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# A REVIEW ON DNA ISOLATION METHOD

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***Abstract :*** Since Friedrich Miescher's pioneering DNA extraction in 1869, scientists have continually refined methods to make them safer, more efficient, and environmentally friendly. Traditional liquid-liquid extraction, reliant on hazardous reagents like phenol-chloroform, has given way to physical extraction techniques, offering simplicity and safety. These innovations, such as magnetic bead and cellulose-based filter paper extraction, have revolutionized DNA handling. In the era of gene editing and personalized medicine, the demand for precise, high-yield DNA isolation methods has surged. Consequently, this review explores the transition from solvent-based to physical extraction methods, each presenting distinct advantages and limitations. This protocol emphasizes a novel approach: employing in-house prepared reagents for DNA isolation. By utilizing locally sourced materials, researchers can reduce costs and dependency on commercial products. Additionally, this approach promotes sustainability and flexibility, as reagents can be tailored to specific research needs. In summary, this review underscores the evolution of DNA extraction techniques, highlighting the shift towards safer, more efficient methods. By embracing innovative strategies like in-house reagent preparation, researchers can meet the growing demand for reliable DNA isolation while minimizing environmental impact and resource dependency

***Keywords:*** **DNA, DNA Extraction Methods, DNA Isolation, Purification**

## I. INTRODUCTION

Nucleic acids extraction is the starting point in any molecular biology study and hence is considered as a crucial process (Mariyam and S. Preetha,2020). The extraction of first crude DNA had been performed by the Swiss physician Friedrich Miescher in 1869, who had accidentally purified DNA from the nucleus while he was investigating proteins from leukocytes and found that the property of this substance was fundamentally different than proteins, hence coined the term “nuclein” (Dahm R,2005). DNA can be extracted from sources as diverse as clinical samples such as fine needle aspirates of body fluids and biopsy samples; forensic samples such as dried blood spots, buccal swabs and fingerprints; to soil, plant and animal tissue, insects, protozoa, bacteria and yeast (Dhaliwal A,2013).Now it becomes very important to isolate genomic DNA of superior quality and quantity for analyzing through PCR based application (Aamir S *et al*,2015).Further, extraction of high-quality and-quantity DNA is a fundamental requirement for genetic research. It is very important to address the use of DNA extraction methods that are simple and cost-effective in gene polymorphism with large number of samples (Mohammad S and Abbas M,2018). For the selection of suitable DNA isolation method, especially where there is a large number of samples, speed and accuracy of the assay should be maximal, while the risk of contamination and the cost of the assay should be minimal (Kessler HH *et al*,2001). For DNA isolation different compounds are used like detergent (to lyse the cell and denature the nucleoprotein complex),Protein kinase(to digest protein),Chelating agent(to bind the bivalent cation and inactive DNAase),RNAase(to remove RNA contamination),Organic solvents including phenol chloroform and isoamyl alcohol(to purify DNA in most common procedures) are the examples(Nasir H *et al*,2005,Javidia *et al*,2014).Now a days very cost effective method which is known as the salting out method. It is simple and nontoxic DNA extraction techniques introduced by Miller et al. through this technique we can isolate a high quality from blood (Sugana S *et al*,1989). Biological information is stored in DNA through its linear sequence of polynucleotides. It is translated into mRNA and subsequently transcribed into a sequence of amino acids that determines the three-dimensional structure of the protein, which in turn determines its biological function. Hence, DNA provides the instructions to maintain biological function and is considered to be the blueprint of life (Bruce Alberts,*et al*,2002). At neutral pH and physiological salt concentration, DNA mostly exists in the B-form, the classic right-handed double helical structure. A-form nucleic acid, found in RNA-DNA and RNA-RNA duplexes, is thicker with its base pairs packed closer together due to the syn conformation of its deoxyribose sugar ring (Hardison R,2020). Z-DNA is present in small amounts in the cell and has a left-handed helical structure that is thinner with more base pairs per turn as compared to B-form. Its phosphodiester backbone follows a zigzag pattern owing to the alternate stacking of purine bases that maintain a syn conformation and pyrimidine bases that are rotated into the anti-conformation (Eun H,1996).

## II.RESEARCH METHODOLOGY

Different DNA extraction methods were searched in electronic databases, hand searched journals and through contact with authors directly. The data extraction and screening were conducted by two reviewers independently. Electronic data sources used include PubMed, ScienceDirect, ResearchGate and Google Scholar. The term which was used “DNA extraction method”, “Advantage of DNA extraction method” and “limitation of DNA extraction method”. Solvent based DNA extraction and Physical DNA extraction. Review of literature published was conducted with more than 50 publications reviewed.

## III. RESULTS AND DISCUSSION

**Chromatography-Based DNA Extraction Method**

It can be used to isolate DNA from any kind of biological material (Carpi F M et al,2011). This method includes exclusion chromatography (SEC) invented by Lathe and Ruthven (1955), ion-exchange chromatography (IEC)developed by Peterson and Sober (1956) and affinity chromatography (AC) reported by Cuatracasas and Wilcheck (Peterson E, Sober H,1956, Cuatracasas P et al,1968 and Lathe and Ruthven,1955).

**EtBr-CsCl Gradient Centrifugation Method**

It was developed back in 1957 by Matthew Meselson Franklin W, Stahl and Jerome Vinograd (Meselson M et al,1957).

**Alkaline Extraction Method**

It was first introduced in 1979 by Birnboim and Doly. This method is primarily used to extract plasmid DNA from bacterial cells (Birnboim H, Doly J,1979).

**Silica Matrices**

The high affinity between silicates and DNA was first describe by Vogelstein and Gillespie in 1979(Hossm and Paabo S,1993). The techniques is based on the principle of selective binding of the negatively charged DNA with silica surface that is covered with positively charged ions.

**Salting-Out Method**

This method was developed by Miller Dykes and Polesky in 1988.

**Cetyltrimethylammonium Bromide (CTAB) extraction Method**

It was introduced by Doyle et al in 1990.

**Phenol-Chloroform method**

This method was introduced in 1998 by Baker et al.

**SDS-Proteinase K**

Proteinase K is a serine protease that was first discovered by Ebeling et al in Fungus *Engyodontium album* in 1974(Thomas S et al,1989).

**Silica column-based DNA extraction method**

In this method lysis buffer (0.05 M EDTA and 3ml 0.2 Tris pH 8.0)1% SDS and 100 micrograms of Proteinase K are added to the sample.

**Magnetic Beads**

Trevor Hawkins,1998 filed a patent titled “DNA purification and isolating using magnetic particles (Thomas S et al,1989).

**Cellulose-based paper**

Cellulose is an extensively hydroxylated polymer that has a high binding affinity for DNA. In 2000, Whatman Inc filed a patent titled “Ftacoated media for use as a molecular diagnostic tool” (Whatman,2007).

**Chelax-100 Extraction**

In 2011, Xiong Hui, Xie Liqun and Chen Jiayi patented a DNA extraction method using Chelax-100(Hoy M,2018).

**Filter-Paper-based DNA extraction method**

In 2017, Rui Shi and Dilip Panthee describe a DNA extraction method using filter paper it can be used to isolate DNA from plant sources (Mariyam D and Preetha S,2020).

## IV.CONCLUSION

Absolutely, the evolution of DNA extraction techniques has been remarkable since Friedrich Miescher's groundbreaking work. While each method has its strengths and limitations, the quest for better results continues to drive innovation in this field. Improvements in existing methods could involve enhancing the specificity and efficiency of DNA capture, reducing contamination risks, and streamlining the process for easier use. For example, advancements in sample preparation, such as using microfluidic devices or automation, could simplify and accelerate extraction procedures while maintaining high purity. Moreover, developing novel techniques can open new avenues for DNA extraction. For instance, exploring alternative solvents or reagents that are more environmentally friendly or cost-effective could revolutionize the field. Additionally, integrating nanotechnology or novel biomaterials could offer unprecedented precision and sensitivity in DNA isolation. Furthermore, customization of extraction protocols for specific applications, such as forensic analysis or medical diagnostics, could lead to tailored solutions that optimize yield and purity according to the unique requirements of each context. Collaboration between biologists, chemists, engineers, and computational scientists will be crucial in driving these advancements forward. By leveraging interdisciplinary expertise, researchers can tackle the multifaceted challenges associated with DNA extraction and pave the way for more efficient, reliable, and versatile techniques in the future.

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