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Water filtration through wood with helical cross-flow

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ABSTRACT

The use of wood as a filter element for water treatment can be an efficient, low-cost alternative because wood is a renewable material. Therefore, pioneering a study to examine the possibility of filtering water through wood was advantageous. In 2002, the first experiments with wood filtration in the perpendicular direction of fibers were conducted (Correa and Sens [1]). With the continuation of this study, a new research developed as presented in this article. This study was conducted in two steps by the construction of pilot systems. The first step studied dead-end filtration and the second step studied helical cross-flow. The three species of wood studied were: caixeta (*Tabebuia cassinoides* Lam P. DC.), garapuvu (*Schizolobium parahyba* Vell. Blake), and pine (*Pinus elliottii*). The images obtained in the scanning electron microscope had the same approximations for all the three samples in the pores' direction as well as in the direction of fibers. The porosity of the wood fits within the size of the microfiltration. The observation of the wood's permeability revealed that the more porous the wood, the greater the permeability and the smaller the apparent mass. Filtration in the perpendicular direction of the fibers did not prove valuable because of its very low filtration rate and the need for high working pressure. Pine proved to be the superior option when considering the quality and production of water in the dead-end filtration. In this study, the value for wood density which is calculated to be 0.50 g/cm^3 and the porosity in the range of 40% proved to be significant factors for this treatment system. This implied a correlation between wood density and its porosity when choosing wood for water filtration. With respect to the observed wood, the pore diameter with higher performance was approximately 0.02 mm. The results in the helical cross-flow filtration generated an average removal of 70% to apparent color removal and 93% for average turbidity. The working pressure did not exceed 40 psi for a filtration rate of 15 m^3/m^2.d. The helical cross-flow filtration tests involving coagulation showed enhanced results and higher efficiency. Fouling on the surface of the wood reached a depth of 5 mm, not found in 10 mm. In summary, this treatment system exhibited improved and cost-effective results with minimal power consumption due to low working pressures.

Keywords: Water treatment; Filter element; Helical cross-flow; Water filtration through wood

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