ABSTRAK

Fabrikasi *Scaffold Nanofiber* Polikaprolakton/Pati Kentang dipadukan dengan Karbonat-Hidroksiapatit dari Cangkang Kerang Pokea sebagai Rekayasa Jaringan Tulang

Tulang dalam skala nanometer memiliki struktur yang dinamakan *extracellular matrix* (ECM). *Scaffold* digunkan untuk meniru struktur dan fungsi *extracellular matrix* (ECM). Strategi *scaffold* untuk meniru ECM adalah dengan membuat struktur *nanofiber* dengan komponen perpaduan antara fase organik-inorganik. Dalam riset ini komposit *scaffold*s *nanofiber* difabrikasi menggunakan Polikaprolakton (PCL) dan Pati kentang (PK) sebagai fase organik karbonat hidroksiapatit (CHA) sebagai fase inorganik. CHA disintesis dari kerang Pokea menggunakan metode hidrotermal dengan variasi suhu $120°C$, $160°C$ dan $200°C$. Komposit *scaffold*s *nanofiber* difabrikasi menggunakan PCL dan pati kentang dengan tambahan CHA dengan variasi massa 0%, 5%, 10%, dan 15% dengan *electrospinning*. Karakterisasi sampel dilakukan dengan menggunakan *X-Ray Diffraction* (XRD), *Fourier Transform Infrared* (FTIR) dan *Scanning Electron Microscope Energy Dispersive X-Ray Spectroscopy* (SEM-EDX) dan uji berupa uji mekanis, uji biomineralisasi, uji antibakteri, serta uji *MTT* untuk mengetahui viabilitas sel. Analisa XRD, FTIR, SEM, dan EDX menunjukan Cangkang Kerang Pokea (*Batissa Violacea Var. Celebensis*) dapat digunakan sebagai sumber kalsium dalam sintesis CHA. Dimana kalsium oksida dari cangkang kerang Pokea mengandung 74,33% kalsium.CHA berhasil disntesis dengan metode hidrotermal, dimana ukuran kristal terjadi peningkatan seiring peningkatan suhu hidrotermal. Rasio Ca/P CHA yang dihasilkan mendekati rasio Ca/P tulang yaitu secara berturut turut 1,69, 1,64 dan 1,52. Pengaruh variasi konsentarasi massa karbonat-hidroksiapatit terhadap *scaffold nanofiber* PCL/Pati kentang/CHA yaitu: menurunkan diameter fiber (~ 593 nm sampai ~ 384 nm). Sifat mekanis cenderung menurun seiring penambahan CHA. Uji biomineralisasi menunjukan *scaffold* bersifat bioaktif. Berdasarkan zona hambat anti bakteri *scaffold* bersifat anti bakteri kuat dengan diameter zona hambat (~ 11 mm sampai ~16 mm) pada bakteri *S. aureus* dan (~10 mm sampai ~15 mm) pada bakteri *P.G gingivalis.* Prensentasi viabilitas menunjukan *scaffold* bersifat *non-toxic* dan biokompatibel yaitu *nanofiber* PCL/PK/CHA 0% sebesar 85,94 % dan *nanofiber* PCL/PK/CHA 15% sebesar 95,03 %.

Kata kunci: *Scaffold*s *nanofiber*, karbonat hidroksiapatit, Polikaprolakton, Kerang pokea.

ABSTRACT

Fabrication of Polycaprolactone/Potato Starch Nanofiber Scaffolds combined with Carbonate-Hydroxyapatite from Pokea Clam Shells as Bone Tissue Engineering

Bones on the nanometer scale have a structure called extracellular matrix (ECM). Scaffolds are used to mimic the structure and function of the extracellular matrix (ECM). The scaffold strategy to mimic ECM is to create a nanofiber structure with components that combine organic-inorganic phases. In this research, composite nanofiber scaffolds were fabricated using polycaprolactone (PCL) and potato starch (PK) as the organic phase and carbonate hydroxyapatite (CHA) as the inorganic phase. CHA was synthesized from Pokea shellfish using the hydrothermal method with temperature variations of 120°C, 160°C and 200°C. Composite nanofiber scaffolds were fabricated using PCL and potato starch with the addition of CHA with mass variations of 0%, 5%, 10%, and 15% by electrospinning. Sample characterization was carried out using X-Ray Diffraction (XRD), Fourier Transform Infrared (FTIR) and Scanning Electron Microscope Energy Dispersive X-Ray Spectroscopy (SEM-EDX) and tests in the form of mechanical tests, biomineralization tests, antibacterial tests, and MTT tests for determine cell viability. XRD, FTIR, SEM, and EDX analysis show that Pokea Clam Shells (Batissa Violacea Var. Celebensis) can be used as a source of calcium in CHA synthesis. Where calcium oxide from Pokea shells contains 74.33% calcium. CHA was successfully synthesized using the hydrothermal method, where the crystal size increased as the hydrothermal temperature increased. The resulting CHA Ca/P ratio was close to the bone Ca/P ratio, namely 1.69, 1.64 and 1.52 respectively. The effect of varying the carbonate-hydroxyapatite mass concentration on the PCL/Potato Starch/CHA Nanofiber scaffold is reducing fiber diameter (~ 593 nm to ~ 384 nm). Mechanical properties tend to decrease with the addition of CHA. The biomineralization test shows that the scaffold is bioactive. Based on the anti-bacterial inhibition zone, the scaffold is strongly anti-bacterial with an inhibition zone diameter of (~ 11 mm to ~ 16 mm) for S. Aureus bacteria and (~ 10 mm to ~ 15 mm) for P. Gingivalis bacteria. The viability percentage shows that the scaffold is non-toxic and biocompatible, namely 0% PCL/PK/CHA nanofiber is 85.94% and 15% PCL/PK/CHA nanofiber is 95.03%.

Keywords: Nanofiber scaffolds, Carbonate hydroxyapatite, Polycaprolactone, Pokea shells.