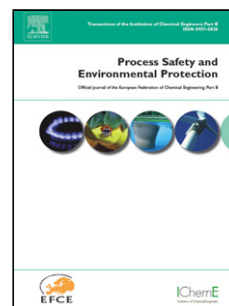


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Author: N.A. Oladoja R.O.A. Adelagun A.L. Ahmad I.A. Ololade



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Green Reactive Material for Phosphorus Capture and Remediation of Aquaculture Wastewater

By

¹Oladoja, N.A. ²Adelagun, R. O. A. ³Ahmad, A. L. and ¹Ololade, I. A.

¹Department of Chemical Sciences, Adekunle Ajasin University, Nigeria

²Department of Chemical Sciences, The Federal University, Wukari, Nigeria

³School of Chemical Engineering, Universiti Sains Malaysia, Malaysia

*Corresponding Author E-mail: bioladoja@yahoo.com

*Phone No.: +2348055438642

Abstract

A green biogenic resource, Gastropod shell (GS), was used as the reactive material in a column reactor to develop a double pronged approach for the management of aquaculture wastewater (AQW). The GS was used to capture and recover phosphorus (P) from AQW, for reuse as fertilizer cum soil conditioner, and for the remediation of AQW for safe discharge. The kinetics and equilibrium isotherm parameters of the P-recovery process were derived in a batch process and the time-concentration profiles of the P-recovery process and the ability of the process to remediate AQW were evaluated in a column reactor, over a period of 30d. The batch kinetic analysis showed that the P recovery occurred via mechanism controlled by either chemisorption or ion exchange. Significant amount of the total P loaded ($P_{in} = 50.71\text{g}$) into the column reactor was captured ($P_{ads} = 37.18\text{g}$) in the GS matrix. The values of the P-sorption-yield ($P_{\%} = 73.32\%$) and the maximum-P-uptake ($q_{max} = 185.9\text{mg/g}$), obtained from the column reactor, showed that the capacity of the GS for P was high and the capacity was not exhausted at the end of the 30d. The values of the thermodynamic driving force ($\Delta G \text{ (kJ/mol)} < 0$) showed that the precipitation of phosphate, as calcium mineral, contributed to the P-recovery process. Despite the deposition of extraneous matters, as confirmed by the SEM, on the GS, the non-appearance of diagnostic peaks in the X-Ray diffractogram of the spent GS showed that amorphous calcium phosphate mineral was formed on the GS.

Keywords: Aquaculture wastewater; column reactor; eutrophication; nutrient recovery; phosphorus recovery; resource recovery.

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