ABSTRAK

Rekayasa jaringan tulang merupakan salah satu metode yang dikembangkan untuk memperbaiki kerusakan tulang dengan menggunakan *scaffold* sebagai struktur pendukung regenerasi sel. *Scaffold* ideal harus bersifat biokompatibel, berpori, dan memiliki kekuatan mekanik memadai. Penelitian ini mengembangkan *scaffold* berbasis kitosan yang diperoleh dari cangkang kepiting rajungan (*Portunus pelagicus*), dikombinasikan dengan kolagen dan hidroksiapatit, serta ditambahkan glutaraldehid sebagai *crosslinker*. Kitosan diekstraksi melalui tahapan deproteinasi, demineralisasi dan deasetilasi. *Scaffold* difabrikasi dengan metode *freeze-drying* dan dikarakterisasi menggunakan FTIR untuk identifikasi gugus fungsi, serta diuji porositas, morfologi pori, *swelling ratio, degradation ratio*, dan *compressive strength*. Rendemen kitosan sebesar 9,169 ± 0,919 % diperoleh. Porositas *scaffold* dengan glutaraldehid lebih rendah (43,568 ± 1,226%) dibanding tanpa glutaraldehid (58,270 ± 1,186%) (p < 0,05), sedangkan ukuran pori tidak berbeda signifikan. *Swelling ratio scaffold* dengan glutaraldehid lebih rendah secara konsisten dari 1 hingga 24 jam dibanding scaffold tanpa glutaraldehid. *Degradation ratio scaffold* dengan glutaraldehid lebih lambat (54,508 ± 6,133% dalam 4 minggu) dibanding tanpa glutaraldehid (84,075 ± 4,783%). *Compressive strength scaffold* dengan glutaraldehid jauh lebih tinggi (112,183 ± 2,907 MPa) dibanding tanpa glutaraldehid (2,398 ± 0,142 MPa) (p < 0,05). Penambahan glutaraldehid terbukti memengaruhi karakteristik *scaffold* dengan meningkatkan stabilitas dan performa mekanik untuk aplikasi rekayasa jaringan tulang.

Kata kunci: glutaraldehid, *scaffold*, kitosan, kepiting rajungan, kerusakan tulang.

ABSTRACT

Bone tissue engineering is one of the methods developed to repair bone damage using scaffolds as structural support for cell regeneration. An ideal scaffold should be biocompatible, porous, and possess adequate mechanical strength. This study developed a chitosan-based scaffold derived from blue swimming crab shells (*Portunus pelagicus*), combined with collagen and hydroxyapatite, and incorporated glutaraldehyde as a crosslinker. Chitosan was extracted through deproteinization, demineralization, and deacetylation, yielding 9.169 ± 0.919%. The scaffold was fabricated using the freeze-drying method and characterized by FTIR for functional group identification, as well as porosity, pore morphology, swelling ratio, degradation ratio, and compressive strength tests. The scaffold with glutaraldehyde exhibited lower porosity (43.568 ± 1.226%) than the one without (58.270 ± 1.186%) ($p < 0.05$), while the pore size showed no significant difference. The swelling ratio of the glutaraldehyde-crosslinked scaffold was consistently lower from 1 to 24 hours. Its degradation rate was slower (54.508 ± 6.133% in 4 weeks) compared to the non-crosslinked scaffold (84.075 ± 4.783%). Furthermore, the compressive strength was significantly higher (112.183 ± 2.907 MPa vs. 2.398 ± 0.142 MPa) ($p < 0.05$). The addition of glutaraldehyde significantly influenced the scaffold characteristics by enhancing its structural stability and mechanical performance, making it a promising candidate for bone tissue engineering applications.

Keywords: glutaraldehyde, scaffold, chitosan, blue swimming crab, bone defect.