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Simultaneous determination of heavy metals and cationic dyes from industrial effluent by prawn shell derived chitosan-*g*-poly(acrylic acid) biocomposite

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ABSTRACT

Poly(acrylic acid) (PAA) grafted modified chitosan biocomposite adsorbent was obtained by varying the amount of chitosan and acrylic acid (AA) to determine heavy metals and cationic methylene blue from aqueous solution and industrial effluent. The reaction was carried out in a homogeneous aqueous phase by using *N,N*-methylenebisacrylamide as a cross-linker, and ammonium persulfate as an initiator. Fourier transform infrared (FTIR) revealed the presence of absorption band in the composite for –OH, –NHCO, and $–NH_2$ of chitosan took part in grafting with acrylic acid. It was also observed that grafting percentage (G%) decreases with increasing chitosan amount in the composite, however, the degree of swelling slightly increases with increasing chitosan amount due to the amphiphilic nature of the PAA modified chitosan. The adsorption behaviors for Cr(VI), Pb(II), and methylene blue (MB) on the biocomposite adsorbent were studied for 25 ppm standard solution with 0.05 g adsorbent dose and at pH 4, 6, and 9.1 for Cr(VI), Pb(II), and methylene blue (MB), respectively. The highest removal efficiencies 42% and 36% for Cr(VI) and Pb(II), respectively, were given by the composite (C-4) prepared from 2:1 chitosan and AA. On the other hand, the composite with higher AA (chitosan: AA = 1:7.2) showed a remarkable higher MB adsorption efficiency (64%) than other composites. The composite adsorbent was applied to reveal its efficiencies for the real sample from tannery and textiles. The results revealed that 33% Cr(VI) and 36% Pb(II) can be eliminated by a single adsorption of 0.05 g C-4 (prepared from chitosan and AA at 2:1 ratio) after 2 h of adsorption. On the other hand, 53% MB removal was observed for C-1 (obtained from chitosan and AA ratio of 1:7.2) with a similar adsorption conditions.

Keywords: Prawn shell; Poly(acrylic acid); Heavy metals; Methylene blue

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