

Laccase/ultrasound system for cotton bleaching – an ultrasonic pilot-scale reactor

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Abstract

This work exploited the bleaching efficiency of cotton fabrics using a combined laccase-hydrogen peroxide system assisted by ultrasound. The main goal was to reach the whiteness levels obtained by conventional treatments, reducing the amount of chemical and energy consumption. Laccase promoted the oxidation of flavonoids responsible for the natural color of the fabric. In addition, ultrasound energy enhanced the mass transfer and speed-up of bleaching reactions. Laboratory experiments demonstrated that the biobleaching process allowed higher whitening levels than those obtained by standard methods. Thus, an adjustment of different operational parameters such as hydrogen peroxide concentration, temperature and incubation time was possible. As result, comparing with conventional processes, the amount of hydrogen peroxide was reduced 50% as well as the energy consumption in terms of temperature (reduction of 40 °C) and processing time (reduction of 90 minutes). Further, a pilot reactor for the explored technology was scaled-up by adapting an existing dyeing machine with piezoelectric ultrasonic devices. The developed ultrasonic pilot-scale reactor contributes for a sustainable bleaching process with reduced environmental impact as well as offers a better performance for the finishing operations.