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HYDROTHERMALLY SYNTHESIZED ORGANO-SILICATE NANOPARTICLES AS ADSORBENT AND SLOW RELEASE FORMULATION OF 2,4-DICHLOROPHENOXYACETIC ACID (2,4-D)

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Abstract

Synthesized silicates and their organically modified products have been least explored for their potential use in contaminated water remediation and also as slow release formulations. In this study, adsorption potential and applicability of surfactant modified clinoptilolite (SMC) and montmorillonite (SMM) nanoparticles as adsorbent and slow release formulation of 2,4-dichlorophenoxyacetic acid (2,4-D) have been investigated. The surface modification of hydrothermally synthesized silicate nanoparticles is made using different doses of cationic surfactants hexadecyltrimethylammonium (HDTMA) and dioctadecyldimethyl ammonium (DODMA). The surfactant modified silicates (SMSs) show nearly three times higher adsorption potential than the unmodified silicates. The HDTMA loaded clinoptilolite (SMC_{HDTMA}), HDTMA loaded montmorillonite (SMM_{HDTMA}), DODMA loaded clinoptilolite (SMC_{DODMA}), DODMA loaded montmorillonite (SMM_{DODMA}), unmodified clinoptilolite and montmorillonite absorbed as much as 24.87 mg g^{-1}, 22.94 mg g^{-1}, 25.09 mg g^{-1}, 25.42 mg g^{-1}, 8.72 mg g^{-1} and 8.97 mg g^{-1} of 2,4-D, respectively. This study has revealed a potential of SMSs for organic herbicide adsorption especially anionic ones from aqueous solution. Slow release studies have been performed by soil column percolating system. The results of release study indicate that SMSs nanoparticles can be used as slow release formulations.

Key words: adsorption; 2,4-D, silicate nanoparticles, slow release formulation, surfactant modification

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