

INTISARI

Studi Preparasi dan Karakterisasi Alginat Teresterifikasi Sebagai Membran Hemodialisis

Oleh

Choirul Amri
10/307258/SPA/00345

Kemampuan alginat membentuk film dan kekayaan gugus fungsinya menarik untuk diteliti sebagai kandidat membran hemodialisis. Kelemahan utama alginat sebagai membran tersebut berkaitan dengan kurangnya stabilitas atau resistensinya dalam air dan rendahnya kekuatan mekanik membran. Selain itu, banyaknya gugus karboksilat dalam alginat dimungkinkan memicu terjadinya deposisi protein pada permukaan membran. Untuk itu dalam penelitian ini diupayakan untuk meningkatkan stabilitas dan kekuatan mekanik membran, serta menurunkan serapan protein pada permukaan membran. Strategi yang ditempuh yaitu modifikasi gugus karboksilat melalui esterifikasi menggunakan 1-butanol, 1,4-butanadiol, dan polivinil alkohol yang akan bereaksi membentuk esternya secara *grafting*, sambung silang, dan pencampuran polimer.

Untuk mempelajari hal tersebut, dalam penelitian ini membran alginat teresterifikasi dipreparasi dan dikarakterisasi kekuatan mekanis (kuat tarik dan elongasi), daya serap air dan stabilitas, kinerja dialisis membran, dan efek hemokompatibilitas (rasio hemolisis, adsorpsi protein, dan pelekatan trombosit). Selain itu, untuk mendukung preparasi dan karakterisasi tersebut, dilakukan pula uji hidrofilitas-hidrofobitas dan uji porositas membran. Untuk mempelajari karakter membran alginat teresterifikasi, karakter membran selulosa triasetat digunakan sebagai pembandingan.

Hasil studi menunjukkan bahwa esterifikasi alginat menggunakan 1-butanol, 1,4-butanadiol, dan polivinil alkohol mampu meningkatkan stabilitas dan kekuatan mekanik membran, serta hemokompatibilitasnya dari sisi serapan protein. Membran alginat teresterifikasi 1,4-butanadiol dan PVA lebih mendekati karakter membran selulosa triasetat dibanding membran alginat teresterifikasi 1-butanol. Pada uji simulasi dialisis selama 4 jam, membran alginat teresterifikasi 1,4-butanadiol mampu mengurangi konsentrasi urea 43,8-56,8% dan kreatinin 38,1-50,4%, dengan fluks urea dan kreatinin masing-masing 2,61-2,75 dan 0,058-0,061 mg cm⁻² jam⁻¹. Sementara itu membran alginat teresterifikasi polivinil alkohol mampu mengurangi konsentrasi urea 43,4-55,1% dan kreatinin 39,6-50,2%, dengan fluks urea dan kreatinin masing-masing 2,62-2,79 dan 0,057-0,060 mg cm⁻² jam⁻¹.

Kata kunci: Karakterisasi, alginat teresterifikasi, membran hemodialisis, hemokompatibilitas

ABSTRACT

Study on Preparation and Characterization of Esterified Alginate as Hemodialysis Membrane

By

Choirul Amri
10/307258/SPA/00345

The ability of alginate to form film and its functional group properties are interesting to be studied as candidate of hemodialysis membrane. The main weakness of alginate as a membrane are low stability in water and low mechanical strength. Moreover, the excessive of carboxylic groups of alginate enable it to trigger protein adsorption on the membrane surface. For that reasons, this study is aimed to increase stability and mechanical strength of membrane, and also to decrease the protein adsorption on the membrane surface. The strategy adopted is modification of a carboxylic group through esterification using 1-butanol, 1,4-butanediol, and polyvinyl alcohol to give different reactions such as grafting, crosslink, and polymer blend.

For the purpose of such study, preparation and characterization of the esterified alginate membranes including mechanical strength (tensile strength and elongation), water sorption and stability, the performance of dialysis membrane, and the effect of hemocompatibility (the ratio of hemolysis, protein adsorption, and platelet adhesion) has been carried out. Furthermore, hydrophilicity-hydrophobicity and porosity test of the membrane were also conducted. Finally, characters of esterified alginate were compare to those of cellulose triacetate.

Results of the study showed that esterification of alginate using 1-butanol, 1,4-butanediol, and polyvinyl alcohol improves the stability and the mechanical strength of the membrane. This modification also increased hemocompatibility of the membrane from the point of view of protein adsorption. Membranes of 1,4-butanediol-esterified alginate and polyvinyl alcohol-esterified alginate membranes showed closer character of the membrane of cellulose triacetate as compared to that of 1-butanol-esterified alginate membrane. In the dialysis test for 4 hours, membrane of 1,4-butanediol-esterified alginate is able to reduce urea and creatinine of 43.8-56.8% and 38.1-50.4%, respectively, and flux of urea and creatinine of 2.61-2.75 and 0.058-0.061 mg cm⁻² h⁻¹, respectively. Meanwhile membrane of polyvinyl alcohol-esterified alginate is able to reduce urea and creatinine of 43.4-55.1% and 39.6-50.2% , respectively, and flux of urea and creatinine of 2.62-2.79 and 0.057-0.060 mg cm⁻² h⁻¹, respectively.

Keywords: Characterization, esterified alginate, hemodialysis membrane, hemocompatibility