



PEMBUATAN KOMPOSIT ALGINAT/ZEOLIT/NPK/Ca SEBAGAI PUPUK LEPAS LAMBAT

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INTISARI

Pembuatan komposit Alginat/Zeolit/NPK/Ca atau disingkat A/Z/NPK/Ca dan kajian kinetika pelepasannya telah dilakukan. Tujuan penelitian ini adalah untuk meningkatkan persentase nitrogen pada sintesis komposit A/Z/NPK/Ca dan mempelajari kinetika lepas lambatnya dalam mengembangkan material pupuk lepas lambat makronutrisi NPK dan Ca.

Komposit disintesis dengan mencampur suspensi alginat dan zeolit (rasio berat A : Z = 3 : 1) serta larutan amonium nitrat (variasi berat 5, 10, 15, 20, dan 25 g), amonium dihidrogen fosfat 15 g, dan kalium nitrat 15 g hingga homogen. Campuran tersebut ditetaskan ke dalam larutan CaCl_2 (0,1 M) agar terbentuk butiran komposit. Komposit dikarakterisasi dengan menggunakan spektroskopi Fourier Transformed Infrared (FT-IR) dan X-ray Diffraction (XRD). Kandungan N dan P dianalisis menggunakan spektroskopi UV-Vis sedangkan K dan Ca menggunakan spektroskopi serapan atom (SSA). Kajian pelepasan N, P, K, dan Ca dilakukan dalam media akuades selama 720 jam (30 hari).

Spektra FTIR menunjukkan gabungan spektra karakteristik alginat, zeolit, amonium, nitrat, dan fosfat. Difraktogram sinar-X menunjukkan bahwa komposit bersifat kristalin. Kenaikan berat amonium nitrat meningkatkan persentase N, dimana variasi 5, 10, 15, 20, dan 25 g persentase kenaikannya yaitu 16,43; 21,81; 20,98; 25,11; dan 30,84 %. Kenaikan berat amonium nitrat meningkatkan persentase N sedangkan persentase K tetap dan persentase P serta Ca menurun. Kinetika pelepasan N, P, K, dan Ca mengikuti kinetika orde dua semu. Penambahan amonium nitrat optimum pada massa 15 g dengan tetapan laju pelepasannya adalah $P (0,89 \times 10^{-2}) < N (1,56 \times 10^{-2}) < K (7,83 \times 10^{-2}) < Ca (23,89 \times 10^{-2}) \text{ mg g}^{-1} \text{ jam}^{-1}$.

Kata kunci: alginat, zeolit, NPK, Ca, pupuk lepas lambat



PRODUCTION OF ALGINATE/ZEOLITE/NPK/Ca COMPOSITES AS SLOW RELEASE FERTILIZER

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ABSTRACT

Production of alginate/zeolite/NPK/Ca (or labeled as A/Z/NPK/Ca) and its release kinetics have been investigated. The aims of this research were to increase percentage of nitrogen on the synthesis of A/Z/NPK/Ca composites and to study slow release kinetics on developing slow release fertilizer material for macronutrients of NPK and Ca.

Composites were synthesized by homogeneous mixing of alginate and zeolite suspension (weight ratio of alginate: zeolite = 3:1), ammonium nitrate solution (variation of weight 5, 10, 15, 20, and 25 g), 15 g ammonium dihydrogen phosphate, and 15 g potassium nitrate. The mixture was then dropped into 0.1 M CaCl₂ solution to form beads of composites. The beads of composites were characterized by Fourier Transformed Infrared (FTIR) and X-Ray Diffraction (XRD) spectroscopy. The total content of N and P in the composites were analyzed by UV-Vis spectroscopy whereas K and Ca in the composites were analyzed by Atomic Absorption Spectroscopy (AAS). The release mechanisms of NPK and Ca were studied in aqueous solution for 30 days.

FTIR spectra showed that A/Z/NPK/Ca composites gave peak combination of alginate, zeolite, ammonium, nitrate, and phosphate whereas XRD patterns showed crystalline structure of A/Z/NPK/Ca. Increasing ammonium nitrate weight increased percentage of nitrogen. Variation weight of ammonium nitrate 5, 10, 15, 20, and 25 g increased percentage of N to 16.43, 21.81, 20.98, 25.11, and 30.84 % respectively. Increasing weight of ammonium nitrate increased percentage of N but percentage of K constant and percentage of P and Ca decreased. Release kinetics of NPK and Ca followed pseudo-second-order kinetics. Addition of 15 g ammonium nitrate gave the release rate constant NPK and Ca in the order of P (0.89×10^{-2}) < N (1.56×10^{-2}) < K (7.83×10^{-2}) < Ca (23.89×10^{-2}) mg g⁻¹ hour⁻¹.

Keywords: alginate, zeolite, NPK, Ca, slow release fertilizer



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