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Role of nanoparticles in forensic DNA typing

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Biotechnology is a valuable and beneficial field as it can be used to examine human genetic diversity. Further, along with biotechnology, nanotechnology can be applied in analysing forensic DNA. Forensic DNA typing is a procedure that involves the identification of human beings or inheritance patterns of genes. This process is performed by using genetic samples that are characterised by a set of recognising numbers. These numbers are matched in order to detect if they are identical to the reference sample. In forensic studies, DNA typing can be performed using biological specimens, such as blood, saliva, sperm cells, muscles, teeth and bones. Forensic DNA typing begins with the collection of DNA samples from individuals. This process involves various procedures, such as extraction and purification, quantification and analysis and amplification and detection. During extraction and purification, copper nanoparticles or magnetic nanoparticles are used for improving the quality of the Polymerase Chain Reaction (PCR), where the nanoparticles bind to the DNA with very high affinity. The quantification of the obtained DNA concentration should be reliable and the analysis must show the enhanced quality of the DNA sample. Magnetic nanoparticles with carboxylic compounds are used in the isolation phase of DNA extraction and as absorbents for PCR amplification. After the separation and detection of the PCR products, the samples of genotypes are detected and compared to other sample results. If a match occurs, the DNA profile is then correlated to the population databases. Furthermore, DNA typing is advantageous and adequate because it only requires a small DNA sample. However, the process of forensic DNA typing is very challenging as forensic samples are often the most difficult to process due to the small fraction of biological samples available from the crime scene. In addition, the collected DNA sample may get contaminated. Therefore, further research to overcome these challenges will aid in the better analysis of DNA in the forensic context.

Keywords: DNA typing, Nanotechnology, Polymerase chain reaction, DNA profiling, Nanoparticles

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