

INTISARI

PEMBUATAN BIOPLASTIK KARBOKSIMETIL SELULOSA-KOLIN KLORIDA-UREA BENTONIT SEBAGAI MODEL PUPUK NITROGEN LEPAS LAMBAT

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Pupuk urea mengalami mobilisasi yang tinggi di dalam tanah melalui denitrifikasi maupun pencucian, sehingga tidak dapat terserap secara efisien oleh tanaman. Hal ini mendorong upaya pembuatan bioplastik yang dapat mengontrol pelepasan urea. Pembuatan bioplastik pada penelitian ini meliputi 3 variasi, yaitu bioplastik KMS-urea, KMS-urea-bentonit dan KMS-KK-urea-bentonit. Bioplastik karboksimetil selulosa (KMS)-urea dengan perbandingan rasio (b/b) 1:0,5 dan 1:1, KMS-urea-bentonit dengan variasi berat bentonit 0,1; 0,5; 1 dan 2 g, serta KMS-kolin klorida (KK)-urea-bentonit dengan variasi berat bentonit 1 dan 2 g telah berhasil disintesis dengan mencampurkan suspensi bentonit, urea dan KK dalam gel KMS. Telah dikaji pengaruh variasi rasio berat urea terhadap KMS, variasi berat bentonit, dan pengaruh penambahan pemlastis KK-urea dalam pembuatan bioplastik. Bioplastik yang dihasilkan dikarakterisasi dengan spektroskopi FTIR, XRD, uji kekuatan mekanik, uji kemampuan biodegradasi selama 2 bulan dan kemampuan melepas lambat nitrogen selama 96 jam. Penentuan urea dalam kajian lepas lambat nitrogen dilakukan dengan spektrofotometer UV-Vis.

Hasil penelitian menunjukkan bahwa peningkatan berat bentonit memiliki pengaruh terhadap struktur bioplastik yang terbentuk. Bioplastik yang mengandung bentonit dalam jumlah yang rendah memiliki struktur eksfoliasi, sedangkan bioplastik yang mengandung bentonit dengan jumlah yang lebih besar memiliki struktur terinterkalasi. Peningkatan berat bentonit juga berpengaruh pada peningkatan sifat mekanik bioplastik, namun pada penambahan bentonit yang sebanyak 2 g terjadi penurunan yang signifikan terhadap kemuluran bioplastik, sehingga dilakukan variasi penambahan pemlastis KK-urea. Penambahan pemlastis KK-urea meningkatkan kemuluran bioplastik dari 2,26% menjadi 22,00%. Semakin banyak kadar bentonit dalam bioplastik menyebabkan semakin banyak urea yang terkandung pada bioplastik. Adsorpsi dan desorpsi urea dipengaruhi oleh konsentrasi urea. Bioplastik KMS-urea 1:0,5 dan 1:1 memiliki tetapan laju desorpsi berturut-turut sebesar 0,0005 mg/jam dan 0,0094 mg/jam. Bioplastik KMS-urea-bentonit 1g memiliki tetapan laju sebesar 0,0094 mg/jam, sedangkan bioplastik KMS-KK-urea-bentonit 1g memiliki tetapan laju sebesar 0,004 mg/jam.

Kata kunci: KMS, KK, urea, bentonit, bioplastik, pupuk nitrogen lepas lambat

ABSTRACT

SYNTHESIS BIOPLASTIC OF CARBOXYMETHYL CELLULOSE- CHOLIN CHLORIDE-UREA-BENTONIT AS A MODEL OF NITROGEN SLOW- RELEASE FERTILIZER

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High mobility of urea in the soil through denitrification or leaching resulted in inefficient absorption by plants. Therefore, efforts to prepare slow-release urea fertilizer in the form of bioplastic are encouraged. Bioplastics carboxymethyl cellulose (KMS)-urea with a ratio of 1:0,5 and 1:1, KMS-urea-bentonite with weight variations of bentonite of 0.1; 0.5; 1 and 2 g, and KMS-KK-urea-bentonite with weight variations of bentonite of 1 and 2 g, successfully synthesized by mixing bentonite suspension, urea and KK in KMS gel. On the synthesis of bioplastics, not only the effect of the weight ratio of urea toward the KMS and the effect of weight variation of bentonite, but also the effect of the addition of KK-urea plasticizers to bioplastic were studied. Bioplastics were characterized by FTIR spectroscopy, XRD, mechanical strength, biodegradability for 2 months and the ability to slow-release nitrogen for 96 h. The amount of urea in the study of nitrogen slow-release was observed by UV-Vis spectrophotometer.

The results showed that the increase in the weight of bentonite had an influence on the structure of bioplastics. Bioplastics containing small amount of bentonite had a structure of exfoliation, while bioplastics containing high amount of bentonite had intercalated structure. The increase in the weight of bentonite also affects the increase in the mechanical properties of bioplastics, but the addition of 2 g weight of bentonite decreased the elongation of bioplastics. The addition of KK-urea plasticizers improved the elongation of bioplastic from 2.26% to 22.00%. The more the amount of bentonite in bioplastics, the more the urea contained in bioplastics. Adsorption and desorption of urea was affected by the concentration of urea. The rate constant of KMS-urea bioplastics 1:0,5 and 1:1 are 0.0005 mg/h and 0.0094 mg/h respectively. The desorption constant of KMS-urea-bentonite (1g) bioplastics is 0.0094 mg/h, while the rate constant of KMS-KK-urea-bentonite (1g) bioplastic is 0.004 mg/h.

Key words: KMS, KK, urea, bentonite, bioplastic, Nitrogen slow release fertilizer.