Chemical Engineering Journal

Thiol-modified magnetic polypyrrole nanocomposite: An effective adsorbent for the adsorption of silver ions from aqueous solution and subsequent water disinfection by silver-laden nanocomposite

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Abstract:
A magnetic nanocomposite (NC), Fe3O4@PPy-MAA, was synthesised via in situ oxidative polymerisation of the pyrrole monomer in a thioglycolic acid (mercaptoacetic acid) solution (as a dopant), in the presence of iron oxide (Fe3O4). The newly developed NC was characterised using ATR-FTIR, FE-SEM, HR-TEM, XRD, TGA, BET and VSM. The performance of the NC for silver ion (Ag+) adsorption was carried out through batch studies as a function of pH, adsorbent dose, temperature and initial Ag+ concentration. The maximum adsorption capacity of Ag+ was determined to be 806.4 mg/g at 25 °C using Langmuir adsorption isotherm at a solution pH of 5.6. The kinetics studies indicated that the Ag+ adsorption onto the Fe3O4@PPy-MAA NC surface was rapid and was well described by the pseudo-second-order kinetics equation. Also, the present study emphasised the reusability of Ag+-adsorbed waste material for the disinfection of microorganisms, which was demonstrated through the excellent antimicrobial activity of the NC against Escherichia coli in both synthetic and natural water samples. Therefore, the as prepared Fe3O4@PPy-MAA NC has an excellent ability to successfully remove Ag+ ions from aqueous solutions and subsequently, the Ag-loaded waste material could be used as a potential candidate disinfectant.