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Equilibrium and kinetics studies on the biosorption of caffeine by hydrogel beads

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The US-EPA as the major institution in the protection of the environment in the United States has stated that the presence of drugstore products in surface waters is a top-priority. Bibliographic reports have demonstrated that caffeine has negative impacts in animals and ecology in general. Caffeine does not only contribute to the increase of BOD and COD, but also causes behavioral changes in animals. Biosorption focuses on the removal of heavy metals, dyes, PAHs and other organic pollutants, but little attention has been paid to the so-called pollutants of emerging concern (i.e. caffeine). This study explores the role of initial solution pH, dose of hydrogel beads, presence of salts in solutions and time on the elimination of caffeine from aqueous solutions by using chitosan and alginate hydrogel beads. Experimental results demonstrate a strong solution pH effect on the adsorption, showing its highest values around neutral conditions. Moreover, the presence of salts has a negative effect on the adsorption, due to competition for the adsorption sites of both hydrogels. Finally, time dependence experiments demonstrate that less than 20 minutes are needed to reach adsorption equilibrium. Kinetics models were fitted to the time-dependent results, indicating that caffeine adsorption follows pseudo-second order kinetics. These results suggest that these cost-effective hydrogel beads of alginate and chitosan are candidates for the elimination of pollutants of emerging concern from contaminated waters. This study also proposes the use of these hydrogel beads as encapsulating agents of drugs and pharmaceutical products.

Biography

Ziu Wing Lo is a sophomore student at BMCC, majoring in Biotechnology. Ziu Wing desires to continue her science career and transfer to a senior college to major in Food Science. Ms. Lo has been working under the mentorship of Professor Navarro since this May 2015 in the bioremediation of phenolic and pharmaceuticals products from contaminated solutions. The authors would like to thank BMCC Foundation Research Scholars and the Science Department at BMCC for the research facilities and financial support. A.N. would also like to thank PNICP (project ECIP-1-P-042-14) and CONCYTEC for the sponsorship.

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