

FORMULASI SEDIAAN PUPUK UREA LEPAS LAMBAT “*SLOW RELEASE FERTILIZER*” DENGAN TEKNIK MIKROENKAPSULASI MENGGUNAKAN BIOPOLIMER POLIKAPROLAKTON

Abstrak

Pupuk yang banyak digunakan di bidang pertanian adalah pupuk urea karena kandungan nitrogennya yang tinggi, harga murah, dan ketersediaan komersial, namun terdapat beberapa kendala dalam penggunaan pupuk urea seperti pencemaran lingkungan dan meningkatkan biaya karena pelepasannya yang cepat. Tujuan dari penelitian ini yaitu untuk membuat pupuk urea lepas lambat dengan teknik mikroenkapsulasi menggunakan polikaprolakton (PCL) sebagai bahan penyalut. Mikro kapsul dibuat dengan metode penguapan pelarut dengan rasio urea-PCL 1:1, 1:2 dan 1:3. Mikro kapsul yang dihasilkan dievaluasi meliputi *Fourier Transform Infra-Red* (FTIR), *Scanning Elecron Microscopy* (SEM), distribusi ukuran partikel, penetapan kadar urea dalam mikro kapsul, uji pelepasan dan model kinetika pelepasan zat aktif. Spektrum IR menunjukkan tidak adanya interaksi kimia yang terjadi antara urea dan polikaprolakton selama proses pembuatan mikro kapsul. Hasil *Scanning Elecron Microscopy* (SEM) menunjukkan mikro kapsul yang berbentuk spheris dengan permukaan yang kasar dan membentuk agegat. Distribusi ukuran partikel mikro kapsul urea berada pada rentang 20-240 μm yang dipengaruhi oleh konsentrasi polikaprolakton. Efisiensi enkapsulasi mikro kapsul urea formula 1, 2, dan 3 berturut-turut $80,276 \pm 0,813\%$, $82,646 \pm 1,219\%$, dan $79,642 \pm 0,646\%$. Persentase efisiensi pelepasan formula 1, 2 dan 3 yaitu $58,852 \pm 1,719\%$, $26,761 \pm 0,762\%$, dan $40,424 \pm 2,393\%$. Model kinetika pelepasan urea dari mikro kapsul mengikuti persamaan langenbucher yang artinya pelepasannya berdasarkan mekanisme difusi dan erosi. Hasil uji statistik ANOVA satu arah menunjukkan penggunaan polikaprolakton mempengaruhi efisiensi pelepasan secara signifikan ($\text{sig} < 0,05$) dimana terdapat perbedaan rata-rata pelepasan zat aktif urea pada tiap formula. Kesimpulannya, polikaprolakton dapat digunakan dalam formulasi mikro kapsul urea untuk pupuk lepas lambat.

Kata Kunci: Urea, Mikroenkapsulasi, Polikaprolakton, Lepas Lambat

FORMULATION OF UREA SLOW RELEASE FERTILIZER BY MICROENCAPSULATION TECHNIQUE USING BIOPOLYMER OF POLYCAPROLACTONE

Abstract

The most widely used fertilizer in agriculture is urea fertilizer because of high nitrogen content, low cost and commercial availability, but there are some Obstacles encountered in the use of urea fertilizer such as enviromental pollution and increase the cost because the fertilizer release active substance quickly. The aims of this research is to produce urea slow release fertilizer by using microencapsulation technique with biopolymer polycaprolactone (PCL) as coating material. Microcapsules were made using solvent evaporation method with ratio urea-PCL 1:1, 1:2, and 1:3. Microcapsules were characterized by Fourier Transform Infra-Red (FTIR), Scanning Elecron Microscopy (SEM), particle size distribution, amount of urea in microcapsule, release test and release kinetic model of active substance. IR specrum showed that there were no chemistry interaction between urea and polycaprolactone during microencapsulation process. Result of Scanning Elecron Microscopy (SEM) showed that microcapsules were spheric in shape with rough surface and formed agregate. Particle size distribution of urea microcapsules were in range 20-240 μm , influenced by concentration of polycaprolactone. Encapsulation efficiency of urea microcapsules in formula 1, 2, and 3 were $80,276\pm 0,813\%$, $82,646\pm 1,219\%$, and $79,642\pm 0,646\%$ respectively. The persentage of release efficiency in formula 1, 2, and 3 were $58,852\pm 1,719\%$, $26,761\pm 0,762\%$, and $40,424\pm 2,393\%$. The release kinetic model urea from microcapsules followed langenbucher equation which means that the release according to diffusion and erosion mecchanism. One way ANOVA statistic test showed that use of polycaprolactone affect the efficiency of release test significantly ($\text{sig} < 0,05$) which means that there were differentiation on release average of active substance in each formula. In conclusion, polycaprolactone could be used in microencapsulation formulation of urea for slow release fertilizer.

Keyword: Urea, Microencapsulation, Polycaprolactone, Slow Release