NANOTECHNOLOGY METHODS FOR DNA ISOLATION

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Abstract

Deoxyribonucleic acid (DNA) is unique to each individual and will remain unchanged for a lifetime as it follows the rules of the Mendelian lineage. However DNA analysis is a widely accepted technique for individual identification. Extracting and isolating DNA from ancient bone samples and mutilated body parts is an even more difficult and challenging task for the forensic scientist. But newer technology, such as nanotechnology, will help to analyze such models for DNA. Therefore, in this research paper we have shortlisted some research papers that used different nanoparticles to extract DNA. The different nanoparticles used for DNA extraction were cited and briefly explained.

Keywords: Nanotechnology; Personal Identification; DNA; Forensic; Nanoparticles; Copper nanoparticles; Gold nanoparticles; Magnetic Nanoparticles

Introduction

Personal Identification Using DNA

Traditionally, human remains have been identified individually or forensically based on fingerprint, otontology or bone evidence, facial features, scars, marks or other special features. In many cases, available methods have not proven effective because the amount of destruction or destruction of debris or debris is very high [1].

Disasters terrorist attacks, traffic accidents, wars, fires, explosions, plane crashes highly, decomposed body or severely burnt and other harrowing events individual identification or forensic identification become very tough for the investigation man from skeletal remains [2-4]. During decomposition human body undergoes a series of multiple changes and the rate of decomposition may vary due to factors like monsoon, microorganisms growth, and insect and wild scavengers [1]. During this time the soft tissues are often destroyed and may have no dental history [2]. Some of conditions Deoxyribo Nucleic Acid (DNA) can prove to be the most very very essential and useful source of identification or a good another source for identification purposes [2]. Deoxyribonucleic acid (DNA) is responsible for genetic inheritance,

So the discovery of the dual helix structure of DNA in 1953 had a major impact And in all fields of science, including forensic investigations Led to significant changes.

This understanding is the foundation for the development of new techniques and methods

It is based on the individual DNA sequence.

DNA is made up of phosphate spines, deoxyribose sugars and nitrogen bases Where phosphate backbone and deoxyribose sugar remain unchanged in all individuals, Only nitrogen bases are different for each person. Thus, human DNA makes up 99.9 percent of the scenery per person , Only 0.1 percent are unique to each person, though the possibility of having same genetic material is about approximately 10-15 between two mismatched individual [5,6]. These minute differences can be detected in human DNA sequences and based on these differences between the 1984 DNA sequences The first forensic DNA tests were performed [7]. In recent years, it has become widespread that DNA can lead to the personal identification of human remains, I.e. bone residues in most cases. DNA sample identification and specification play a very important role in mass disaster And also helps identify suspects in civil and criminal cases. But at the same time, many organisms exposed to microorganisms, moisture and bone residues Or it should be noted that the decomposition of genetic material by mineral compounds reduces DNA levels and the reliability of extracting good quality DNA. The use of small-scale loci multiplication by polymerase chain reaction (PCR) to overcome such a problem yields excellent results for further analysis of genetic material. However, in forensic examination of skeletons, in the context of individual identification, PCR-ready genetic material extraction has become an important and challenging task. For forensic uses, DNA is usually separated from many biological evidence, such as blood, saliva, semen, hair, urine, skin, tissues, teeth, and bones [8-20].

From all of these bone and dental specimens, especially from the ancient / buried / autopsy bone remains specimens, the examination is a chalky endeavor as the skeletal remains bring problems to the DNA extraction process. Effective disruption of nucleoprotein / protein-DNA complexes in cells and dinosaur embedded cells. In addition, even pulse-sized bone dust does not have uniform consistency, usually due to low levels of cellular material and age-related degradation of DNA in the bone and polymerase chain reaction (PCR) inhibitors Integrating. In addition to DNA hydrolysis, DNA molecules undergo biochemical degradation such as hydrolytic and oxido-dive damage [21,22] by cellular nuclei and microbial dextro-dione.

There are several commercial products for DNA isolation, including column chromosomes or extraction following agros gel electrophoresis, But these techniques fail to avoid contamination or complicated procedures. It is necessary to get rid of any contaminants such as DNA protein and RNA isolated from biological samples. The process of genetic DNA isolation and purification has progressed significantly over the past decade,

But improvements are needed in the mechanisms for DNA isolation. There is a need to replace old labor and time consuming traditional techniques,

It generally relies on the use of the phenol-chloroform method. All of these DNA extraction techniques are time consuming, multi-step and use for organic solvent extraction, alcohol precipitation and centrifugation [23]. However, nanotechnology has recently entered into DNA isolation to answer and deal with such issues.

Forensic Nanotechnology

The advent of nanotechnology controls atoms and molecules individually, modifying and making them usable with extraordinary levels of precision. The word 'nano' is derived from the Greek word for dwarf, which refers to one billion (10-9) nanometers (nm) [24]. It is associated with growing material or devices with a size of 100 nm or less. Nanoparticles are applied in a variety of fields, including electronics, engineering, physics, and semantics, and have found application in the field of medical science [25]. Advances in nanotechnology have led to the development of new methods that are innovative and have advanced properties that demonstrate their validity in all fields of science and technology. Nanotechnology currently plays an important role in the fields of biology and biology [26,27].

Currently, nanoparticles have attracted great attention for their applications in biochemistry, medicine and biotechnology due to their unique size and physical properties. In the case of biodegradation and refining, the viable solution is to replace the nanoparticles with nanoparticles because they are more proportional to the surface. Integrated systems have been developed to isolate DNA, which use solid-phase support Integrated Systems Have Been Developed To Isolate Dana, With Us Us Solita-Pache Support Magnetic particles have been used successfully to extract genetic DNA from body fluids such as blood, saliva and semen [30]. Magnetic particles coated with different polymers such as agros, carboxyl and silica have been studied for DNA isolation [31].

Solid phase systems are used to purify DNA-silica-based particles, glass fibers, anion-transfer carriers, and modified magnetic beads because they have the advantage of minimal DNA decay during refining [32-41]. Extraction of DNA from blood was done by ZM Saeed et al using magnetic nanoparticles. [40], Rui Kong et al. Use magnetic microspheres. [41] and ZM Syed et al. [42], from cell culture using magnetic nanoparticles by ZM Saeed et al. [42] and Zhang Zhao et al. Using magnetic nanoparticles coated with salicylic acid. [43], A. Sebastianelli et al. From soil using silica-magnetic nanoparticles. [44], Ji Shan and others using magnetic nanoparticles from urine. [45] and Li Yi et al. From saliva using magnetic nanoparticles. [46]. The phenol / chloroform method uses toxicity, timing and multi-step and organic solvent extraction, alcohol precipitation and centrifugation [47]. The method has a limit when dealing with small amounts of DNA. The use of magnetic carrier technology to separate living cells, such as DNA, RNA, and proteins [48,49], has become a widespread technique.

Lotha et al. [50] The unique property of copper nanoparticles was first used to isolate DNA from bone residues. Copper nanoparticles are synthesized in the microwave using diethylene glycol (DEG), ascorbic acid and polyvinyl pyrrolidone (PVP), which bind highly to DNA. The novelty of this method is that copper nanoparticles have not yet been used for DNA isolation. Furthermore, the author said that this developed method could be easily used to isolate DNA from bone remains.

Mundaha et al. [51] DNA quality and quantity improved when DNA was extracted from gram-negative bacteria by extraction methods (boiling, alkaline lysis, and salt extraction) in the presence of ZnO nanoparticles. The resulting heat effectively caused the pathogen to decompose. The resulting DNA is extracted from the cell body and transferred to the PCR system. This led to a step-by-step demonstration of the success of the real-time PCR system.

Conclusion

The use of nanotechnology to identify unknown human remains using forensic genetics / DNA has the potential to provide accurate personal identification, even from small, dangerous, trace samples. Forensic analysis needs to increase DNA extraction capabilities because sample sizes are often limited and may introduce incomplete DNA extraction dependencies, thus altering the interpretation of the results. Reproduction and nanomaterials used in the extraction steps require research. None of the standardized extraction methods currently used in forensic laboratories are used because of the DNA extraction protocols based on different types of nanoparticles. It may limit the ability to compare forensic models in different forensic research and laboratory groups, countries, or case studies. Finally, laboratory standardization based on nanoparticles in chip DNA forensic methods should be explored. When these problems are solved, forensic scientists will be able to combine nanomaterials and DNA analysis into a commonly used casework, using nanotechnology to provide robust, reliable sources for personal identities.

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