

**FEATURE**

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## National Institute of Criminalistics

The National Institute of Criminalistics (INC) is the central criminalistics body of the Brazilian Federal Police, located in Brasília, linked to the Technical-Scientific Directorate of the Federal Police.

The INC has several laboratories of various specialties installed in the services and thematic sectors, which are: Computer Expertise Service; Documentoscopy Expertise Service; Engineering Expertise Service; Accounting and Economic Expertise Service; Audiovisual and Electronics Expertise Service; Laboratory Expertise Service; Forensic Genetics Sector; Ballistic Expertise Sector; Environmental Expertise Sector; Forensic Medicine and Dentistry Sector; Crime Scene Investigation Sector; Geographic Information Sector; and Specialized Group on Bombs and Explosives.



Dr. Ricardo Guanaes Cosso, Federal Criminal Expert and Director of the National Institute of Criminalistics

The INC conducts, standardizes and disseminates techniques and methodologies for analysis of the most diverse types of traces of criminal actions, such as drugs of abuse, medicines, fuels, pesticides, food and others, and authenticity tests of works of art. Modern analytical techniques are used, such as chromatography, high resolution and isotope ratio mass spectrometry, atomic spectrometry, infrared spectrometry, X-ray spectrometry, scanning electron microscopy and other complementary techniques.

According to Dr. Jesus Antonio Velho, Federal Criminal Expert and Head of the Institutional Development Sector, several techniques are used for forensics authenticity analysis of artwork, with Raman spectroscopy being a nondestructive technique for the work of art itself.



Laboratory of Instrumental Analytical Chemistry of the National Institute of Criminalistics

With regard to documentoscopy, Elvio Botelho, MSc, Federal Criminal Expert and Head of the Laboratory Expertise Service, highlights the chemical analyses of different colorants (dyes and pigments) used commercially in inks used in handwritten documents. There are two types of document dating examinations through chemical analysis of dye degradation:

I. Comparison of inks: with the purpose of verifying whether graphic records are contemporary and/or produced by the same pen.

II. Date comparison: between the alleged date (or informed in the document) and the one suspected (presumed) by the investigation. Due to the speed of degradation observed experimentally in pen ink dyes, pen ink dating examination requests should only be processed if the difference between the date in the questioned document and the date suspected by the police investigation is greater than several years.

### **Some prominent cases studied at the National Institute of Criminalistics**

Operation “Carne Fraca” was an operation triggered by the Federal Police in March 2017 to investigate an alleged scheme of adulteration of meat sold in the domestic and foreign markets. This operation investigated the Ministry of Agriculture, Livestock and Supply (MAPA) and the largest companies in the sector in Brazil, such as JBS S.A., owner of the Seara, Swift and Friboi Vigor brands, and BRF S.A., owner of the Sadia and Perdigão brands.

In October 2007, Operation “Ouro Branco” uncovered frauds practiced by two milk cooperatives in the State of Minas Gerais (MG): the “Cooperativa dos Produtores de Leite do Vale do Rio Grande (Coopervale)”, based in Uberaba, and the “Cooperativa Agropecuária do Sudoeste Mineiro (Casmil)”, based in Passos. The fraud consisted of adding a chemical solution of caustic soda, citric acid, sodium citrate, salt, sugar and water to the milk to increase its volume and shelf life. According to the expert Botelho, as fraud in milk was not a type of case commonly found in forensic chemistry investigations, it was necessary to establish partnerships with several public research institutions for the development and performance of analysis using different analytical techniques for detecting substances used for the adulteration of milk: with the Farming National Laboratory (LANAGRO, MG), the addition of whey to milk was identified by gel permeation chromatography, the addition of alkaline substances was identified by ash alkalinity and the addition of sodium citrate was identified by ultraviolet/visible spectroscopy; with the Thomson Laboratory of

the University of Campinas (Unicamp, Campinas, SP), techniques were developed to detect maltodextrin addition by ion mobility mass spectrometry and vegetable fat addition by MALDI-TOF (matrix-assisted laser desorption/ionization–time-of-flight) mass spectrometry; with the Ezequiel Dias Foundation (FUNED, MG), the addition of sucrose and lactic acid was identified by high-performance liquid chromatography; and with the Instituto Adolfo Lutz (IAL, SP), the fatty acid profile in milk was determined by gas chromatography with flame ionization detection.

### **Projects in development at the National Institute of Criminalistics**

In its final implementation phase, the National Laboratory for Stable Isotopes (LANIF) was designed to have two integrated laboratory bases, one at the INC in Brasília and the other at the Federal Police Department in Manaus, Amazonas. Both have isotope ratio mass spectrometry (IRMS) equipment. Additionally, LANIF can count on the technological park of a network of partner institutions. At the INC, an isotope ratio mass spectrometer (model DELTA V Plus) coupled to a FlashSmart elementary analyzer and a Trace GC 1310 gas chromatograph coupled to an ISQ7000 quadrupole mass spectrometer from Thermo Fisher Scientific are already in the installation/training phase. In Manaus, the laboratory is already in operation.



Laboratory of Isotopic Analysis of the National Institute of Criminalistics

The isotopic ratio technique makes it possible to determine or exclude the origin of criminal evidence of different types, such as drugs of abuse, explosives and wood. It also enables the development of efficient solutions to assist in the identification of missing people or check whether commercialized animals come from captivity or from nature. The technique has a transversal character, is innovative at the national level and will assist in the integration of investigations that involve different scientific themes at the same time.

A great advantage of the isotopic technique is the speed and objectivity of the laboratory analysis. This technique makes it possible to make important inferences regarding various aspects of criminal conduct, such as the origin of the trace or trafficked material, routes of criminal action, adulteration or counterfeiting processes and authorship, among others. Following this trend, the INC instituted the creation of isotope databases and the use of isotopic analysis in police investigations and criminal proceedings as strategic guidelines.

### **Other projects developed at the National Institute of Criminalistics**

- FARMONITOR – monitoring of legislation and trends in pharmaceutical counterfeiting.
- Drug chemical profiling (PeQui Project) – involving the seizure of cocaine and MDMA (3,4-methylenedioxymethamphetamine) followed by determination of the chemical profiles of the drugs seized across the country, establishing characteristics such as the origin of the drug, the products used for manufacture, the conditions of transport and the purity of each sample.
  - Identification of new psychoactive substances (NPS) – characterization of NPS seized for the first time, using nuclear magnetic resonance spectroscopy, with the support of the Institute of Chemistry of the University of Brasília when necessary.
  - Toxicology – validation of methodologies in the scope of ISO/IEC 17025:2017 accreditation.
  - Preparation of certified reference materials and drug proficiency testing in partnership with the National Institute of Metrology, Quality and Technology of Brazil (Inmetro) and the National Secretariat for Drug Policy of the Ministry of Justice and Public Safety (SENAD/MJSP).
  - CLOACIN Project – analysis of drugs in sewage, in partnership with the SENAD/MJSP.

### **Accreditation**

In September 2014 the Laboratory Expertise Service (SEPLAB) of the National Institute of Criminalistics received the accreditation certificate for compliance with the ISO/IEC 17025:2005 Standard, which defines the requirements for quality management in analytical laboratories.

It was the National Accreditation Board/FQS Forensic Accreditation (ANSI-ASQ) that granted the accreditation certificate to SEPLAB, which became the first laboratory of forensic chemistry in Brazil to receive this international recognition and one of the few in Latin America. Currently, Inmetro is the body responsible for maintaining SEPLAB accreditation in ISO/IEC 17025:2017.