

Efficiency Meets Innovation: Isolating Forensic DNA Made Easy



The isolation of forensic DNA presents several significant challenges and problems, including:

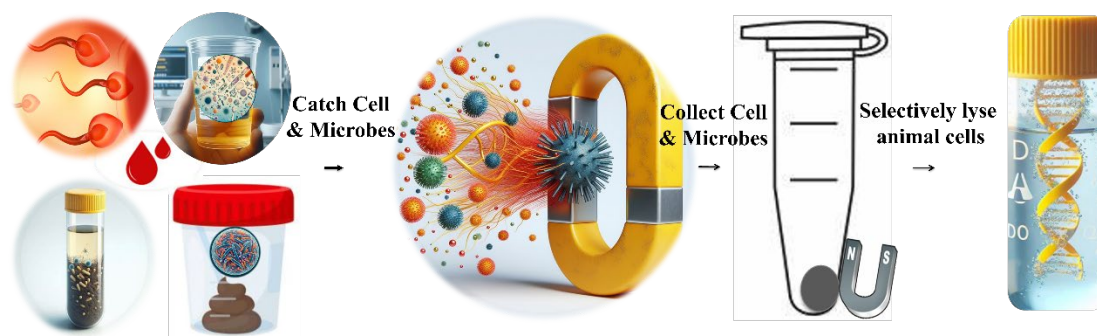
1. **Sample Quality:** Forensic samples are often degraded, contaminated, or present in very small quantities, making DNA extraction challenging. Factors such as exposure to environmental conditions, handling practices, and biological materials present in the sample can affect DNA quality and yield.
2. **Presence of Inhibitors:** Forensic samples may contain inhibitors such as chemicals, proteins, or substances used in preservation methods, which can interfere with DNA extraction and downstream analysis. These inhibitors can lead to reduced DNA yield, PCR amplification failure, or inaccurate genotyping results.
3. **Cellular Material Diversity:** Forensic samples can consist of various biological materials, including blood, saliva, semen, hair, and tissue, each with its own challenges for DNA extraction. Different extraction methods may be required to effectively recover DNA from different sample types.
4. **Non-human DNA Contamination:** Non-human DNA contamination in forensic samples poses challenges such as false results or inconclusive interpretations, potentially originating from various sources during sample collection, handling, processing, or analysis. Interference during PCR-based STR analysis may lead

to allelic dropout or inaccurate genotyping. Analyzing complex mixtures containing human and non-human DNA can be challenging, particularly with high concentrations of non-human DNA. Inhibition by substances within non-human DNA can hinder PCR reactions, resulting in reduced efficiency or inaccurate allele sizing, complicating result interpretation.

In response to these challenges, Bioclone has devised two specialized platforms: the BcMag™ Easy Forensic DNA Extraction Platform (Fig. 1) and the BcMag™ Tough Forensic Sample DNA Extraction Platform (Fig. 2). These platforms are meticulously designed to facilitate the extraction of DNA from challenging forensic samples, such as those exhibiting degradation, contamination, or resistance to lysis, and those available in limited quantities.

BcMag™ Easy Forensic DNA Extraction Platform offers several advantages:

1. **Utilization of Specially Designed Cell Capture Magnetic Beads:** The proprietary magnetic beads are engineered to selectively capture and enrich animal cells and microbes, facilitating the removal of contaminants, such as PCR inhibitors, from the sample. This selective capture ensures the extraction of DNA from cells, even in scenarios like a tiny blood drop mixed with soil.
2. **Implementation of Specially Formulated Animal Cell Lysis Buffer:** The lysis buffer is exclusively designed to lyse animal cells, thereby guaranteeing the extraction of 100% human DNA while minimizing the presence of non-human DNA.
3. **Adoption of Negative Chromatography DNA Purification:** Following cell lysis, the supernatant contains purified DNA (No DNA loss), eliminating the need for traditional DNA purification procedures involving "Bind-Wash-Elution." Such procedures are known to cause a significant loss of DNA, typically ranging from 20% to 40%.



Workflow

1. Place the forensic sample in a 1.5 ml centrifuge tube and add 0.5-1 ml of water.
2. Use vortexing or pipetting to detach cells.
3. Transfer the supernatant to a new tube.
4. Add magnetic beads and invert the tube 20 times to capture cells.
5. Separate beads magnetically and remove the supernatant.
6. Wash beads three times with pure water.
7. Add human cell lysis buffer and heat at 70°C for 10 minutes, then 80°C for 10 minutes.
8. Extract purified DNA from the supernatant.

Feature and Benefits:

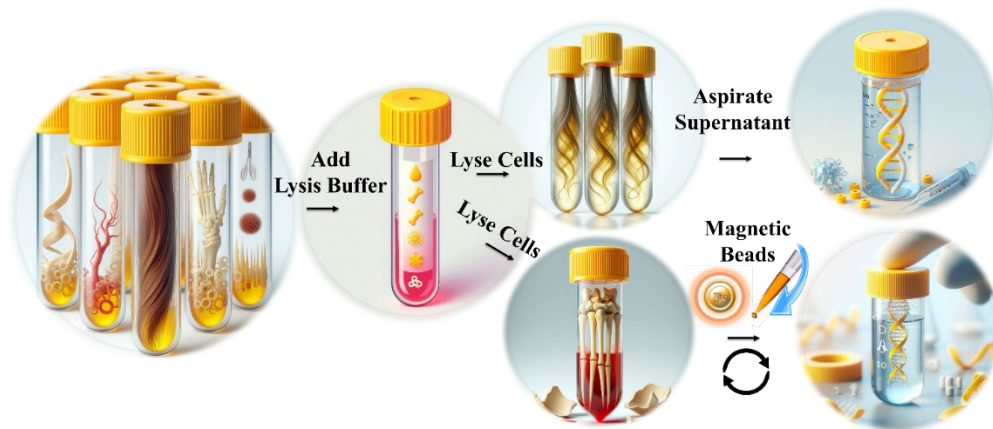
1. The extraction process ensures the absence of PCR inhibitors, thereby maintaining the purity of the extracted DNA and mitigating the risk of interference with subsequent PCR reactions.
2. The platform demonstrates minimal contamination from non-human DNA sources, contributing to the precision and reliability of forensic DNA analysis.
3. It yields a higher quantity of DNA without any loss during the extraction process, optimizing the availability of genetic material for analysis.
4. The extraction protocol is straightforward and user-friendly, facilitating seamless integration into laboratory workflows and minimizing the potential for procedural errors.
5. Designed for high-throughput applications, the platform offers automation capabilities, enabling the efficient processing of multiple samples simultaneously and reducing both manual labor and turnaround times in forensic DNA analysis.

Applications

The BcMag™ Easy Forensic DNA Extraction Platform demonstrates efficacy in handling a wide range of forensic samples, including blood, stool, saliva, semen, swabs, fingerprints, touch samples, cigarette butts, and others.

BcMag™ Tough Forensic Sample DNA Extraction Platform

The BcMag™ Tough Forensic Sample DNA Extraction Platform is specifically engineered to enable efficient DNA extraction from challenging forensic samples that are notably small and resistant to lysis, such as rootless hair, bone, and nail specimens. This platform incorporates a specially formulated proprietary lysis buffer optimized for effectively lysing the sample to release DNA. Additionally, the platform utilizes specially tailored magnetic beads designed to efficiently capture the released DNA, ensuring high extraction yields from these challenging sample types.



Workflow

1. Place the forensic sample in PCR tube (for 1–2-inch hair sample) or a 1.5 ml centrifuge tube (for bone, nail, tooth) and add 5 μ l lysis buffer (hair) or 0.5 ml-1 ml lysis buffer (bone, nail, or tooth)
2. Heat at 80°C for 40 minutes. Transfer the supernatant to a new tube.
3. Add magnetic beads and invert the tube 20 times to capture DNA.
4. Separate beads magnetically and remove the supernatant.
5. Wash beads three times with wash buffer.
6. Elute the DNA from the beads.

Feature and Benefits:

1. The extraction process guarantees the absence of PCR inhibitors, ensuring the purity of the extracted DNA and reducing the risk of interference with subsequent PCR reactions.
2. The platform demonstrates minimal contamination from non-human DNA sources, enhancing the precision and reliability of forensic DNA analysis.
3. It yields a higher quantity of DNA without any loss during the extraction process, maximizing the availability of genetic material for analysis purposes.
4. The extraction protocol is straightforward and user-friendly, facilitating seamless integration into laboratory workflows and minimizing the potential for procedural errors.
5. Tailored for high-throughput applications, the platform offers automation capabilities, enabling the efficient processing of multiple samples simultaneously and decreasing both manual labor and turnaround times in forensic DNA analysis.

Applications:

The efficacy of the BcMag™ Tough Forensic Sample DNA Extraction Platform is evident in its capacity to efficiently handle challenging forensic samples such as hair, nail, and bone specimens.