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Amino functionalized bentonite as a potential adsorbent for heavy metal removal from aqueous system

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Pollution of water with toxic substances especially heavy metal is of major concern for human health as well as for the environmental quality and it has received a great deal of attention due to their toxic effect to the ecosystem, agriculture, and human health. Therefore, to control the heavy metal disposal into the environment by removing heavy metals various conventional technologies such as precipitation, ion exchange, reverse osmosis, and filtration had been developed. However, these methods have several disadvantages/limitations such as being expensive, generating secondary pollutants like sludge and ineffective in treating effluents with low metal concentrations etc. Among the physico-chemical treatments, adsorption process is easy to operate and can treat waste effluents with high loadings and at very low concentrations. Use of clays as adsorbents to remove contaminants has been increasingly paid attention because of their low cost and most effectiveness. Modified clay minerals with enhanced cation exchange capacity and specific surface area for the adsorption of metal ions from aqueous solutions, for the purpose of water purification or industrial wastewater treatment, have been widely studied. With this background, an amino functionalized bentonite was synthesized and characterized in detail by X-ray diffraction, infra-red spectroscopy, scanning electron micrography, surface area and cation retention capacity. Batch adsorption experiment was carried out to study the potential of functionalized bentonite for heavy metals (Zn, Cu, Ni and Cd) sorption in aqueous system. The effect of adsorbent amount, pH and concentration of metals on the extent of adsorption was investigated. The adsorption data were fitted with Langmuir, Freundlich, Dubinin-Radushkevich, Hargins-Jura and Flory-Huggins adsorption isotherms. The maximum monolayer adsorption capacity of functionalized bentonite as obtained from Langmuir adsorption isotherm was found to be 48.49 mg g-1, 42.99 mg g-1, 21.55 mg g-1 and 18.54 mg g-1 for Zn (II), Cu (II), Cd (II) and Ni (II), respectively. The order of adsorption capacity was found to be Zn (II) > Cu (II) > Ni (II) > Cd (II). The study demonstrates that amino functionalized bentonite could be potentially used for removal of Cu (II), Zn (II), Cd (II) and Ni (II) ions from aqueous solution.

Biography

P Kumararaja has completed Post-graduation in Soil Science and Agricultural Chemistry from Institute of Agricultural Sciences, Banaras Hindu University, Uttar Pradesh, India. He did his MSc research work on the topic “Fate of applied micronutrients to Organic matter”. He is a PhD Research Scholar at Indian Agricultural Research Institute in the Division of Soil Science and Agricultural Chemistry and is working on the topic “Modified clay minerals as heavy metal adsorbents and their influence on heavy metal uptake by crop plants”. At present he is working as Scientist in Aquatic Animal Health and Environment Division (AAH&ED), Central Institute of Brackish Water Aquaculture (CIBA), Indian Council of Agricultural Research.

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