Investigating the Use of Plant Xylem from Angiosperm Wood Species as Organic Water Filters

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A major global concern pertains to the availability of potable water due to continuous growth in water demand which is not balanced by adequate restoration. Common technologies for water disinfection suffer from high costs, fouling, require pumping power due to low flow rates that prevent their wide implementation in developing countries. Xylem tissue in plants contain pores which not only allow for the passage of water between interconnected vessels, but also protect the plant against the formation of embolisms and spread of pathogens, raising the question of whether or not plant xylem can be used to make inexpensive water filtration devices. This study shows how xylem tissue from Tilia americana, and Ochroma pyramidale, angiosperm wood species were identified as suitable materials for filtration considering their availability, pore size, and resistance to fluid flow. A simple pressure-driven filtration apparatus was designed to contain xylem membranes during the flow and filtration process experimentation. Filtration was examined using soluble ink particles ranging from 10-60um in size. At pressures of 2940Pa, flow rates in the Ochroma pyramidale membrane were approximately 1.8mL/s, while flow rates in the Tilia americana were 0.5mL/s. Low flow rates in the Tilia Americana membrane were due to its uniform interconnected porous structure, yet the Tilia americana xylem membrane exhibited highest filtration characteristics, having a particle rejection reading of 44.1337%. Plants are readily available as byproducts of the agricultural industry, and if certain wood species could be used to make water filtration devices, then such biodegradable, sustainable materials can be implemented in many resource-limited settings.

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