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Selective removal of Cr(VI) from aqueous solution by polypyrrole/2,5-diaminobenzene sulfonic acid composite

Kera NH
Bhaumik M
Ballav N
Pillay K
Ray SS
Maity A

ABSTRACT:

A polypyrrole/2,5-diaminobenzenesulfonic acid (PPy/DABSA) composite, synthesised by the in situ oxidative polymerization of pyrrole in the presence of DABSA, was studied as an adsorbent for the removal of Cr(VI) from aqueous solution. The structure and morphology of the composite were investigated by ATR-FTIR, FE-SEM, EDX, TGA, XRD and XPS studies. The adsorption of Cr(VI) by PPy/DABSA composite was highly pH dependent and optimum removal was achieved at pH 2. Adsorption of Cr(VI) was confirmed by EDX and XPS studies. The isotherm data fitted the linear Langmuir model well, with a maximum adsorption capacity of 303 mg/g at 25 °C. Thermodynamic parameters (G°, H° and S°) were calculated using isotherm data and confirmed that the adsorption process was spontaneous and endothermic. Adsorption kinetics was best described by the pseudo-second-order model. The activation energy of the adsorption process suggested that Cr(VI) was chemisorbed by PPy/DABSA composite. PPy/DABSA composite could be used for three consecutive adsorption-desorption cycles without loss of its original adsorption capacity. Highly selective removal of Cr(VI) was observed even when co-existing ions such as Cu(sup2+), Zn(sup2+), Ni(sup2+), Cl(sup-), SO(sub4)(sup2-) and NO(sub3)(sup-) were present in the solution. In summary, the potential of PPy/DABSA composite for remediating industrial wastewater contaminated by Cr(VI) has been demonstrated.