SINTESIS KOMPOSIT BIOPLASTIK *XANTHAN GUM*/KITOSAN/BENTONIT SEBAGAI MATERIAL LEPAS-LAMBAT PUPUK NPK

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INTISARI

Komposit lapis tipis sebagai model pupuk lepas-lambat NPK telah berhasil disintesis dengan menggunakan bahan penyusun berupa *xanthan gum*, kitosan, dan bentonit. Preparasi komposit dilakukan dengan variasi konsentrasi *xanthan gum* (1; 2; dan 3%), konsentrasi kitosan (1; 2; dan 3%), massa bentonit (0,25; 0,5; 0,75 dan 1,0 g), dan NPK (0,5; 1,0; 1,5 dan 2,0 g). Komposit yang dihasilkan dianalisis sifat fisik dengan uji degradasi dalam tanah dan ketahanan komposit dalam air serta sifat mekanik menggunakan *Universal Testing Machine*. Karakterisasi komposit dilakukan menggunakan spektrofotometer FTIR, difraktometer sinar-X (XRD) dan *Transmission Electron Microscope* (TEM).

Hasil penelitian menunjukkan bahwa komposit yang paling baik sifat fisiknya diperoleh pada komposit dengan konsentrasi *xanthan gum* 3% (b/v), konsentrasi kitosan 2% (b/v), massa bentonit 0,25 g dan massa NPK 0,5 g. Kemampuan degradasi dalam tanah dan ketahanan terhadap air paling baik pada hari ke-7 adalah komposit kitosan/NPK (KN) dan kitosan/NPK/bentonit (KNB). Hasil uji pelepasan nutrien N, P dan K menunjukkan bahwa komposit *xanthan gum*/kitosan/bentonit (XGKN) memiliki laju pelepasan lebih lambat dibandingkan dengan NPK komersial. Proses lepas-lambat N, P dan K dari komposit mengikuti model kinetika orde kedua semu dengan nilai tetapan laju pelepasan N, P dan K berturut-turut sebesar 0,131; 5,068; dan 82,165 L g^{-1} jam $^{-1}$.

Kata Kunci: *xanthan gum*, kitosan, lepas-lambat, NPK

SYNTHESIS OF XANTHAN GUM/CHITOSAN/BENTONITE BIOPLASTIC COMPOSITE AS SLOW-RELEASE MATERIAL FOR NPK FERTILIZER

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ABSTRACT

Thin layer composites as a model of *NPK* slow-release fertilizer have been successfully synthesized using *xanthan gum*, chitosan, and bentonite. The composites were prepared by varyinng the concentration of *xanthan gum* (1; 2 and 3%), chitosan (1; 2; and 3%), the mass of bentonite (0.25; 0.5; 0.75 and 1.0 g), and *NPK* (0.5; 1.0; 1.5 and 2.0 g). The resulting composites were analyzed for physical properties such as soil degradation test, composite resistance in water and mechanical properties using Universal Testing Machine. The composites were characterized using FTIR spectrophotometer, X-ray diffractometer (XRD) and Transmission Electron Microscope (TEM).

The results showed that the composite with the best physical properties was obtained from a composite with a concentration of 3% *xanthan gum* (w/v), chitosan concentration of 2% (w/v), bentonite mass 0.25 g and *NPK* mass 0.5 g. The best degradation ability in soil and resistance in water on the 7 day were chitosan/*NPK* (KN) and chitosan/*NPK*/bentonite (KNB) composites. The release of nutriens study of nitrogen, phosphorus and potassium showed that the *xanthan gum*/chitosan/bentonite (XGKN) composite had a slower release rate than commercial *NPK*. The slow-release process of nitrogen, phosphorus and potassium from the composite followed the pseudo-second-order kinetics model with the nitrogen, phosphorus and potassium release rate constants of 0.131; 5.068; and 82.165 L g^{-1} h^{-1}, respectively.

Keywords: *xanthan gum*, chitosan, slow-release, NPK