Chapter 11
Nano Forensic Testing of Illicit Drugs

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ABSTRACT

Nano forensics utilizes nano-based sensors in matters of crime or where the legality of the process is challenged. There exist many conventional techniques, but considering the approach of criminals and the modern-day standard of investigation, there is a need for nanotechnology-based sensors for their sensitive, selective, and rapid detection of illicit drugs. Illicit drugs are psychoactive in nature. They act upon the CNS that results in different perceptions and long-lasting responses. This chapter covers the drugs that can be the potential source of causing abuse and those commonly detected in forensic lab testing. The conventional techniques have a few drawbacks. They are time-consuming, highly expensive, and some of these techniques are also destructive. Nanosensors are nanoparticle-based probing techniques that constitute a sensing platform for the detection of the biological substance present in the evidence sample collected from the crime scene. These nanosensors can work with limited quantities, and the quality of the sample yields valuable information for preparing the scientific report.

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INTRODUCTION

From the 20th Century onwards there has been an era of advancement in every field of science. Specifically, in the last few decades, science and its associated fields have progressed to new heights. Of all the scientific disciplines one of the most fascinating ones is the field of forensic science which also has progressed in every field of life (Nikkel, 2020). Forensic science is a science of its own having many sub-disciplines that work together to produce a scientific report that helps both the criminal investigation and judiciary towards the resolution of the case. Under the sky of the forensic world, one of its disciplines nano-forensic testing has gained its utmost attention in recent times (Tully et al., 2020).

Nano-forensic is the modern approach that focuses on the applicability of nano-based sensors in matters of crime or where the legality of the process is challenged (Paikrao, Tajane, Patil, & Dipole, 2022). There exist many conventional techniques that are being applied in forensic testing, but considering the approach of criminals and the modern-day standard of investigation. There exists a deficiency in producing the scientific report that is very common (Graziano, Anzillotti, Mannocchi, Pichini, & Busardò, 2019). Whenever a crime happens anywhere in the world some sort of evidence is always left. The evidence is most often in the fragile form left that is not only contaminated but also very compromised in its composition. Even though the existing evidence is being collected properly from the crime scene, the conventional techniques are sometimes unable to detect meaningful information and the production of any conclusive results (Walters, 2018).

Nano-forensic testing covers every bit that is applied by using scientific techniques based upon the preparations from the nano-scale materials that are equal to the millionth part of a meter. An illustration is given in Figure 1.

Figure 1. The modern sensing device based upon an electrochemical sensing platform used for illicit drug testing work at the scene of the crime. (A) shows the individual components of the sensing platform 1-potentiometer, 2-buffer solution, 3-SPE, 4- spreader, 5-Pasteur pipette and 6-evidence sample. (B) shows sample preparation. In (C), the sample is loaded in the designated area of the sensing SPE platform, and (D) shows the interface having the results of electrochemical sensing.
Source: Parrilla et al. (2022)