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Dry preservation of xylem water filters for point-of-use filtration of microbes from drinking water

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Studies suggest that the relatively high cost of point-of-use water filters is one of the main barriers that prevent their adoption in poor communities. The recently demonstrated ability of sap-conducting xylem tissue in the sapwood of coniferous trees to filter out bacteria from water opens the possibility of realizing inexpensive, locally-manufacturable, and disposable point-of-use water purification devices. However, a major challenge associated with the use of xylem for water filtration is the drop in permeability and deterioration in rejection ability due to the structural changes induced during drying. We investigated the drying process in xylem tissue of Eastern White Pine and explored the effects of drying conditions, geometry of the filter, and solvent on drying. Through this investigation, we have developed methods to preserve the structural integrity of the xylem and minimize the negative impacts on filtration characteristics due to drying, which address the critical issue of transportation and shelf-life of these filters. Further, we find that the permeability after drying is a strong function of filter length, which enables understanding of trade-offs in the filtration device design to achieve an optimal balance between flow rate and rejection ability. Building upon these advances, we have demonstrated gravity-driven filtration through xylem filters and conducted preliminary investigations of fouling and filter lifetime. These results demonstrate a step towards realization of cost-effective point-of-use xylem water filters for removal of pathogens from drinking water.

Biography

Krithika Ramchander completed her Bachelors from the Indian Institute of Technology Delhi, India in 2013. She is currently a Masters student in the Mechanical Engineering Department at Massachussets Institute of Technology and a fellow with the Tata Canter for Technology and Design. Before coming to MIt, she worked with Shell for a year on the design and inspection of heat transfer equipment such as heat exchangers, furnaces etc.

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