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PC16) Assessing Feasibility of Combining Two Alternative Nutrient-rich Sources for Struvite Crystallization and Process Optimization by Response Surface Methodology

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1. Introduction

A procedure of struvite crystallization (phosphate fertilizer) has been proven to be an effective method in recovering ammonium nitrogen (N) and phosphate phosphorus (P). In this study, struvite crystal was proceeded by combining of P recovery from incinerated Sewage Sludge Ash (SSA) and N recovery from Food Wastewater (FW).

2. Materials and Methods

Acid-pretreated alkaline leaching method was used to leach out the P from SSA with achievement in the removal of most undesirable metals. Moreover, a quadratic statistically model of Response Surface Methodology (RSM) was proposed at pH of 8-11, Mg/P ratio of 1-2, N/P ratio of 0.6-2 to predict optimization of struvite precipitation process and 99.9% of P and 79.6% of N was recovered at pH 9.38, Mg/P ratio of 2 and N/P ratio of 0.6. Struvite was confirmed by XRD as a major mineral precipitate with halite (NaCl) impurity.

3. Results and Discussion

98.4% of bioavailability with low level of heavy metals content of precipitated struvite showed it could be used as fertilizer. Thereafter, two different waste types of SSA and FW provided as rich alternative source of P and N respectively and were successfully combined together as sustainable method for eco-friendly fertilizer. In addition, RSM could be used as an effective predictive tool to make sure high recovery of both P and N. In order to optimize both P and N recovery, process optimization was performed by numerically and graphically. The optimal condition was predicted to be pH 9.38, Mg/P of 2 and N/P of 0.6, and PO_4-P recovery of 99.96% and NH_4-N recovery of 68.90% would be obtained by the numerical calculation of the model. Desirability was mentioned as number from (0) to (1) and the closer the number to (1), the higher the desirability. The predicted optimal condition has desirability of 0.915 from the results. With multiple responses, the optimum condition was graphically searched by over laying critical response contours on a contour plot, where maximum conditions of two responses (PO_4-P and NH_4-N recovery) were met.

4. References

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