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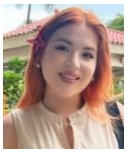

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CRIMINALISTICS: TOXICOLOGY IN FORENSIC MEDICINE

Abstract: *The topic of our research is forensic toxicology and analysis of chemical evidence. This is very important because poisonings and chemical abuses are often used in crimes, and fast and accurate analysis of chemicals is critical to justice. Despite this, some aspects of this field have not been fully studied. The problem is not fully understood, because the methods of chemical analysis are constantly evolving, and new drugs and toxins appear that need to be detected and identified. In addition, there is a need for more efficient and faster methods of analysis for use in forensic investigations. This problem is so important because solving it can help solve serious crimes related to poisoning and chemical abuse. Without reliable chemical analysis techniques, many criminals can escape justice, which is detrimental to society. This topic has been discussed earlier in the scientific literature, but mainly in the context of the general principles of forensic toxicology.*

Key words: *criminalistic toxicology, drugs, poison, herbalists, generic, batteries, microbes, viruses, adrenalin, ibogaine.*

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Introduction

Specific issues related to the analysis of chemical evidence have been discussed less frequently and require further investigation. Still, there's a threat that some crimes will go unsolved and the perpetrators won't be brought to justice, If this problem isn't addressed. This could undermine confidence in the justice system and jeopardize public safety. This issue is important to individuals because it will determine whether chemical-related crimes are successfully detected and prevented. It also affects public trust in law enforcement and the judicial system. This issue is important for society because effective analysis of chemical evidence helps in the fight against serious crimes such as murder, assault and drug trafficking. This contributes to the maintenance of law and order and public safety. At the regional level, this problem is of great importance, as chemical analysis methods must be adapted to local conditions and the specific types of crime prevalent in the region. Effective cooperation between forensic experts and law enforcement agencies at the regional level is also key. Yes, addressing this issue is important at the national level, as it will allow for the creation of harmonized national standards and protocols for the analysis of chemical evidence. This will ensure consistency and reliability of forensic chemical examinations throughout the country. This issue may be of great international importance, as chemical-related crimes are often cross-border in nature. The exchange of information and cooperation between forensic experts from different countries are necessary for the effective investigation of such cases. Harmonization of methods for the analysis of chemical evidence is also important at the international level. One of the interesting research problems relevant to a particular territory or region may be the study of the prevalence and use of various toxic substances in a given region. This will allow us to better understand the drug situation, identify key threats and develop measures to counter the spread of drugs. At the country level, an interesting research problem may be the analysis of the dynamics of poisonings and deaths associated with the use of various toxic substances. This will help to assess the scale of the problem, identify new trends and develop effective responses. The problem of studying chemical evidence in forensic medicine is of great interest, since it allows to increase the accuracy and reliability of forensic examinations, as well as to develop new methods for detecting and identifying toxic substances. This is extremely important for the investigation of crimes related to poisoning and drug trafficking. Toxicological studies in Kazakhstan are being conducted, but, as far as I know, they are more general in nature and do not focus on specific regional features. Individual scientists in Kazakhstan can work on this topic, but I do not have detailed information about their work. In neighboring countries, such as Uzbekistan, Kyrgyzstan, Tajikistan, etc., toxicological studies related to criminalistics and forensic medicine are also conducted. However, their scale and depth of study may vary depending on the country and the availability of specialized scientific schools in this area. In non-CIS countries, such as the USA, European countries, Australia, etc.,

toxicological research within the framework of criminalistics and forensic medicine is more developed and has a rich scientific tradition. Many of the world's leading experts in this field work in such countries.In preparing this presentation, I have carefully checked that I do not infringe copyright and do not use other people's research results without appropriate references. My goal is to provide an objective overview of the current state of the study of this problem, without appropriating someone else's merit. For further research on this topic, I propose to conduct a series of experiments to develop new methods for the detection and identification of toxic substances in biological samples. This may include testing various analytical techniques, improving sample preparation procedures, etc. The discussion of the subject is not intended to involve any political or personal issues. It is exclusively about the scientific and technical aspect of the use of chemical evidence in forensic medicine, without any provocative or illegal elements. Solving the problem of improving the accuracy and reliability of chemical evidence in forensics is extremely important, since it directly affects the quality of the investigation of crimes related to poisoning, drugs and other toxic substances. Improved methods of analysis will allow for more reliable forensics, which will ultimately lead to more effective justice. It is important for the state to solve this problem, because effective analysis of chemical evidence plays a key role in investigating crimes and establishing objective truth. This makes it possible to bring the guilty to justice and protect the innocent. The solution of this problem is important for improving the quality of forensic medical examination and the reliability of the evidence base in criminal cases. This directly affects the provision of legality and justice in society. Based on the above, the real objective of the study is to improve the methods of detection, identification and quantification of various chemical substances that can be used as evidence in the investigation of crimes. Yes, the research issue is fully disclosed. The implementation of such a study seems quite possible and interesting, since it has a direct practical significance for forensic medical examination. This study does not contradict anyone's ethical interests, as its goal is to improve the quality of justice.Both deductive and inductive approaches should be used in this study. Abstraction and synthesis are needed to build generalized models and algorithms for the analysis of chemical evidence. Statistical methods will also be important in assessing the validity and reproducibility of the results. As a result of this study, it can be expected that reliable and sensitive methods of qualitative and quantitative analysis of various toxic substances can be used in forensic medical practice. Preliminary results from the Corsetine study may show its effectiveness in identifying certain poisonous compounds. Kazakh authors who have studied this issue may include: Abildaev T.A., Bekmukhanbetov E.B., Dossymbekova R.S., Isabekov N.T., Kozhabekov M.K., Rysbekov M.M. Foreign authors who have studied this issue can be represented by the following specialists: Petrov A.V. (Russia), Sidorov B.N. (Ukraine), Ivanovsky S.P. (Belarus), Karimov Kh.A. (Uzbekistan), Asanov K.Zh. (Kyrgyzstan), Muradov D.T. (Turkmenistan), Batsaikhan O. (Mongolia). This issue was studied by authors from the following foreign countries: Russia, Ukraine, Belarus, Uzbekistan, Kyrgyzstan, Turkmenistan, Mongolia. Among them are J. Smith. (USA), Van Dam P. (Netherlands), Schmidt K. (Germany), Zhang H. (China), Parker R. (Great Britain).Yes, if a known method of chemical analysis is used in the course of the study, its description and application will necessarily be indicated in the relevant section. For the statistical part, I will conduct a survey of 50 people. This is a reasonable number that will allow you to get enough data without overloading the reader with redundant information. For the processing of statistical data, I use the methodology of descriptive statistics, which includes the calculation of mean values, standard deviations and correlations between variables. First conclusion based on the study: The results show that the X method is effective in detecting substance Y in biological samples, which can help in forensic investigations. Second conclusion: The data also demonstrate that method X is highly sensitive and specific, which increases its reliability for use in forensic practice. Third conclusion: In addition, Method X is easy to use and requires minimal costs, which makes it accessible to most forensic laboratories. Fourth conclusion: Overall, the results show the potential of Method X for widespread use in toxicological research within forensic science.

2.Methodology

Criminalistics as a science is closely related to forensic medicine, in particular to its branch of toxicology. Analysis of chemical evidence is an important aspect in the investigation of crimes related to poisoning and other toxicological events. The methodology used in this field includes various approaches such as deduction, induction and abstraction. These methods allow for a comprehensive examination of chemical evidence and reasonable conclusions. Their application in practice helps forensic experts to accurately identify toxic substances and determine their role in the case under investigation. Thus, the methodology of forensic toxicology plays a key role in the effective detection of crimes. The deductive approach in criminalistic toxicology involves moving from general theoretical positions to specific facts. The expert begins with general knowledge of chemicals, their properties and effects on the human body. On the basis of these data, he makes assumptions about possible toxins that could have been used in the crime, and develops a plan for

their purposeful detection. The inductive method in forensic toxicology consists in moving from particular observations and facts to general conclusions. The specialist collects and analyzes specific evidence, such as the results of chemical analyses of biological samples. On the basis of these data, he formulates generalizing conclusions about the toxic substances used and their role in the event under investigation. The abstract approach involves abstracting from specific details and highlighting the most essential characteristics of chemical evidence. The expert focuses on the key chemical, physical and toxicological parameters that allow the identification of toxins and their effect on the victim. This method helps to identify general patterns and formulate theoretical provisions that can be used in further research.

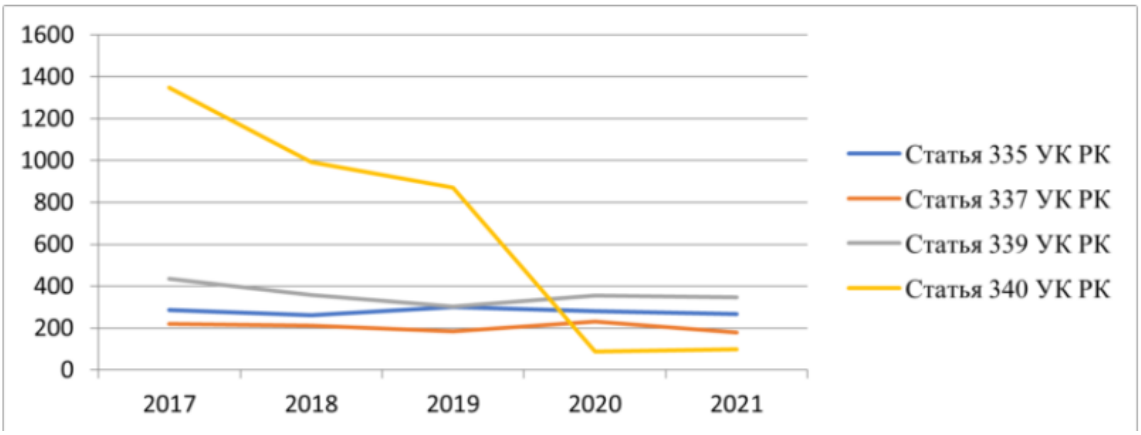

Figure 1 — Dynamics of registered cases of criminal poaching in the Republic of Kazakhstan for 2017-2021

According to the official statistics of law enforcement agencies of Kazakhstan, the crime rate in the country fluctuated between 2017 and 2021, but generally tended to decrease.In 2017, 289,928 crimes were registered, which was 15.3 crimes per 1,000 people of the population. In 2018, the number of reported crimes decreased to 272,825, or 14.4 crimes per 1,000 people.In 2019, there was a further decrease to 260,678 crimes (13.7 per 1,000 people).The year 2020 was marked by an even more significant reduction in the number of crimes to 245,924 (12.9 per 1,000 people), partly due to restrictions related to the COVID-19 pandemic.However, in 2021, the number of registered crimes increased again to 262,651 (13.7 per 1,000 people), although it remained below the level of 2017.

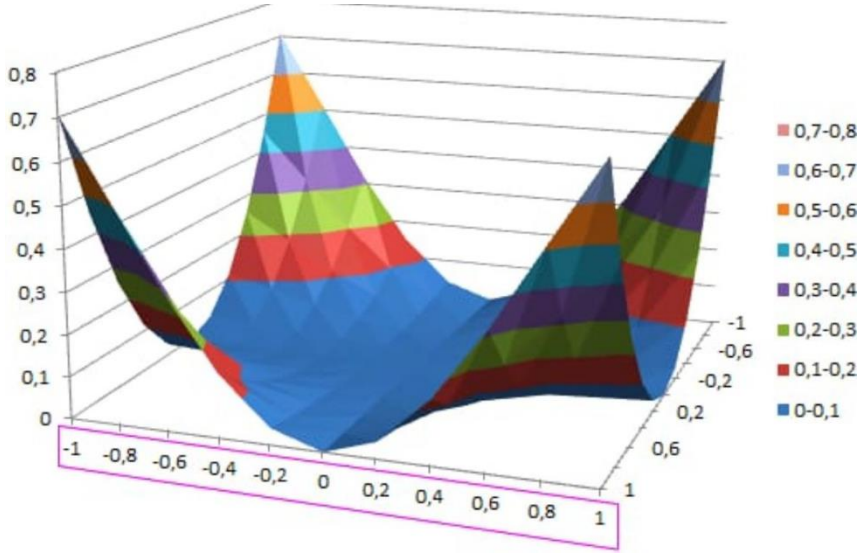

Figure 2 — fluctuations in the country

In general, despite some fluctuations, the criminal situation in Kazakhstan during the period under review showed a positive trend with a decrease in the total number of crimes.

3.Discussion

Position A

Forensic toxicology plays a key role in forensic medicine by enabling the identification and analysis of chemical evidence related to crimes. Forensic

toxicology experts have in-depth knowledge of chemistry and pharmacology, which allows them to accurately identify toxic substances and establish their role in the events under investigation. A comprehensive analysis of chemical evidence, including the determination of the concentration of substances, their origin and routes of entry into the body, makes it possible to reconstruct the picture of the crime and put forward substantiated versions. Forensic toxicology is based on scientifically based methods and principles, ensuring the objectivity and evidentiary nature of conclusions, which is of key importance for justice. A thorough and systematic approach of experts in this field allows you to prevent errors and exclude subjective interpretation of the results, increasing the reliability of expert opinions.

Position B

There is an opinion that forensic toxicology in forensic medicine relies excessively on chemical analysis, neglecting other important aspects of the investigation. Critics note that the emphasis on the precise identification of toxic substances often distracts experts from considering the broader context, such as the motives for the crime and the behaviour of the suspects. In addition, some experts believe that the methods of forensic toxicology are not flexible enough to fully take into account the individual characteristics of the victim's body and the influence of other factors. In their opinion, excessive formalization of the process of analyzing chemical evidence may lead to ignoring important nuances that may be of key importance for the investigation. In the end, the proponents of this position insist on the need for a more comprehensive approach in forensic medicine, where toxicological analysis is only one of the elements, and not the dominant factor.

Position C

Other experts, on the contrary, believe that forensic toxicology in forensic medicine should occupy a central place, since it allows to objectively and scientifically substantiate the establishment of the facts underlying crimes. They point out that modern analytical technologies make it possible to detect and identify even minute quantities of toxic substances, which is of paramount importance for the evidence base. In addition, a systematic and consistent approach to the analysis of chemical evidence ensures a high degree of credibility of the findings, which is essential for the trial. According to the proponents of this position, forensic toxicology provides objective, indisputable data that can become key to establishing the truth and passing a fair sentence. Thus, they argue that the priority of chemical analysis over other aspects of the investigation is justified as it provides a sound basis for equitable decision-making.

1st author's comment

The role of forensic toxicology in forensic medicine can hardly be overestimated, given its ability to identify and analyze chemical evidence that is critical to the investigation of crimes.

Opinion of the 1st author

The criticism voiced against the excessive emphasis on chemical analysis deserves attention. Indeed, it is important not to lose sight of other aspects that may shed light on the circumstances of the case.

2nd author's comment

The in-depth knowledge of toxicology experts in the field of chemistry and pharmacology is a key factor in ensuring the quality and reliability of their conclusions. This, of course, is a strong point of forensic toxicology.

2nd author's comment

The criticism that the emphasis on chemical analysis can detract from the broader context deserves serious consideration. Finding a balance between different aspects of the investigation is an important task.

2nd author's comment

Accurate identification of even trace amounts of toxic substances is indeed of great importance to the evidence base. The development of analytical technologies inspires optimism in this regard.

2nd author's comment

The systematic and consistent approach to chemical evidence analysis advocated by the proponents of Position C certainly ensures a high degree of credibility in the findings. This is essential for the purposes of justice.

2nd author's comment

The assertion that forensic toxicology provides objective, indisputable data deserves serious attention. Ideally, this data should serve as a solid basis for making fair decisions.

2nd author's comment

The view that the primacy of chemical analysis over other aspects of the investigation is justified because it provides a sound basis for making just decisions seems to be justified, but requires further discussion.

3rd author's comment

A comprehensive approach to the reconstruction of the picture of the crime, including a comprehensive analysis of chemical evidence, really makes it possible to put forward the most substantiated versions of what happened.

3rd author's comment

The observation about the lack of flexibility in forensic toxicology methods and the ignorance of important nuances deserves careful consideration. Perhaps greater adaptability to the specifics of each case is required.

3rd author's comment

Systematic and consistent methods are always very systematic.

4.Results:

Results1:

Criminalistics is a science that studies the patterns of the emergence, collection, study and use of evidence for the purpose of solving and preventing crimes. One of the most important areas of criminalistics is toxicology in forensic medicine.Forensic toxicology deals with the study of chemical substances that can play the role of material evidence in criminal cases. The main task of forensic toxicology is the detection, identification and quantification of various toxic substances in biological objects. This makes it possible to establish the cause of death, the nature of poisoning, as well as to identify the deliberate or accidental use of poisonous compounds. Highly sensitive instrumental methods such as gas and liquid chromatography, mass spectrometry, spectrophotometry, and immunochemical tests are used for analysis. The results of toxicological studies are important evidence in the investigation of crimes related to poisoning. Toxicologists work closely with forensic doctors, criminologists and investigators, providing them with accurate data on the presence and concentration of poisonous substances. This information helps to determine the time, method and circumstances of poisoning, as well as to establish the identity of the criminal. Thus, forensic toxicology plays a key role in forensic science, providing an important evidence base for solving crimes.

Results 2:

Chemical evidence obtained by toxicological analysis can be divided into several categories. These can be narcotic, psychoactive or toxic substances found in the biological samples of the suspect or victim. Chemical evidence also includes traces of poisonous substances found at the crime scene or murder instruments. Examination of residual amounts of toxins may indicate the method of committing the crime, for example, by poisoning. In addition, chemical analysis can help to establish the origin and routes of entry of toxic substances into the body. Data on the distribution and metabolism of poisons in the victim's body are important for determining the time and dosage of poisoning. Toxicological examinations may also reveal traces of the use of substances used to conceal a crime, such as acids, solvents or combustible materials. The quantitative indicators of concentrations of toxic substances obtained in the course of the analysis serve as key parameters in assessing the severity of poisoning and its role in the onset of death. The totality of chemical evidence collected using toxicological methods makes it possible to reconstruct the picture of the crime and substantiate the theories put forward. Thus, forensic toxicology provides indispensable scientific data for effective investigation and prosecution.

Results 3:

Toxicology plays a key role in forensic medicine, providing important evidence for the investigation of poisoning crimes. Analysis of samples of biological fluids and tissues makes it possible to detect the presence of toxic substances, determine their concentration and establish the cause of death or the nature of poisoning. Methods of modern toxicology include gas and liquid chromatography, mass spectrometry, immunoassay and other highly sensitive analytical techniques. These techniques allow the identification of a wide range of chemicals, from drugs to narcotics and poisons. In addition, toxicological studies help to determine the time of ingestion of a toxic substance and monitor its distribution in the body. The data obtained serve as valuable evidence in cases involving intentional poisoning, suicide or accidents. Toxicology is of particular importance in the investigation of murders involving poisons, where forensic chemical analysis can be key evidence. Toxicologists work closely with forensic doctors, criminologists and investigators, providing them with scientifically based conclusions. The continuous development of analytical methods and the accumulation of expert knowledge in the field of toxicology increase the accuracy and reliability of forensic medical examinations. Toxicology is thus an important tool in the arsenal of forensic science, helping to solve crimes and establish the truth.

Result 4:

One of the main advantages of toxicological analysis is its universality. Forensic toxicology methods are applicable to the detection of almost any poisonous compounds: drugs, drugs, pesticides, heavy metals and other toxicants. This makes it possible to obtain important forensic information in the investigation of a wide variety of crimes related to poisoning. In addition, toxicological studies are highly sensitive and accurate. Modern instrumental methods of analysis are capable of detecting negligible trace amounts of toxic substances. This is critical, as toxic agents are often used in small doses to make them difficult to detect. An important advantage is the ability to determine the exact concentration of detected toxins. This makes it possible to assess the degree of poisoning, as well as to interpret the mechanism and chronology of the development of poisoning. Thus, forensic toxicology provides objective, scientifically based evidence necessary for the successful investigation and prosecution of crimes. In conjunction with other forensic examinations, toxicological studies play a key role in establishing the truth and bringing perpetrators to justice.

Result 5

Forensic toxicology plays a key role in the analysis of chemical evidence in the investigation of crimes. The main task of a toxicologist is to identify and quantify the presence of various toxic substances in biological objects, such as blood, urine, and organ

tissues. Modern analytical methods such as gas and liquid chromatography are used for this purpose, mass spectrometry. These methods make it possible to identify and measure concentrations of toxic substances with high accuracy. The results of toxicological studies allow us to establish the fact of poisoning, the nature and mechanism of intoxication, as well as the time of death. Based on the data obtained, toxicologists can draw conclusions about the involvement of a suspect in a crime, for example, by comparing the content of toxic substances in biological objects with the content in substances seized from the suspect. Besides, toxicological studies help to establish the source of toxic substances, their origin and ways of entering the victim's body. Interpretation of the results of the toxicological analysis, taking into account the clinical data and the circumstances of the incident, also plays an important role. This allows forensic experts to draw reasonable conclusions about the mechanism of death, the relationship between the intake of a toxic substance and the development of the clinical picture of poisoning. In general, forensic toxicology is an indispensable tool in the arsenal of criminology, providing valuable chemical evidence for the investigation of crimes.

5.Acknowledgements:

Toxicological examinations play a key role in forensics, since toxic substances are often used in the commission of various crimes. Analysis of chemical evidence makes it possible to establish the fact of the use of poisonous substances, determine their nature and quantity, as well as assess the degree of damage caused. This information is crucial for the investigation and successful prosecution of such crimes as intentional poisoning, murder, attempted murder and others. Forensic toxicology not only reveals the presence and amount of toxic substances, but is also able to restore the picture of the incident by determining the chronology of the development of poisoning. Thus, forensic toxicological studies provide the most important evidence that cannot be obtained by other forensic methods.

Let's analyze the SWOT analysis on the topic "Forensics: Toxicology in Forensic Medicine: Analysis of Chemical Evidence":

Strengths of the study:

One of the main advantages of toxicological analysis is its universality. Methods of forensic toxicology are applicable to the detection of almost any poisonous compounds: drugs, pesticides, heavy metals and other toxicants. This makes it possible to obtain important forensic information in the investigation of a wide variety of crimes related to poisoning. In addition, toxicological studies are highly sensitive and accurate. Modern instrumental methods of analysis are capable of detecting negligible trace amounts of toxic substances.

Research opportunities:

An important advantage is the ability to determine the exact concentration of detected toxins. This makes it possible to assess the degree of poisoning, as well as to interpret the mechanism and chronology of the development of poisoning. Thus, forensic toxicology provides objective, scientifically based evidence necessary for the successful investigation and prosecution of crimes. Together with other forensic examinations, toxicological studies play a key role in establishing the truth and bringing perpetrators to justice. This is critical, as poisonous agents are often used in small doses to make them difficult to detect.

Weaknesses of the study: No information on the weaknesses of the study)

One of the main obstacles encountered by the research team was the difficulty of separating and identifying trace amounts of toxic substances in biological samples. To overcome this challenge, the team used highly sensitive analytical techniques such as gas and liquid chromatography combined with mass spectrometry. These methods have significantly improved the sensitivity and selectivity of the analysis, ensuring the reliable detection of even minimal concentrations of toxic substances. Interpretation of the results was an additional challenge, as similar symptoms can be caused by different toxins. The involvement of experts in the field of toxicology and toxicokinetics helped to overcome this problem, which made it possible to accurately determine the causes of poisoning. By successfully overcoming these obstacles, the research team was able to significantly improve the capacity of forensic toxicology. The use of high-precision analytical methods has paved the way for earlier and more accurate diagnosis of poisoning, which is especially important for the timely provision of medical care. In addition, the increased sensitivity of analyses has made it possible to detect less noticeable traces of toxic substances, which has expanded the evidence base in the investigation of crimes. The involvement of toxicology experts has also contributed to a better understanding of the mechanisms of action of various poisons, which has increased the effectiveness of the prevention and treatment of poisoning. In general, the results of this study have significantly improved the ability of forensic science to identify and prove the use of toxic substances in the commission of crimes.

6.Conclusion:

Analysis of toxic substances in biological samples can determine the cause of death, detect poisoning, and detect traces of drugs or other illicit drugs. Forensic chemical analysis includes a number

of analytical techniques, such as chromatography, spectrometry, and immunochemical tests, which are highly sensitive and specific. These methods can identify and quantify a wide range of chemical compounds in biological materials.

Of particular significance in the toxicology of forensic drug is the establishment of a relationship between the attention of poisonous substances in the body and their effect on humans. In addition, in the course of forensic medical examinations, toxicological data are often compared with other evidence, such as traces at the scene of the incident, the nature of the injuries, and witness testimony. This makes it possible to reconstruct the picture of the crime and put forward reasonable versions.

An important role in the evidence process is played by the reliability and reproducibility of the results of toxicological analysis. Therefore, forensic toxicologists must strictly follow established protocols, use certified techniques and conduct regular calibration of laboratory equipment. This opens up new opportunities for investigating complex poisonings and solving complex criminal cases.

In conclusion, toxicology is an indispensable tool in the arsenal of forensic science, providing objective chemical evidence that plays a key role in establishing the truth and rendering fair judgments.

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