EXTRACTION OF HUMIC SUBSTANCES FROM VERMICOMPOSTS AND APPLICATION AS COMPONENT MATRIX FOR SLOW-RELEASE FERTILIZERS

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ABSTRACT

Humic acid was extracted from vermicomposts (hereafter referred as VCHAs) by alkali/acid fractionation and their concentration were determined to be 54.79 (± 0.25) g HS/kg vermicompost in average. The extracted humic substances from vermicomposts were also determined to contain an average K^+ of 0.0671 (± 0.0053) g K/kg vermicompost. The Fourier transform infrared spectra of crude VCHSs show similar spectral features with humic acids extracted from vermicomposted materials.

The VCHSs were complex with K^+ nutrient and encapsulated in cross-linked Ca-alginate to form vermicompost humic substance – potassium slow-release fertilizer bead (VCHS-K SRF). The synthesized VCHS-K SRF were subjected to total nutrient analysis, swelling kinetics, and slow release test to evaluate the role of nutrient compositions on its capability and capacity as slow- release fertilizer.

Results for total nutrient analysis show that with an increase in nutrient loading, encapsulation efficiency is low and nutrient concentration is low. These findings imply that at neutral pH of HS solution, binding sites are saturated with Na^+, therefore with having the same affinity as K^+, minimal ion exchange took place and it became difficult for K^+ to bind to the HS complex. It also suggests that the amount of polymer coating and the degree of crosslinking were not sufficient to hold all nutrients.

Discrepancies on the amount of released K^+ was also observed on the release profile as a product of errors on acid digestion and matrix effect, this lead to elevated amounts of release by the VCHS-K SRF. The result of the release behavior profile of VCHS-K SRF shows that with an increase in enriched nutrient load, the release rate is faster. The results on the release profile of the VCHS-K SRF exhibited a parabolic and burst release. This finding in relation to the observed fluctuations on the absorbency pattern suggests that internal pressure build-up on the polymer matrix caused abrasions on the surface of the polymer coating resulting to the instantaneous release of nutrient and absorbed water.

Overall, the VCHS-K SRF cannot be classified as a slow-release fertilizer. The present findings suggest the need for further improvement on the study of VCHS-K SRF from vermicompost.