

Recovery of Chromium(III) from Tannery Wastewater by Nanoparticles and Whiskers of Chitosan

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Abstract : The present study was aimed to approximate the optimal conditions to chromium recovery from wastewater by nanoparticles and whiskers of chitosan. Chitosan with an average molecular weight of 63 kDa and a 96% deacetylation degree was prepared according to our previous study. Chromium recovery is influenced by different parameters. In our search, we determined the appropriate range of pH to form chitosan-Cr(III), nanoparticles Cr(III), and whiskers- Cr(III) complex. We studied also the influence of chromium concentration and the nature of chitosan-based materials on the complexation process. Our main aim is to approximate the optimal conditions to remove chromium(III) from the tanning bath, recuperated from tannery wastewater of Marrakech in Morocco. A Perkin Elmer optima 2000 Inductively Coupled Plasma- Optical Emission Spectrometer (ICP-OES), was used to determine the quantity of chromium persistent in tannery wastewater after complexation phenomenon. To the best of our knowledge, this is the first report interested in the optimal conditions for chromium recovery from wastewater by nanoparticles and whiskers of chitosan. From our research, we found that in chromium solution, the appropriate range of pH to form complex is between 5.6 and 6.7. Also, the complexation of Cr(III) is depending on the nature of complexing ligand and chromium concentration. The obtained results reveal that nanoparticles present an excellent adsorption capacity regardless of chromium concentration. In addition, after a critical chromium concentration (250 mg/l), our ligand becomes saturated, that requires an increase of ligand mass for increasing chromium concentration in order to have a better adsorption capacity. Hence, in the same conditions, we used chitosan, its nanoparticles, whiskers, and chitosan based films to remove Cr(III) from tannery wastewater. The pH of this effluent was around 6, and its chromium concentration was 300 mg/l. The results expose that the sequence of complexing ligand in the effluent is the same in chromium solution, determined via our previous study. However, the adsorbed quantity is less due to the presence of other metallic ions in tannery wastewater. We conclude that the best complexing ligand-based chitosan is chitosan nanoparticles whether it's in chromium solution or in tannery wastewater. Nanoparticles are the best complexing ligand after 24 h of contact nanoparticles can remove 70% of chromium from this tannery wastewater.

Keywords : nanoparticles, whiskers, chitosan, chromium

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