

Equilibrium, kinetic and thermodynamic studies of a new potential biosorbent for the removal of Basic Blue 3 and Congo Red dyes: pineapple (*Ananas comosus*) plant stem

ABSTRACT

The waste management becomes particular nowadays and waste conversion into valuable materials is one of the promising alternative capable of reducing the resource depletion rate. The performance of lignocellulosic residues, pineapple plant stem (PPS) for cationic (Basic Blue 3, BB3) and anionic (Congo Red, CR) dyes removal has been evaluated in a batch process, using different parameters such as, pH, contact time, agitation rate, initial dye concentration and sorbent dosage. The kinetics of both dyes sorption fitted well with pseudo-second order kinetic model. Boundary layer effect and intraparticle diffusion models were applied to study the rate-limiting step. The isotherm data of BB3 could be well described by Freundlich model ($r^2 = 0.998$) whilst high coefficient of determination of CR obtained from Langmuir ($r^2 = 0.999$) and Temkin ($r^2 = 0.996$) models. The maximum sorption capacities for BB3 and CR were found to be 58.983 and 11.966 mg g⁻¹, respectively under a favourable sorption process. The BB3 and CR adsorption on PPS was found to be exothermic. The result suggests that PPS has higher affinity on cationic than anionic dye. The promising regeneration capability of PPS using acid, implied PPS was a potential biosorbent for BB3 removal.

Keyword: Pineapple plant stem; Adsorption; Basic Blue 3; Congo Red; Batch study