

INTISARI

KOMPOSIT TABUNG BERLUBANG ZEOLIT/LEMPUNG/KALSIUM OKSIDA/POLIVINIL ALKOHOL SEBAGAI ENKAPSULATOR PUPUK LEPAS-LAMBAT UREA

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Pembuatan komposit zeolit/lempung/kalsium oksida/polivinil alkohol telah dilakukan. Komposit dibuat dengan mencampur zeolit dan lempung (perbandingan berat 1:1) dengan variasi jumlah CaO (0; 2,5; 5; 10; 15; 20 dan 25% b/b) dan PVA (2; 4; 6; 8 dan 10% b/b). Komposit yang dihasilkan dikarakterisasi dengan spektrofotometer FT-IR dan difraktometer sinar-X (XRD). Sifat fisik komposit dikaji melalui uji kuat tekan, uji porositas, uji kestabilan komposit dalam air selama 30 hari, dan uji kapasitas absorpsi air. Sifat lepas-lambat komposit dikaji melalui uji lepas-lambat urea dalam air selama 672 jam (28 hari) menggunakan komposit yang dicetak dalam bentuk tabung berlubang terisi urea dengan ketebalan dinding bervariasi (4,75; 6,75; dan 8,50 mm). Penentuan pelepasan urea dilakukan dengan menggunakan spektrofotometer UV-Vis.

Hasil penelitian menunjukkan bahwa komposit dengan variasi jumlah CaO 5% dan PVA 4% menghasilkan komposit dengan kestabilan bentuk yang baik selama 30 hari pengujian sebagai enkapsulator urea. Komposit tersebut mempunyai nilai kuat tekan sebesar 3,42 MPa, porositas sebesar 76,30%, dan kapasitas absorpsi air sebesar 62,38%. Studi kinetika pelepasan urea dari komposit tabung berlubang zeolit/lempung/CaO/PVA menunjukkan bahwa ketebalan dinding tabung berpengaruh terhadap jumlah urea yang terlepas. Proses pelepasan urea mengikuti kinetika orde kedua semu. Tetapan laju pelepasan urea dalam media akuabides paling lambat sebesar $4,60 \times 10^{-5} \text{ mg g}^{-1} \text{ jam}^{-1}$ yang diperoleh dari komposit dengan ketebalan dinding tabung sebesar 8,50 mm.

Kata kunci: komposit tabung berlubang, pupuk lepas-lambat urea, kinetika orde kedua semu

ABSTRACT

HOLLOW TUBE COMPOSITE OF ZEOLITE/CLAY/CALCIUM OXIDE/POLYVINYL ALCOHOL AS AN ECAPSULATOR OF SLOW- RELEASE UREA FERTILIZER

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Preparation of zeolite/clay/calcium oxide/polyvinyl alcohol composite has been performed. The composites were prepared by mixing zeolite and clay powder (weight ratio of 1:1) at various amount of CaO (2.5, 5, 10, 15, 20, and 25 wt%) and PVA (2, 4, 6, 8, and 10 wt%). The composites were characterized by FT-IR spectrophotometer and X-Ray diffraction (XRD). The physical properties of the composite were evaluated through the compressive strength test, porosity, shape stability test in water for 30 days, water absorption capacity, and the ability to slow-release for 672 h (28 days) using hollow tube filled with urea at various wall-thickness of the tubes of 4.75; 6.75; and 8.50 mm. The amount of urea was determined by UV-Vis spectrophotometer.

The results showed that composites with 5% CaO weight and 4% PVA produced composites with good shape stability for 30 days of testing as urea encapsulation system. The composite has a compressive strength value of 3.42 MPa, porosity of 76.30%, and water absorption capacity of 62.38%. The kinetic study of urea release from hollow-tube composite of zeolite/clay/CaO/PVA/urea shows that the tube wall-thickness affects the amount of urea released. The process of releasing urea follows pseudo second-order kinetics. The slowest release of urea in aquabidest is $4.60 \times 10^{-5} \text{ mg g}^{-1} \text{ hour}^{-1}$, obtained from composites with a tube wall thickness of 8.5 mm.

Keyword: hollow tube composite, slow-release urea fertilizer, pseudo second-order kinetic