

Synergistic Sorption of Cr(VI) and Cu(II) onto Sweet Potato Vine from Binary Mixtures Cr(VI)-Cu(II)

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Abstract : Over the last decades, biosorption has been an alternative to costly wastewaters treatment for metal removal. Most of the literature on metal biosorption was devoted to studying of single metal ions but nowadays studies on multi-components biosorption are booming. Hexavalent chromium is usually found in mixtures with divalent metal ions in industries wastewaters. However, studies on the simultaneous removal of Cr(VI) and divalent metals are hardly found and the cooperative or competitive mechanism governing each metal ions sorption is still unclear. In this work, simultaneous sorption of Cr(VI) and Cu(II) from their binary mixtures by using sweet potato vine (SPV) was investigated. Sweet potato is one of the four major grain crops in China. Each year about 2000 tons of SPV are generated as by-products. SPV could be a low-cost biosorbent for metal ions due to its rich in cellulose and lignin. In this work, the sorption of Cr(VI) and Cu(II) from their binary mixtures solutions was studied by using SPV sorbent. Equilibrium studies were carried out in binary mixtures in which Cr(VI) and Cu(II) concentration was both varied between 0.1 mM and 0.3 mM, Cr(VI) and Cu(II) single solutions were also prepared as comparison. All the experiments were performed at pH 3 ± 0.05 under $30\pm 2^\circ\text{C}$ for 7 days to make sure sorption achieved equilibrium. Results showed that (i) chromium was partially (10.93%-42.04%) eliminated under studied conditions through reduction and sorption of hexavalent and trivalent forms. The presence of Cu(II) exerts a synergistic effect on the overall sorption process in all the cases of the 0.1-0.3 mM binary mixtures concentration range. (ii) Cr(VI) removal by SPV is favoured by the presence of Cu(II) in solution, because more protons needed for Cr(VI) reduction are available due to Cu(II)-proton competition; however sorption of the formed Cr(III) is unfavoured as a result of the competition between Cr(III) and Cu(II) for protons and sorbent active sites. (iii) Copper was partially (9.26%-13.91%) sorbed onto SPV under studied conditions. The presence of Cr(VI) in binary mixtures also exerts a synergistic effect on the Cu(II) removal in all the cases of the 0.1-0.3 mM binary mixtures concentration range. The results of the present work indicate that sweet potato vine can be successfully employed for the simultaneously removal of Cr(VI) and Cu(II) in binary mixtures, taking advantage of the synergistic effect provoked by one of the metal ion to each other, even though the acquisition of higher removal yields has to be further investigated. Acknowledgements—This work has been financially supported by Ministry of Human Resources and Social Security of PRC (Anhui15), Education Department of Anhui Province (KJ2016A270) and Anhui Normal University (2015rcpy33, 2014bsqdjj53).

Keywords : sweet potato vine, chromium reduction, divalent metal, synergistic sorption

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