

## **BENTONIT TERMODIFIKASI CETILTRIMETILAMONIUM SEBAGAI PUPUK LEPAS LAMBAT MAKRONUTRIEN NPK**

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### **INTISARI**

Studi pemanfaatan bentonit termodifikasi surfaktan CTAB (cetiltrimetilamonium bromida) yang mengandung NPK (NPK-CTA-Bentonit) sebagai pupuk lepas lambat telah dilakukan. Penelitian ini bertujuan untuk mempelajari sintesis bentonit termodifikasi CTAB (CTA-Bentonit), pengaruh konsentrasi surfaktan CTAB terhadap pelepasan makronutrien NPK dari NPK-CTA-Bentonit, dan pelepasan makronutrien NPK dalam akuades dan asam sitrat. Bentonit dimodifikasi menggunakan surfaktan CTAB sebanyak 0, 0,5, 1, dan 2 kali KTK bentonit menjadi CTA-Bentonit. Pelepasan nutrisi N, P, dan K dari NPK-CTA-Bentonit diuji dalam akuades dan dalam larutan buffer asam sitrat pH 5,0 dan 6,5. Material dikarakterisasi menggunakan spektrofotometer FTIR (*Fourier Transform Infra Red*), XRD (Difraktometer Sinar-X), dan SEM (*Scanning Electron Microscope*). Pelepasan N dan P diuji menggunakan spektrofotometer *UV-Visible*, dan K diuji menggunakan AAS. Kinetika pelepasan NPK dari NPK-CTA-Bentonit optimum pada larutan sitrat pH 6,5 yang sesuai dengan kondisi normal tanah dikaji menggunakan model kinetika orde nol, orde satu, orde dua, orde satu semu, orde dua semu, dan Korsmeyer-Peppas.

Hasil penelitian menunjukkan bahwa CTA-Bentonit berhasil disintesis yang dibuktikan dengan karakterisasi FTIR. Berdasarkan difraktogram sinar-X, terjadi peningkatan jarak basal sebesar 10,79 Å. Pelepasan NPK dipengaruhi oleh konsentrasi CTA<sup>+</sup> dalam NPK-CTA-Bentonit. NPK-CTA-Bentonit 2 KTK dapat menghambat pelepasan NPK dalam akuades. Massa N, P dan K terlepas dari NPK-CTA-Bentonit 2 KTK dan laju pelepasannya dalam larutan buffer sitrat pH 6,5 lebih besar daripada di pH 5,0 dan akuades. Kinetika pelepasan NPK pada larutan sitrat pH 6,5 mengikuti model kinetika orde dua semu, dengan nilai konstanta laju pelepasan (k) untuk N, P, K berturut-turut sebesar 0,0045; 0,588; dan 0,016 mg<sup>-1</sup> hari<sup>-1</sup>.

Kata kunci: CTA-Bentonit, CTAB, NPK, pupuk lepas lambat

***CETYLTRIMETHYLAMMONIUM MODIFIED BENTONITE AS SLOW  
RELEASE FERTILIZER OF NPK MACRONUTRIENTS***

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**ABSTRACT**

Studies on the use of CTAB (cetyltrimethylammonium bromide) modified bentonite that contain NPK (NPK-CTA-Bentonite) as slow release fertilizer have been carried out. This study aims to learn the synthesis of CTA-Bentonite, the effect of CTAB concentration on the release of NPK nutrients from NPK-CTA-Bentonite, and the release of nutrients within water and citric acid. Bentonite was modified using CTAB as much as 0, 0.5, 1, 2 CEC value of bentonite to yield CTA-Bentonite. NPK-CTA-Bentonite was analyzed for its NPK release ability within water and citric acid (citrate buffer pH 5.0 and 6.5). Characterizations were done using Spectrophotometer FTIR (Fourier Transform Infra Red), XRD (X-Ray Diffraction), and SEM (Scanning Electron Microscope). Amount of released N and P were analyzed using Spectrophotometer UV-Visible, and K were analyzed using AAS (Atomic Absorption Spectroscopy). The release kinetics of N, P, and K macronutrients of optimum NPK-CTA-Bentonite under pH 6.5 condition were studied by using zero order, first order, second order, pseudo-first order, pseudo-second order, and Korsmeyer-Peppas kinetics models.

Result showed that CTA-Bentonite were successfully synthesized which is proven by FTIR spectra. Result of characterization using XRD showed that basal spacing was increased up to 10.79 Å. Release of NPK macronutrients was affected by CTA<sup>+</sup> concentration loaded. NPK-CTA-Bentonite 2 KTK could inhibit NPK release in water. Amount of N, P, and K released from NPK-CTA-Bentonite 2 KTK within citric acid pH 6.5 was greater than in pH 5.0 and water. The release process of NPK under pH 6.5 condition can be described by pseudo-second order kinetics models, and the k value of N, P, and K were 0.0045; 0.588; and 0.016 mg<sup>-1</sup> day<sup>-1</sup>, respectively.

Keywords: CTA-Bentonite, CTAB, NPK, slow release fertilizer