Removal of Antibiotic Oxytetracycline from Synthetic Urine Using Colloidal Biochar

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Oxytetracycline (OTC) depicts a frequent utilization in both human and veterinary industry as an antibiotic to treat infections. Urine is considered as a source for pharmaceuticals including OTC, causing serious environmental issues such as development of antibiotic resistant microorganisms and hence treatment is essential. Among many different materials, biochar has identified as one of the finest materials to remove emerging contaminants such as antibiotics from water bodies. This study investigates the use of colloidal biochar (CBC) for pharmaceutical removal and improves the knowledge of removal mechanisms in synthetic urine. The adsorbent CBC was characterized using Fourier-Transform Infrared (FTIR) spectroscopy, and Particle Size Analyser. Woody biochar (700 °C), a waste by-product of gasification of *Gliricidia sepium* was collected from dendro thermal power plant, in Thirappane, Sri Lanka, preconditioned at -80 °C freezer for 3 days and mechanically ground using a disk mill with ethanol at 1000 rpm for 2 minutes. Synthetic hydrolysed urine was prepared according to a standard procedure based on literature using pH 9 phosphate buffer as the base matrix. Kinetic and isotherm experiments were conducted at 1 mg/L CBC initial concentration to study the best time for the highest adsorption and mechanisms involved in the adsorption with changing OTC concentrations respectively. Average particle size of 400 nm was observed for CBC. Pristine biochar exhibited a strong broad peak at 3420 cm^{-1} which assigned as phenolic –OH stretching while the shoulder at 1733 cm^{-1} showed aldehyde C=O. Sharp peaks presented in 1420 cm^{-1} and 1384 cm^{-1} expressed C=O ketone and CH_3 bend respectively. Kinetic data exhibited a very fast adsorption of OTC with an equilibrium of 30 mg/g reaching within first 50 minutes at 100 mg/L initial concentration. Isotherm reached an equilibrium at an initial concentration of 300 mg/L. Data modeling indicated a physisorption process by fitting into pseudo first order kinetic equation whereas chemisorption and co-operative adsorption were suggested by Langmuir and Hills isotherm equations. Experimental and modelling data confirms the successful removal of OTC from hydrolysed urine through CBC as an adsorbent.

Keywords: Hydrolysed Urine, Emerging Contaminants, Woody Biochar, Wastewater Treatment