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Removal of heavy metal ions from water by Hydroxyl terminated Triazine-based Dendrimer

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ABSTRACT

Waste water containing heavy metal ions is being discharged from numerous industries and can cause several problems due to high toxicity and water solubility. It is crucial to treat metal containing water before discharging into the environment. Dendrimers are a new class of macromolecules. Due to their dense terminal functionality and internal cavities, they are perfect for water remediation by adsorption. In this paper, we have synthesized hydroxyl terminated triazine-based dendrimer generations by divergent method using piperazine, triazine trichloride and diethanolamine as starting materials. Full generation dendrimers $G1(OH)_8$, $G2(OH)_{32}$ and $G3(OH)_{128}$ were terminated by 8, 32 and 128 hydroxyl groups, respectively. Structures of dendrimer generations were characterized by infrared spectroscopy (FT-IR), ^1H NMR, ^{13}C NMR, and electrospray ionization mass spectrometry. Hydroxyl terminated full dendrimers $G1(OH)_8$, $G2(OH)_{32}$ and $G3(OH)_{128}$ were used as adsorbents in a series of experiments to study the adsorption behavior in the removal of Cu^{2+}, Ni^{2+} and Zn^{2+} ions from water. Sorption behaviors of synthesized dendrimer generations were investigated in relation to pH and generation number. Results revealed that generation 3 dendrimer $G3(OH)_{128}$ had the highest sorption capacity. Sorption capacity of dendrimers was increased with increase in generation number and pH. Metal-containing dendrimer was further studied by FT-IR and thermo gravimetric analysis. Both analytical methods have confirmed the presence of metal in the final metal containing dendrimer.

Keywords: Triazine trichloride; Diethanolamine; Metal ion adsorption; Water remediation

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