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Fenton oxidation and Chromium recovery from Tannery wastewater by means of iron-based coated biomass as heterogeneous catalyst in fixed-bed columns

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Abstract

This work deals with the treatment of a tannery wastewater by a mixed-iron coated olive stone bio-sorbent particles. Olive stones were used as the support to zero-valent iron and magnetite nanoparticles to develop a new material for the removal of chromium, organic matter and total phenols from the wastewater. The optimal operating conditions were determined in batch reactors, after which the process was scaled-up using fixed-bed columns in series. The maximum adsorption capacity for both Cr(III) and Cr(VI), up to 8.37 and 4.29 mg g^{-1}, was attained for a sorbent mass concentration of 4 g L^{-1}, meaning a total chromium adsorption capacity of 12.66 mg g^{-1}, whereas equilibrium contact time was found to be 120 min. The combination of coated olive stones and hydrogen peroxide allowed to develop an heterogeneous Fenton process, that led to reach a COD removal efficiency of 58.4% and a total phenols removal of 59.2%, at H_2O_2/COD (w/w)=0.875. In addition, re-use of the coated olive stones by regeneration with NaOH and $C_2H_2O_4$ solutions after 5 cycles was reported. The column process was successfully described by BDST and Thomas models.

Keywords: *Heterogeneous-Fenton; Tannery wastewater; waste reuse; column; nZVI; Cr(VI).*