Comparison of different rice straw based adsorbents for chromium removal from aqueous solutions

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ABSTRACT

Chromium is a well known highly toxic heavy metal and one of the major pollutants in the tannery wastewaters. This research aims at studying the feasibility of using different rice straw-based adsorbents, fine rice straw (FRS), rice straw carbon (RSC), and rice straw activated carbon (RSAC) for removal of chromium from aqueous solution. In batch experiments, effect of operating variables such as contact time, adsorbent dose, pH of solution, and initial chromium concentration have been studied. The best operating conditions were: FRS—equilibrium time 12 h, FRS dose 20 g/l, pH 2; RSC—equilibrium time 8 h, RSC dose 12 g/l, pH 2; RSAC—equilibrium time 4 h, RSAC dose 8 g/l, pH 2. The maximum adsorption achieved at pH 2.0 for all studied adsorbents. The adsorption results for the studied adsorbents were fitted to Langmuir and Freundlich isotherms with correlation coefficient of 0.99, 0.95, respectively, and the maximum adsorption capacity was 7.99, 18.83, and 40.32 mg/g. Desorption of chromium from different rice straw (RS) particles using acid and base treatment exhibited a higher desorption efficiency by more than 85, 95, and 97\% for FRS, RSC, and RSAC, respectively. The present study showed that RS could be used as a biosorbent for removal of chromium from aqueous solution with a limited ratio.

Keywords: Adsorbent; Chromium; Heavy metals; Raw agricultural wastes; Rice straw

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