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Title: LOW ENERGY ULTRASONIC SEPARATION

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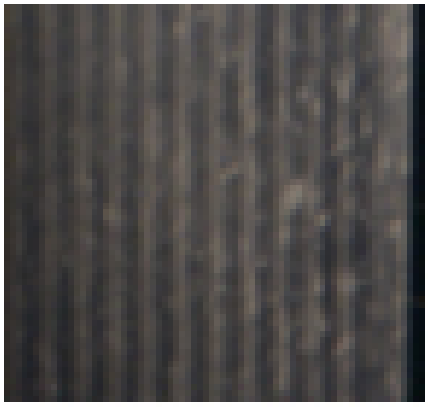

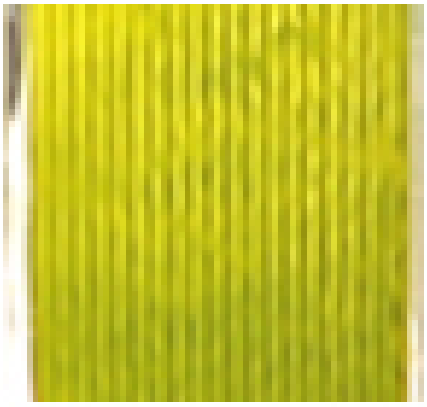

Tech Snapshot

Manufacturing

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LOW ENERGY ULTRASONIC SEPARATION

Continuous Removal of Particles from Industrial Process Streams

SUMMARY

Separations exist in all manufacturing sectors, accounting for 22% of in-plant energy use. Whereas energy-intense technologies such as centrifuges are well established, low energy separations account for only 1% of industrial energy consumption. Researchers at Los Alamos National Lab are developing a low energy ultrasonic particle concentrator for industry. This technology may reduce energy use, improve separations, reduce wastes, and cut manufacturing costs.

MARKET

Centrifugation and membrane filtration are currently the leading separations solutions used by industry. Recent data suggests a centrifuge market size of $8.69B and a membrane filtration market size of $13.5B. However, current growth and innovation in the separations market are driven by industry demands for energy reduction, product recovery, waste management, and increased demand. The Los Alamos low-energy ultrasonic separation technology fits well within process industries that currently use centrifuges and filtration, but could reduce energy consumption and eliminate the cost of consumables like membrane filters. This new ultrasonic technology could penetrate this large market while providing substantial additional benefit to users.

BENEFITS

This ultrasonic separation technology operates at low energy without moving parts and fouling filters. It could benefit companies seeking to reduce energy use, processing costs and waste.

- Low capital costs with simple push-button operation
- Low energy consumption – can use less energy than a centrifuge
- Low maintenance – continuous operation without the need to clean filters
- Modular design offers customized sizing with a small footprint
- Safe, quiet operation without moving parts that could injure personnel

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WHY WE ARE BUILDING LOW ENERGY ULTRASONIC SEPARATION

Industrial separations consume nearly as much energy as the residential sector. Aproximately 80% of energy usage in current industrial separations methods is wasted by inefficient thermal processes. Los Alamos is developing low energy ultrasonic separation to reduce capital and operating costs in comparison with filtration and centrifugation. We aim to reduce the reliance on these more costly and high-energy technologies by replacing them with the more environmentally friendly technology of ultrasonic separation.

WHAT'S BEHIND OUR TECHNOLOGY

This ultrasonic separation technology reduces costs and energy via its simple design. The complexities of particle separation are simplified by forcing particles together without the need for chemical additives, filters that foul, or fast-moving parts as in centrifuges. The benefits of ultrasonic separation reduce risk and enable simple operation via a push-button interface. The modular design of the ultrasonic separation technology eases scale up to meet your process-rate needs.

OUR COMPETITIVE ADVANTAGES

• Low energy requirements – conceived to reduce energy needed for separations • Low capital cost and simple operation – emerging from decades of experience and breadth of application • Eliminates wastes – No chemical additives or filters to clean and replace • Modular, particle-centric design – particle characteristics dominate scale up design and our modular approach can match any process scale while minimizing footprint

OUR TECHNOLOGY STATUS

The ultrasonic separation technology has been tested and demonstrated on a wide range of particle separation challenges including the concentration of microalgae for biofuels, removal of lignocellulosic fines from biochemical process streams, dewatering of protein and carbohydrate food products, ultrasonic trapping of extracellular polymeric substances, and dewatering of mineral suspensions. The next step is to identify industry partners for collaboration and development of a ruggedized, full-scale ultrasonic separation prototype. This could be accomplished through a Cooperative Research and Development Agreement (CRADA) and/or technology licensing and product development.

PUBLICATIONS AND IP

Publication

Coons, J. E., D. M. Kalb, T. Dale, and B. L. Maronne, Getting to low-cost algal biofuels: A monograph on conventional and cutting-edge harvesting and extraction technologies, *Algal Research* **6** (2014) 250–270.

Patents

S133320 entitled 'Acoustic Manipulation of Fluids Based on Eigenfrequency.' U.S. Pat. No. 10,428,324 granted October 1, 2019.

S133490 entitled 'Ultra Low Power Acoustic Separation.' U.S. Pat. App. No. 16/011,496 filed June 18, 2018.