

ABSTRAK

POTENSI PELIKEL SELULOSA BAKTERI BERBASIS KOMPOSIT ALGINAT DAN ENZIM PAPAIN SEBAGAI AGEN PEMBALUT LUKA

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Pelikel selulosa bakteri (BC) dimanfaatkan dalam bidang biomedis karena memiliki potensi yang sangat baik yaitu sebagai agen pembalut luka yang memiliki kemampuan menyerap air cukup tinggi sekitar 98-99%. Selulosa bakteri bersifat murni umumnya disintesis dari bakteri *Acetobacter xylinum* serta memiliki potensi dan kontribusi yang sangat baik dalam bidang biomedis karena sifatnya yang unggul. Polimer alami seperti selulosa, kitosan, kitin, alginat, pati, kolagen memiliki kemampuan dalam mendorong proses regenerasi luka, karena memiliki sifat hidrofilisitas, biokompatibilitas, dan kelembaban yang baik. Metode yang digunakan dalam penelitian ini meliputi 2 tahap yaitu sintesis selulosa bakteri dan karakterisasi. Karakterisasi meliputi: pengukuran berat dan ketebalan, uji absorpsi, SEM, FTIR, XRD, uji kuat elastisitas, laju transmisi uap air (LTUR), uji antimikroba, uji hemokompatibilitas, uji biodegradasi, dan analisis data.

BC dan komposit BC/Alginat/Papain memiliki berat dan ketebalan (BC 35,5 gr dan 4,02 mm), (BC/Alginat 40,3 gr dan 6,95 mm), variasi (BC Alginat/Papain 4 dan 6%; 40 gr dan 6,14 mm) dan (BC/Alginat/Papain 8%; 40,2 gr dan 6,14 mm). Kapasitas absorpsi BC sebesar 0,46% pada DW dan 0,34% pada NaCl. Kapasitas absorpsi BC/Alginat sebesar 0,16% pada DW dan 0,17% NaCl. Kapasitas absorpsi variasi BC/Alginat/Papain 4 dan 6% pada DW 0,82% dan NaCl 0,31% serta BC/Alginat/Papain 8% mempunyai kapasitas serapan paling tinggi. BC/Alginat memiliki struktur yang paling padat dan mempunyai nilai elastisitas paling tinggi. Komposit BC memiliki kemampuan menghambat pertumbuhan bakteri, memiliki kemampuan biodegradasi tinggi, dan hemokompatibel. BC/Alginat/Papain 8% memiliki nilai indeks zona hambat paling tinggi yaitu pada *S.aureus* dan *E.coli* masing-masing 5,9 mm dan 6,4 mm. Hasil uji biodegradasi menunjukkan bahwa rata-rata seluruh sampel memiliki persentase weight loss yang tinggi yaitu 94-97% artinya memiliki kemampuan biodegradasi tinggi. Hasil uji hemokompatibilitas menunjukkan bahwa BC/Alginat/Papain konsentrasi 6 dan 8% memiliki persentase hemolisis yang rendah yaitu $1,71 \pm 0,31$ dan $0,86 \pm 0,3$ di bawah 2% dan memiliki kompatibilitas darah yang baik.

Kata kunci: Selulosa bakteri, *Acetobacter xylinum*, SEM, FTIR, XRD, antimikroba BC, biodegradasi, hemokompatibilitas, agen pembalut luka

ABSTRACT

POTENTIAL OF PELLICLE BACTERIAL CELLULOSE BASED ALGINATE AND PAPAIN ENZYME COMPOSITE AS WOUND DRESSING AGENT

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Bacterial cellulose pellicle is widely used in the biomedical field due to its excellent potential, particularly as a wound dressing agent. It has a high water absorption capacity of around 98–99%. Pure bacterial cellulose is typically synthesized by *Acetobacter xylinum* bacteria and offers significant potential and contributions to the biomedical field because of its superior properties. Natural polymers such as cellulose, chitosan, chitin, alginate, starch, and collagen promote wound healing due to their good hydrophilicity, biocompatibility, and moisture-retaining properties. This research consists of two stages: the synthesis of bacterial cellulose and its subsequent characterization. The characterization includes: measurement of pellicle weight and thickness, absorption capacity testing, scanning electron microscopy (SEM), fourier-transform infrared spectroscopy (FTIR), x-ray diffraction (XRD), tensile strength testing, water vapor transmission rate (WVTR), bacterial antimicrobial testing, hemocompatibility testing, biodegradation testing, and data analysis.

The results of the weight and thickness measurements for pure BC and the BC/Alginate/Papain composite are as follows: pure BC 35.5 g, 4.02 mm, BC/Alginate 40.3 g, 6.95 mm, BC/Alginate/Papain variations 4 and 6% 40 g, 6.14 mm, and BC/Alginate/Papain 8% 40.2 g, 6.14 mm. The absorption capacity of pure BC is 0.46% in deionized water (DW) and 0.34% in NaCl solution. The absorption capacity of BC/Alginate is 0.16% in DW and 0.17% in NaCl. The absorption capacity for the BC/Alginate/Papain variations 4 and 6% is 0.82% in DW and 0.31% in NaCl. BC/Alginate/Papain 8% exhibits the highest absorption capacity. The BC/Alginate composite has the most compact structure and the highest elasticity value. The BC composite also demonstrates the ability to inhibit bacterial growth, high biodegradation capability, and good hemocompatibility. BC/Alginate/Papain 8% shows the highest inhibition zone index for *Staphylococcus aureus* 5.9 mm and *Escherichia coli* 6.4 mm. Biodegradation tests indicate that all samples have a high percentage of weight loss 94-97%, suggesting high biodegradability. Hemocompatibility testing revealed that BC/Alginate/Papain concentrations of 6 and 8% exhibited low hemolysis percentages $1.71 \pm 0.31\%$ and $0.86 \pm 0.3\%$, respectively, both of which are below 2%, indicating good blood compatibility (hemocompatibility).

Keywords: Bacterial cellulose, *Acetobacter xylinum*, SEM, FTIR, XRD, antimicrobial BC, biodegradation, hemocompatibility, wound dressing agent