

Optimization of experimental parameters and thermodynamics analysis for biosorption of Cd(II) from aqueous solutions using raw biomass and biochar of *Panicum maximum* leaves

S. Vihanga¹, N. Priyantha^{2*}

¹Department of Environmental and Industrial Sciences, University of Peradeniya, Sri Lanka

²Department of Chemistry, University of Peradeniya, Sri Lanka

* namal.priyantha@yahoo.com

Water contamination from heavy metals has become a major environmental concern. Cadmium which exists as Cd(II) can be considered to be a toxic heavy metal that causes severe effects. As a remedial measure, adsorption has been introduced as an efficient treatment technique for heavy metal removal. The focus of this study is to identify the capability of raw biomass (RP) and biochar (BP) derived from *Panicum maximum* leaves to remove Cd(II) ions from aqueous solution through the optimization of parameters and extending toward the evaluation of thermodynamic parameters associated with the adsorption process. Optimization of biosorbent dosage, shaking time, settling time and pH, performed by through batch experiments using 50.0 mL of 10 ppm Cd(II) solutions varying one parameter at a time while keeping all the others unchanged, leads to the values of 0.500 g, 40 min, 40 min and ambient pH, respectively,

for both RP and BP. Adsorption characteristics of Cd(II) investigated for RP at ambient temperature and 305 K, and for BP at ambient temperature and 335 K clearly indicate that the equilibrium constant of adsorption increases; consequently, the negative value of the standard free energy change increases when the temperature is increased, confirming the improvement in the spontaneity of the process. Moreover, the standard enthalpy change and the standard entropy change are positive, indicating endothermic behavior of adsorption, suggesting that warmer temperatures would be preferable for large-scale removal of Cd(II) from contaminated water.

Keywords:

Biosorption, cadmium, optimization, thermodynamics