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Rapid Sample Processing of Foodborne Pathogens Using Cross-Flow Microfiltration

Casey Bomrad, Jessica Zuponcic, Linda Liu, Eduardo Ximenes, and Michael Ladisch
Laboratory of Renewable Resources Engineering (LORRE), College of Biological Engineering, Purdue University

ABSTRACT

Foodborne illnesses are a prominent issue, causing 48 million illnesses annually. The *Escherichia coli* O157:H7 outbreak in romaine lettuce is a recent example. The source of the pathogen was contaminated irrigation water. The most common methods for detecting foodborne pathogens involve cultivation and enrichment of food samples. The enrichment steps are time-consuming, taking 24 to 72 hours to complete. Our study aims to accelerate irrigation water sample preparation for pathogenic microorganism fast detection through cross-flow microfiltration. This is accomplished by a device called a continuous cell concentration and recovery device (C3D). The C3D uses cross-flow microfiltration in a hollow fiber module containing a polyethersulphone membrane with 0.2 µm pore size. This is small enough that the liquids and dissolved particles in the sample will be leaked out into a waste container, and any microorganisms present will be trapped. After concentration, the trapped microorganisms are returned into a sample recovery vial, effectively reducing the sample from 500 mL down to a 5-10 mL sample. Further concentration is achieved by centrifugation to a final volume of 0.5-1.0 mL. This concentrates environmental and pathogenic bacteria that may be present in a water sample to a detectable level. A C3D with four separate hollow fiber modules was developed and calibrated to further increase efficiency. Overall, this process has the potential to decrease the time needed for the sample to reach a detectable level from up to 72 hours down to just 6-8, which is within the window of a single shift of a plant.

KEYWORDS

Foodborne pathogens, irrigation water, biofilms, microfiltration, pathogen detection, pretreatment