Using Microfluidic Devices to Filter Algae at High Flow Rates - Year 3

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Microalgae is an optimal biofuel candidate due to its ease of growth in many water environments, high lipid content, and lack of overlap with food production. The separation of microalgae from water is the most difficult part of the biofuel making process. The goal was to design and optimize a microfluidic flow-through frit or centrifugal device for the task. Two different types of frits have been made: simple frits, which are sheets with the frit embedded in them, and flow-through frits, which have a channel for the solution to flow through and frit surrounding it for water to escape from. The frits were designed and made using magnesium powder in PDMS, followed by dissolving the magnesium. By varying the ratio of magnesium to PDMS, magnesium size, and the applied pressure, the filtering capabilities of the frit can be changed and controlled. The frit was tested using a constant pressure pump. The frit composition for the flow through devices are 55% 50μm magnesium with 45% PDMS and a protective layer of 33% 50μm magnesium, 33% 250μm magnesium, and 33% PDMS, which in simple frits achieved 98% rejection rate. Continued testing of the flow through frits capabilities and production methods are ongoing. The centrifugal device has a small, wide channel that spirals through the frit. The algae solution is pushed through, and inertia separates the algae from the water. Both the flow-through frits and centrifugal devices are still being tested, and performance data will be collected.

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