

PENGEMBANGAN MATERIAL *DRUG DELIVERY* ANTIINFLAMASI
BERBASIS HIDROGEL KOMPOSIT KITOSAN/ POLI (VINIL PIROLIDON)/
GLUTARALDEHID/ NATRIUM DIKLOFENAK

TESIS

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar Magister Sains
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oleh

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Tesis ini diajukan untuk memenuhi salah satu syarat memperoleh gelar Magister Sains pada Program Studi Kimia Departemen Pendidikan Kimia Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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ABSTRAK

Penelitian ini bertujuan untuk mengetahui kondisi terbaik sintesis dan karakterisasi hidrogel komposit serta aplikasinya sebagai agen *drug delivery* dalam pengobatan antiinflamasi. Kitosan (CS) dan poli (vinilpirolidon) (PVP) digunakan sebagai prekursor, serta glutaraldehid (GA) sebagai *agen crosslinker* dalam sintesis hidrogel komposit. Tahapan penelitian meliputi tahap sintesis hidrogel komposit melalui metode *solution mixing* dengan optimasi pada dua parameter, yaitu rasio komposisi CS/PVP dan rasio komposisi CS/PVP/GA. Karakterisasi hidrogel komposit menggunakan instrumentasi *Fourier Transform Infrared Spectroscopy* (FTIR), *X-Ray Diffraction* (XRD), *Scanning Electron Microscopy-Energy Dispersive X-Ray* (SEM-EDX), *Thermogravimetric Analysis* (TG/DTA), dan uji kinerja hidrogel komposit melalui uji aktivitas *drug release* serta uji aktivitas anti bakteri. Hasil penelitian menunjukkan bahwa rasio komposisi CS/PVP terbaik yaitu pada rasio 15/15 berdasarkan hasil swelling 2534%, *water contact angle* 78°, dan porositas 67%. Sementara rasio komposisi CS/PVP/GA terbaik yaitu pada rasio 15/15/1,5 berdasarkan hasil swelling 3240%, *water contact angle* 70°, dan porositas 72%. Hasil karakterisasi menunjukkan bahwa sintesis hidrogel komposit CS/PVP/GA/DS berhasil dilakukan dengan munculnya pita serapan gugus khas pada setiap prekursor melalui spektra FTIR. Terdeteksinya unsur khas penyusun untuk masing-masing prekursor pada karakterisasi EDX serta terbentuknya pori pada area *cross section* hidrogel berdasarkan foto SEM. Menyempitnya puncak pada 2 theta 9,46 dan 12,04 pada spektra XRD menandakan semakin kristalin hidrogel. Hidrogel komposit berpotensi untuk diaplikasikan sebagai agen *drug delivery* berdasarkan pengujian aktivitas *drug release* yang ditunjukkan dengan profil *drug release* terbaik pada media buffer pH 10 (94% oleh DS100). Selain itu, aktivitas antibakteri terbaik ditunjukkan oleh sampel DS150 terhadap bakteri *P. aeruginosa* dan *S. aureus* berdasarkan hasil MIC (terbentuknya ZoI berturut-turut sebesar 22 mm dan 19 mm) serta hasil % *Bacteria Killing Ratio* (berturut-turut 93% dan 92%).

Kata kunci: *Drug Delivery*, Hidrogel, Sintesis, Karakterisasi, CS/PVP/GA/DS

ABSTRACT

This study aims to determine the best conditions for synthesis and characterization of composite hydrogels and their application as drug delivery agents in anti-inflammatory treatment. Chitosan (CS) and poly(vinylpyrrolidone) (PVP) were used as precursors, and glutaraldehyde (GA) as a crosslinker agent in the synthesis of composite hydrogels. The research stages include the synthesis of hydrogel composites through the solution mixing method with optimization on two parameters, namely the ratio of CS/PVP composition and the ratio of CS/PVP/GA composition. The characterization of the composite hydrogel using Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD), Scanning Electron Microscopy-Energy Dispersive X-Ray (SEM-EDX) instrumentation, Thermogravimetric Analysis (TG/DTA), and performance test of composite hydrogel through drug release activity test and anti-bacterial activity test. The results showed that the best CS/PVP composition ratio was at a ratio of 15/15 based on the results of 2534% swelling, 78° water contact angle, and 67% porosity. Meanwhile, the best CS/PVP/GA composition ratio is 15/15/1.5 based on swelling results of 3240%, water contact angle of 70°, and porosity of 72%. The characterization results showed that the synthesis of the CS/PVP/GA/DS composite hydrogel was successfully carried out with the appearance of a distinctive group absorption band on each precursor through FTIR spectra. The detection of typical constituent elements for each precursor in the EDX characterization and the formation of pores in the hydrogel cross section area based on SEM photos. The narrowing of the peaks at 2 theta 9.46 and 12.04 in the XRD spectra indicated the more crystalline the hydrogel. The composite hydrogel has the potential to be applied as a drug delivery agent based on the drug release activity test as indicated by the best drug release profile in buffered media pH 10 (94% by DS100). In addition, the best antibacterial activity was shown by the DS150 sample against *P. aeruginosa* and *S. aureus* bacteria based on the MIC results (ZoI formation of 22 mm and 19 mm, respectively) and the results of % Bacteria Killing Ratio (93% and 92% respectively).

Keywords: Drug Delivery, Hydrogel, Synthesis, Characterization, CS/PVP/GA/DS

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