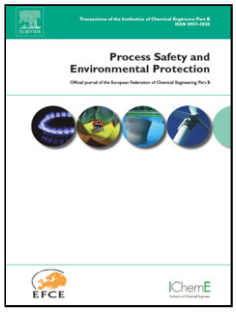

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PII: S0957-5820(16)30226-9
DOI: http://dx.doi.org/doi:10.1016/j.psep.2016.10.004
Reference: PSEP 889

To appear in: *Process Safety and Environment Protection*

Received date: 22-7-2016
Revised date: 3-10-2016
Accepted date: 5-10-2016

Please cite this article as: Oladoja, N.A., Adelagun, R.O.A., Ahmad, A.L., Ololade, I.A., Green reactive material for phosphorus capture and remediation of aquaculture wastewater.Process Safety and Environment Protection http://dx.doi.org/10.1016/j.psep.2016.10.004

Green Reactive Material for Phosphorus Capture and Remediation of Aquaculture Wastewater

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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} = 50.71g) into the column reactor was captured (P_{ads} = 37.18g) in the GS matrix. The values of the P-sorption-yield ($P_{\%}$ = 73.32%) and the maximum-P-uptake (q_{max} = 185.9mg/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 (ΔG (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.