CINNAMON WOOD DRIVED BIOCHAR FOR DETOXIFYING SULFAMETHOXAZOLE FROM AQUEOUS SOLUTIONS

S. Keerthanan[1], T. Jayampathi[2,3], C. Jayasinghe[4], and M. Vithanage[1,*]

[1]*Ecosphere Resilience Research Center, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*School of Agriculture, Food and Wine, University of Adelaide, Waite Campus, Urrbrae, Australia*
[3]*School of Biosciences, University of Nottingham, Sutton Bonington Campus, Loughborough, Leicestershire, UK*
[4]*Department of Food Science and Technology, Wayamba University of Sri Lanka. Makandura, Sri Lanka*

Sulfamethoxazole (SUL) is one of the sulfonamide antibiotics used to treat the urinary infections in human and veterinary animals. About 30% of SUL is excreted through the urine in the unmetabolized form and hence it possibly contaminates water sources. Thus, it is essential to remove the SUL from the water in a greener and cost-effective manner. The present study is mainly focused on the utilization of cinnamon wood biochar (CWBC) as a waste by-product from a bioenergy plant for removing SUL from water. The chemical and morphological state of CWBC was first characterized by Fourier Transformed Infrared (FTIR), Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD), and Brunauer–Emmett–Teller (BET). The pH, where the zero-point charge (pHzpc) of CWBC occurs was also analyzed. The batch adsorption of SUL by CWBC was investigated at different pH values ranging from 3-10. The adsorption kinetics were investigated at different contacting times (10 min-24 h). The adsorption isotherms were developed at various initial concentrations (10-100 mg L^{-1}). The SEM image shows the development of a porous structure on the CWBC, while BET surface area and pore sizes were 589 m^2 g^{-1} and 1.23 nm, respectively, indicating micro-pores on CWBC. The pHzpc was close to 7.7 demonstrating that the removal of SUL by CWBC may be mediated by the ionization effect of the adsorbent which is pH dependent. The highest adsorption occurred at pH 4.5, may be due to the interaction between zwitter ionic form of SUL and the positively charged CWBC. Kinetic study results demonstrated a good fit with the pseudo-second order model and it predicted an adsorption capacity of 95.64 mg g^{-1}. Among different adsorption isotherm models, Toth isotherm and Hill isotherm models well-fitted with experimental data on the basis of R^2 of 0.99. The maximum adsorption capacity predicted by both isotherm models was 113 mg g^{-1}. The fitted models suggested that the adsorption of SUL takes place at the heterogeneous surface of CWBC via cooperative adsorption involving chemical interactions. According to the findings, the CWBC could be a potential adsorbent for removal of SUL from wastewater.

Financial assistance from the Research Council, University of Sri Jayewardenepura, Sri Lanka (ASP/01/RE/SCI/2018/65) is acknowledged.

Keywords: Biochar, Detoxification, Pharmaceutical and personal care products, Urinary antibiotic

**meththika@sjp.ac.lk*