High potential of amine rice husk magnetic biocomposites for Cu(II) ion adsorption and heterogeneous degradation of contaminants in aqueous solution

Iryanti Fatyasari Nata ✉, Doni Rahmat Wicakso, Agus Mirwan, Chairul Irawan, Rinna Juwita, Niken Anggraini Astuti & Rizka Tiara An-Nisa

Abstract

Rice husk (RH) cellulose as a matrix was synthesized for amine rice husk magnetic biocomposite (RB-NH$_2$) by one-pot solvothermal method. The synergic effect of amine on magnetic nanoparticle will enhance the reactivity of material. Ethylene glycol as solvent was used for dissolved iron(III) chloride hexahydrate, Na-acetate anhydrate, and 1,6-hexanediamine, then RH was added, kept at ±200 °C for 6 h. The optimums of Fe contained and amine concentrations on biocomposite were detected at 93% and 2.9 mmol/g, respectively. The surface area of rice husk significantly increased from 1.309 m^2 g^{-1} to 19.45 m^2 g^{-1} when converted to biocomposite. The RB-NH$_2$ has good capability to adsorb Cu(II) ion at 116.45 mg g^{-1} at pH 5 for 60 min. Surprisingly, during adsorption, the RB-NH$_2$ also worked on reducing the chemical oxygen demand (COD) number, total suspended solid (TSS) and dye for 22%, 54.37%, and 33.74%, respectively. The reuse effectiveness for RB-NH2 showed a good result with four repetitions. The multiple effects of amine rice husk magnetic biocomposite on wastewater contaminants leads to becoming a candidate material to be developed and applied in a wide range of waste water treatment applications.