

**SINTESIS, KARAKTERISASI, DAN UJI PERFORMA
MEMBRAN HIDROGEL BERBAHAN BAKU POLIVINIL ALKOHOL,
BORAT, DAN KITOSAN SEBAGAI *SEPARATOR* KCl-MEDIA UNTUK
PENGEMBANGAN MATERIAL CRF**

diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada
Program Studi Kimia

SKRIPSI



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ABSTRAK

Pada sektor pertanian, pupuk berperan sebagai pemenuh kebutuhan unsur hara tanaman. Namun, tidak semua unsur hara pada pupuk dapat terserap oleh tanaman melainkan ada beberapa bagian yang hilang karena menguap, dirusak oleh mikroorganisme, dan bahkan larut ke dalam lingkungan. Untuk mencegah permasalahan tersebut, maka digunakan *Controlled Release Fertilizer* (CRF). Dalam penelitian ini, dilakukan sintesis, karakterisasi, dan uji performa membran hidrogel PVA/borat/kitosan untuk material CRF kalium klorida (KCl). Dengan tujuan untuk menentukan komposisi optimum membran hidrogel PVA/borat dan PVA/borat/kitosan serta mengevaluasi karakteristik dan uji performa membran hidrogel. Penelitian yang dilakukan terdiri dari tiga tahap yaitu: (1) optimasi dan sintesis membran hidrogel PVA/borat dan PVA/borat/kitosan; (2) karakterisasi membran hidrogel yang terdiri dari FTIR dan SEM; (3) uji performa yang terdiri atas ketebalan, *swelling ratio*, *water retention*, dan permeasi KCl. Pada proses optimasi, ditambahkan kitosan dengan rasio volume sebanyak 0,5, 1, 2, 3, 4, dan 5 ke dalam rasio volume PVA/borat 4:1; 4:5; dan 8:1. Hasil karakterisasi menggunakan FTIR menunjukkan adanya interaksi yang cukup signifikan setelah penambahan kitosan, yang ditunjukkan dengan adanya peningkatan intensitas serapan pada bilangan gelombang 3410 cm^{-1} , 2922 cm^{-1} , dan 1246 cm^{-1} . Hasil karakterisasi dengan SEM menunjukkan bahwa kedua membran bersifat homogen serta penambahan kitosan membuat permukaan membran hidrogel menjadi lebih halus. Nilai *swelling ratio* dan *water retention* membran hidrogel PVA/borat/kitosan relatif lebih tinggi dibandingkan dengan PVA/borat. Hasil analisis terhadap data *swelling ratio* menunjukkan bahwa penyerapan air mengikuti kinetika orde 2 dengan nilai k untuk PVA/borat dan PVA/borat/kitosan berturut-turut adalah 0,0062 dan 0,053. Selain itu, pada uji ketebalan membran hidrogel PVA/borat/kitosan cenderung lebih tipis dari PVA/borat sehingga laju permeasi KCl melalui membran hidrogel PVA/borat cenderung lebih besar. Analisis profil laju menunjukkan bahwa laju permeasi KCl mengikuti kinetika orde 1 dengan konstanta laju untuk PVA/borat dan PVA/borat/kitosan berturut-turut 0,0042 dan 0,0017.

Kata kunci: Borat, CRF, kitosan, membran hidrogel

ABSTRACT

In the agricultural sector, fertilizer plays a role as a provider of plant's nutrient needs. However, not all nutrients in fertilizer can be absorbed by plants. It can be evaporated, damaged by the microorganism, and dissolved in the environment. To prevent these problems, a Controlled Release Fertilizer (CRF) has been used. In this research, synthesis, characterization, and performance of hydrogel membrane based on PVA/borate/chitosan as potassium chloride Controlled Release Fertilizer material has been done. This study aims to determine the optimum composition of membrane hydrogel PVA/borate and PVA/borate/chitosan and to evaluate the characteristics and performances of hydrogel membranes. This study consisted of several stages, these are (1) optimization and synthesis of hydrogel membrane PVA/borate and PVA/borate/chitosan; (2) characterization of hydrogel membrane consisting of FTIR and SEM; (3) performance test consisting of thickness, swelling ratio, water retention, and permeation of potassium chloride. While the optimization process, the chitosan was added with volume ratios of 0.5, 1, 2, 3, 4, and 5 into PVA/borate hydrogel with volume ratios of 4:1; 4:5; and 8:1. The result of FTIR characterization shows that has interaction after chitosan is added, where there is increased intensity of absorption in some wavenumbers such as 3410 cm^{-1} , 2922 cm^{-1} , and 1246 cm^{-1} . And the result of characterization with SEM shows that PVA/borate and PVA/borate/chitosan are homogeneous membranes and the addition of chitosan makes the surface of the membrane finer. The value of swelling ratio and water retention of the PVA/borate/chitosan membrane is relatively higher than PVA/borate membrane. The results of the swelling ratio analysis shows that the water absorption followed second-order kinetics with k values for PVA/borate and PVA/borate/chitosan were 0,0062 and 0,053, respectively. In addition, the PVA/borate/chitosan hydrogel membrane is thinner than the PVA/borate so the permeation rate of KCl through the PVA/borate hydrogel membrane tends to be higher. The rate profile analysis shows that the permeation rate of potassium chloride followed first-order kinetics with the rate constants for PVA/borate and PVA/borate/chitosan 0.0042 and 0.0017, respectively.

Keywords: Borate, chitosan, CRF, hydrogel membrane

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