

Health, Medicine and Biotechnology

Self-Contained Device Isolates Biological Samples

Pipette-free technology enables analysis outside of laboratory

Innovators at NASA's Johnson Space Center (JSC) have developed a self-contained device for isolating deoxyribonucleic acid (DNA), ribonucleic acid (RNA), proteins, and cells without using pipettes or centrifuges. Composed of reagents, functionalized membranes, and multi-way valves and pumps, this novel fluidic system enables automation of highly accurate real-time polymerase chain reaction (PCR) technology to isolate genetic material from organisms and microorganisms for molecular analysis. The device is self-enclosed and leak-proof, so users are protected from chemically hazardous reagents. Developed to enable molecular diagnostics aboard the International Space Station (ISS), this easy-to-use analysis tool can be fully automated and programmed, extending laboratory isolation protocols to numerous applications in health care, forensics, and field biology.

BENEFITS

- Compact and portable: DNA/RNA isolation kits (10 x 10 x 2 in)
- Self-contained: Requires no auxiliary equipment to isolate desired targets
- Safe: Does not require hazardous chemicals for PCR analysis
- Effective: Offers sensitivities similar to standard isolation methods

technology solution



NASA Technology Transfer Program

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THE TECHNOLOGY

JSC's technology provides hazard-free, microgravity-compatible hardware for DNA/RNA isolation. It also allows PCR analysis to be used outside the lab in environments where pipetting is difficult and/or where hazardous chemicals must be confined to an enclosed container, such as military settings and remote clinical operations.

This self-contained device for isolating DNA/RNA, proteins, and cells is a component system that includes syringes and pistons, membranes of different capacities, reagents, four-way valves, and small pumps. The pre-filled reagents are the same as those used in conventional PCR laboratory isolation analysis. The DNA and RNA isolation kits are novel and process small sample amounts using a self-enclosed and pipette-free technique. Multiple kits can be stacked to allow several samples to be processed simultaneously. The system can be used in conjunction with existing analysis modules, such as commercially available DNA instruments. The process can be fully automated and programmed and can potentially be applied to other biological processes. The JSC innovation will permit the extension of laboratory isolation protocols to many applications.



FIGURE - 1: Prototype of the automated system to process biological samples.

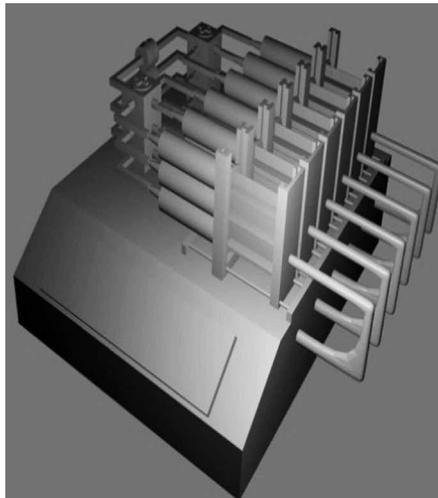


FIGURE - 2: Envisioned commercial product of the automated system with control panel.

APPLICATIONS

The technology has several potential applications:

- Remote clinical operations
- Arctic operations
- Forensic investigations
- Agribusiness
- Space vehicles

PUBLICATIONS

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Patent Pending

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