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Rapid DNA Extraction Using Ultrasonic Bursts

VTIP 20-044: "Focused Ultrasound Extraction (FUSE) for the Rapid Extraction of DNA from Complex Tissue Matrices"

THE CHALLENGE

DNA extraction has a variety of applications from molecular biology to forensic analysis. In the process of DNA extraction, a cell is broken down in order to expose the DNA. Some organisms, such as bacteria, are easy to break up using sonic cleaners to extract DNA. However, breaking down complex tissue matrices is a much more difficult process as the cells are so much stronger. Finding a way to easily break down these complex samples would significantly decrease the time of DNA extraction and result in much faster analysis process.

OUR SOLUTION

Hal Holmes and his team have developed a method of DNA extraction using ultrasonic pulses. The technology, named Focused Ultrasound Extraction (FUSE), creates cavitation clouds using the ultrasonic pulses generated. These cavitation clouds then ablate the tissue that they are focused onto. This process of breaking up the tissue into small particles accelerates the release of DNA for collection and analysis. In a test scenario the FUSE process only took 6 minutes and 40 seconds while traditional enzymatic methods took 45 minutes and resulted in very similar levels of DNA extraction. This will greatly increase the speed of DNA extraction and allow for fast DNA analysis processes without a decrease in quality.



Focused ultrasound pulses create cavitation clouds that effectively ablate complex tissue. This allows for the quick extraction of DNA from the tissue.



The figure above depicts FUSE pulses effectively ablating a tissue sample. Ablation is visible within 500 pulses and complete ablation is seen after 1000 pulses. This entire process took 40 seconds to perform.



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