ENKAPSULASI UREA DENGAN KOMPOSIT ZEOLIT/LEMPUNG/KALSIUM OKSIDA/KARBOKSIMETIL SELULOSA SEBAGAI MODEL PUPUK UREA LEPAS LAMBAT

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INTISARI

Enkapsulasi urea menggunakan komposit tabung berlubang berbahan dasar zeolit, lempung, kalsium oksida (CaO) dan karboksimetil selulosa (CMC) sebagai model pupuk lepas lambat telah dilakukan. Sintesis komposit dilakukan dengan variasi berat CaO (0; 5; 10; 15; 20 dan 25%) dan CMC (2; 4; 6; 8 dan 10%). Karakterisasi komposit dilakukan menggunakan spektrofotometer FTIR dan difraktometer sinar-X (XRD). Kualitas komposit diuji melalui uji kestabilan bentuk dalam air, uji kuat tekan menggunakan *Universal Testing Machine*, dan uji kapasitas absorpsi air. Pengaruh ketebalan dinding tabung komposit terhadap sifat lepas lambat urea ditentukan dengan variasi ketebalan dinding tabung yaitu 4,75; 6,75; dan 8,50 mm.

Dari penelitian yang telah dilakukan, komposit tabung berlubang dengan kualitas optimum diperoleh dari komposisi berat CaO 15% dan CMC 2%. Uji pelepasan urea menunjukkan bahwa komposit zeolit/lempung/CaO/CMC mampu memperlambat laju pelepasan urea dibandingkan dengan urea yang tidak terenkapsulasi. Proses lepas lambat urea dari komposit tabung berlubang mengikuti kinetika pelepasan orde ke-dua semu. Studi kinetika pelepasan urea dari komposit dengan ketebalan dinding 4,75; 6,75 dan 8,50 mm menunjukkan bahwa meningkatnya ketebalan dinding komposit memperlambat laju pelepasan urea. Tetapan laju pelepasan urea dari komposit dengan ketebalan dinding 4,75; 6,75 dan 8,50 mm berturut-turut adalah 0,0119; 0,0100 dan 0,0099 L $g^{-1}jam^{-1}$.

Kata kunci: komposit zeolit, komposit lempung, komposit karboksimetil selulosa, pupuk lepas lambat urea

ENCAPSULATION OF UREA BY USING ZEOLITE/CLAY/CALCIUM OXIDE/CARBOXYMETHYL CELLULOSE COMPOSITE AS A MODEL OF SLOW RELEASE UREA FERTILIZER

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ABSTRACT

Urea encapsulation using hollow tubes composite made from zeolite, clay, calcium oxide (CaO) and carboxymethyl cellulose (CMC) as a model of slow release fertilizer was carried out. Composite synthesis was performed by varying the weight of CaO (0; 5; 10; 15; 20 and 25%) and CMC (2; 4; 6; 8 and 10%). Composite characterization was performed using FTIR spectrophotometer and X-ray diffractometer (XRD). Composite quality was tested through the stability test of the morphology in water, compressive strength test using Universal Testing Machine, and water absorption capacity test. The influence of the thickness of the composite tube wall on the slow-release nature of urea was determined by the variation of the thickness of the tube wall of 4.75; 6.75; and 8.50 mm.

The optimum quality of the hollow tube composite was obtained from the composition of 15% CaO weight and 2% CMC weight. The urea release test showed that the zeolite/clay/CaO/CMC composite was able to slow down the rate of urea release compared to the unencapsulated urea. The slow-release process of urea from the hollow tube composites follows the pseudo second-order release kinetics. Kinetics study of urea release from composites with a wall thickness of 4.75; 6.75 and 8.50 mm show that increasing the thickness of the composite wall slows the rate of urea release. The rate of release of urea from the composite with a wall thickness of 4.75; 6.75 and 8.50 mm are 0.0119; 0.0100 dan 0.0099 L $g^{-1}hour^{-1}$, respectively.

Keywords: zeolite composites, clay composites, carboxymethyl cellulose composites, urea slow-release fertilizers