Enhancement of surface properties of clay through methoxy-modification for the removal of oxytetracycline from aqueous media

Ahmed Ashiq[1*], Meththika Vithange[1], Janitha Walpita[1], Binoy Sarkar[2]

[1]Ecosphere Resilience Research Centre, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda 10250, Sri Lanka
[2]Department of Animal and Plant Sciences, The University of Sheffield, Sheffield, S10 2TN, United Kingdom

[*]Corresponding author

E-mail: aashiqar@live.com

Effective utilization of clays as sorbents for the removal of antibiotics from wastewaters has currently received great attention because of the eco-friendly nature of natural clays and its affinity to trap ionizable contaminants. Oxytetracycline (OTC) is considered as one of the frequently used antibiotic in humans and animals. Its presence in the environment causes the development of antibiotic resistant bacteria and hence the removal is essential. This study was focussed on the adsorption efficiency of methoxy grafted kaolinite for the removal of OTC species in aqueous solutions through batch adsorption experiments at 1 g L^{-1} adsorbent dosage. The adsorption capacity of OTC onto pristine and methoxy-modified kaolinite were highly pH dependent and showed an optimum of 10 mg g^{-1} for pristine kaolinite and 14 mg g^{-1} for the methoxy-modified kaolinite both at pH 6. Kinetic modelling demonstrated the best fit for the pseudo second order model onto pristine kaolinite followed by Elovich model for methoxy-modified kaolinite. The modelling results thus indicated that multiple processes govern the OTC adsorption achieving an equilibrium at 6 hours. The isotherm obeyed Redlich-Peterson model for the pristine kaolinite and Freundlich model for methoxy-modified kaolinite with a maximum adsorption capacity at 36 mg g^{-1} for the methoxy-modified kaolinite. At increasing ionic strengths, OTC adsorption was supressed indicating an important effect of electrolytes towards the interaction between OTC and the methoxy-modified kaolinite. These results show an improved performance of clay methoxy-modification for the remediation of OTC from aqueous media.

Keywords: Pharmaceuticals, emerging contaminant, surface functionalization, methoxy-modification, intercalation