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Effect of synthesis condition on mesoporous silica from elephant grass via sol-gel on its morphology and its application in adsorption of cationic dyes

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In this study, 3 different types of mesoporous silica (MS) was synthesised from elephant grass via sol-gel technique, varying synthesis condition. This low cost, locally available highly efficient eco-friendly adsorbent was applied in adsorption of cationic dyes. Characterisation of the adsorbent was carried out using scanning electron microscope (SEM), transmission electron microscopy (TEM), X-ray fluorescence analysis (XRF), X-ray diffraction analysis (XRD), Brauner-Emmet-Teller analysis (BET), thermo-gravimetric analysis (TGA), and Fourier transform infrared analysis (FTIR). The effect of surfactant concentration, ageing time and temperature on the morphology of MS was also investigated, yielding silica nanotubes (SNT) and silica nanoparticles (SNP). Methyl blue (MB) and methyl red (MR) adsorption studies were carried out on SNT and SNP, varying parameters such as initial dye concentration, pH, adsorbent dose, contact time and temperature. Adsorption process was affected by the molecular structures of different dyes and also the morphology of MS. Langmuir, Freundlich, Temkin and Dubunin-Radushkevich models were used in analyzing equilibrium data. The adsorption of MB and MR on SNT were 40.6 mg/g and 109.97 mg/g, respectively. For SNP, MB and MR adsorption was 40.98 mg/g and 104.85 mg/g, respectively. The adsorption of MB and MR increased with increase in pH, with pH 10 being the optimal. The adsorption capacity of MB and MR for SNP and SNT kinetically favoured the pseudo-second-order model and 3 stage intraparticle diffusion models. Thermodynamic parameters were also evaluated on MB and MR adsorption into SNP and SNT, it was found to be spontaneous and exothermic. The results indicate that SNP and SNT could be considered as an effective adsorbent for dyes removal from wastewater.

Biography

Samson Akpotu is pursuing PhD from the School of Chemistry and Physics, Westville Campus, University of KwaZulu-Natal. His current research is on the conversion of agrowaste to adsorbent and photocatalyst. He remediates organic pollutants with mesoporous silica, silica-graphene and silica-titania composite with the precursor for silica as agrowaste. He has 2 publications in reputable journals and has submitted 2 manuscripts. He is also a reviewer in *Plos One*.

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