law enforcement process that can be accounted for in court.

CONCLUSION

Law enforcement against drug crimes is one of the main challenges facing modern criminal justice systems in various countries, including Timor-Leste. Globally, drug trafficking and abuse have become serious problems that threaten not only public health but also social and economic stability and national security. Therefore, efforts to eradicate drug crimes require an effective, fair law enforcement system based on the principles of justice and the protection of human rights. One of the main pillars of a modern criminal justice system is the use of objective, accurate, and transparent scientific evidence in the trial process.

In law enforcement, evidence is a crucial aspect in determining whether someone is found guilty or not guilty of a crime. Evidence that is not based on substantive facts and truth has the potential to lead to injustice for both suspects and victims. Therefore, a modern criminal justice system demands an evidentiary mechanism that relies not only on witness testimony or suspect confessions but also on scientific evidence obtained through forensic

laboratory examinations. In the context of narcotics crimes, laboratory examination of narcotics evidence is crucial for determining the type, content, and weight of the narcotics found, thus providing a strong basis for prosecution and sentencing.

The Criminal Investigation Police (PCIC), as the institution with the authority and technical competence to conduct forensic examinations in Timor-Leste, plays a central role in ensuring that the process of proving narcotics crimes is conducted objectively and accountably. Through the scientific approach applied in laboratory examinations, the PCIC is able to accurately identify the type, content, and weight of narcotics used as evidence. The results of these laboratory examinations not only serve as valid evidence under criminal procedure law but also serve as a primary instrument in ensuring legal certainty, justice, and the protection of human rights for both suspects and victims.

The crucial role of scientific examination in uncovering the substantive truth in narcotics cases is inseparable from the demand for a fair and transparent justice system. Scientific evidence generated through laboratory testing by the PCIC can minimize errors, manipulation, and subjectivity in the evidentiary process. Thus, court decisions are truly based on material truth that can be scientifically justified. This is crucial given the severe legal consequences of drug crimes, both for the perpetrator and the wider community.

However, the effectiveness of scientific testing by the PCIC in uncovering substantive truth depends heavily on several supporting factors. First, the availability of adequate laboratory facilities and infrastructure is a primary prerequisite for optimal testing. A laboratory equipped with modern equipment and cutting-edge technology will increase the accuracy and reliability of test results. Second, competent and professional human resources are essential to operate laboratory equipment and conduct analyses accurately and responsibly. Third, strict and consistent implementation of standard operating procedures (SOPs) ensures that each stage of the testing is conducted in accordance with scientific principles and applicable law. Fourth, synergistic coordination between investigators, public prosecutors, and the court is essential for the effective use of laboratory test results in the judicial process.

In Timor-Leste, the challenges in strengthening the institutional capacity of the PCIC remain significant. Limited laboratory facilities, a lack of forensic experts, and suboptimal coordination between law enforcement agencies are obstacles that must be addressed immediately. Modernizing laboratory equipment, improving human resource competency, and strengthening cross-sectoral collaboration are strategic steps that must be taken to increase the effectiveness of scientific examinations in handling narcotics crime cases. Furthermore, the need for regulatory and policy updates that support the use of scientific evidence in the judicial process is also a crucial aspect that must be considered.

The PCIC's scientific examination of evidence from narcotics crimes is not merely a technical procedure, but rather a strategic mechanism in realizing a criminal justice system based on substantive truth. With the presence of expert examiners, With objective, accurate, and accountable laboratory results, the law enforcement process can proceed fairly, transparently, and in accordance with human rights principles. This aligns with the primary objectives of the criminal justice system, namely to uphold justice and provide legal protection for all citizens.

Furthermore, the use of scientific evidence in the process of proving drug crimes also contributes significantly to more effective prevention and eradication of drug crimes. With legal certainty based on laboratory test results, drug offenders can be sentenced appropriately, while the public is

protected from the threat of drug trafficking. Furthermore, the use of scientific evidence can also increase public trust in the criminal justice system, as the law enforcement process is conducted professionally, transparently, and accountably.

In the context of globalization and rapid technological development, the challenges in handling drug crimes are increasingly complex. The modus operandi of drug offenders is increasingly sophisticated and difficult to detect with conventional methods. Therefore, strengthening the capacity of forensic laboratories and increasing the professionalism of law enforcement officers is an urgent need. Scientific examination by the PCIC must continue to be developed and adapted to advances in science and technology to meet the increasingly dynamic challenges of drug crime.

Therefore, it can be concluded that scientific examination by the Polícia Científica e de Investigação Criminal (PCIC) of evidence in drug crimes in the laboratory is a key foundation for uncovering substantive truth in the law enforcement process in Timor-Leste. This examination serves not only as valid evidence but also as a strategic instrument in realizing a fair, transparent, and science-based criminal justice system. Therefore, strengthening institutional capacity, modernizing laboratory facilities, improving human resource competency, and strengthening coordination between law enforcement agencies are steps that must be taken to ensure the effectiveness of scientific examination in handling drug crimes in Timor-Leste.

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