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Tailored Biochar Composites from Municipal Solid Waste for Antibiotic Abatement in Wastewater: Implications for Sustainable Waste Management

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Abstract

Existing waste disposal practices remain an inevitable consequence to humans and the other surrounding ecosystems. Thus, the utilisation of the wastes for a more value-added product to curb the increase in wastes at dumpsites is crucial. Therefore, this study aims to investigate the adsorption of oxytetracycline (OTC) onto tailored synthesised biochar that is composed of municipal solid waste and clay. Biochar was derived from municipal solid waste collected from the dumpsite and pyrolyzed at 450 °C for 30 minutes. Clay-Municipal solid waste biochar (MSWBC) slurry was prepared by mixing montmorillonite 1:1 w/w, dried and thereafter taken for characterization and batch adsorption experiments. The composites were characterized using Powder X-Ray diffraction (PXRD) and Fourier transform infrared (FTIR) spectroscopy before and after their treatment with the antibiotics. The crystalline lattices of the pristine materials and the composites showed a significant distinction in the PXRD patterns. This is demonstrated from the interlayer spacing increment from 15.49 Å for the pristine clay to 14.46 Å for the composites. Whereas, the FTIR spectra indicated a merging and widening of bands with the introduction of the antibiotics to the adsorbents. Thus, the added reactive sites for OTC adsorption onto the prepared composites improved to a significant extent, and thus, MSWBC-clay could be considered for a potential material for removing OTC in aqueous media.

Keywords: pharmaceuticals, emerging contaminant, wastewater treatment, remediation, biochar

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