Sarda Nugraheni : 2019. Desain Geometri *Scaffold* dengan Metode 3D *Printing* Berpasta *Injectable Bone Substitutes* (IBS). Skripsi ini di bawah bimbingan Dyah Hikmawati, S.Si., M.si dan Dr. Aminatun, Ir, M.Si. Program Studi Fisika, Departemen Fisika, Fakultas Sains dan Teknologi, Universitas Airlangga.

ABSTRAK

Pengaruh desain geometri terhadap ukuran pori, porositas, kuat tekan dan morfologi dari *scaffold* yang disintesis dengan metode 3D *printing* menggunakan *filament* polylactic acid (PLA) yang kemudian diisi dengan pasta *Injectable Bone Substitutes* (IBS) telah dipelajari pada penelitian ini. *Scaffold* didesain dengan geometri *Hexahedron, Truccated Hexahedron,* dan *Rhombicuboctahedron* yang mempunyai dimensi sel satuan 2,5 mm x 2,5 mm x 2,5 mm dengan ukuran *strut* 0,8 mm. Desain yang telah dibuat, dicetak dengan pencetakan 3D FDM (*Fused Deposition Modeling*) kemudian diisi dengan pasta IBS yang disintesis dengan mencampurkan hidroksiapatit dan gelatin 20% w/v dengan perbandingan 60:40 w/w , streptomisin 10 wt% dan *hydroxypropyl methylcellulose* (HPMC) 4% w/v. Dilakukan uji porositas untuk mengetahui persentase pori *scaffold.* Didapatkan porositas dari *scaffold* berpasta IBS sebesar 20,33–22,65% dengan porositas terbesar dimiliki oleh desain pori *Truccated Hexahedron*. Kuat tekan dari *scaffold* mengalami peningkatan setelah diinjeksi pasta IBS, yaitu 2,217-6,971 MPa yang sebelumnya memiliki kuat tekan 1,110-6,434 MPa pada *scaffold* tanpa IBS. *Scaffold* berpasta IBS mengalami degradasi sebesar 13,67-45,47% selama 4 minggu dan memiliki sifat antibakteri yang ditunjukkan oleh zona hambat yang dihasilkan pada uji antibakteri dengan kadar pelepasan streptomisin sebesar 2,01-6,61%.

Kata Kunci : *scaffold,* 3D *printing, polylactic acid* (PLA), *injectable bone substitutes* (IBS), hidroksiapatit, gelatin, streptomisin, *hydroxypropyl methylcellulose* (HPMC).

Sarda Nugraheni : 2019. Geometri Design Scaffold by 3D Printing Method with Injectable Bone Substitutes (IBS) Paste. This thesis is under guidance of Dyah Hikmawati, S.Si., M.si and Dr. Aminatun, Ir, M.Si. Physics Department, Faculty of Science and Technology, Airlangga University.

ABSTRAK

The effect of geometry design on pore size, porosity, compressive strength, and morphology of scaffold was sinthesized by 3D printing method using polylactic acid (PLA) filament and filled with Injectable Bone Substitutes (IBS) paste were investigated in this study. Scaffold was designed with geometry Hexahedron, Truccated Hexahedron, dan Rhombicuboctahedron which the dimension is 2,5 mm x 2,5 mm x 2,5 with size of strut 0,8 mm. The design was made, was casted by 3D FDM (Fused Deposition Modeling) then was filled with IBS paste which was synthesized by mixing hidroxyapatit and gelatin 20% w/v with rasio 60:40 w/w , streptomicyn 10 wt% and hydroxypropyl methylcellulose (HPMC) 4% w/v. Porosity analyzing was done to analyze the presentage of scaffold pores. It was found that porosity of scaffold with IBS paste is around 20,33–22,65% with the highest porosity is Truccated Hexahedron design pore. Scaffold compressive strength was increased after being injected of IBS paste, about 2,217-6,971 MPa which has compressive strength 1,110-6,434 MPa before, without IBS paste. Scaffold with IBS paste has degradation about 13,67-45,47% for 4 weeks and has antibacterial properties identified by inhibition zone which was found in antibacterial test with amount release of streptomycin 2,01-6,61%.

Keywords : scaffold, 3D printing, polylactic acid (PLA), injectable bone substitutes (IBS), hidroxyapatit, gelatin, streptomicyn, hydroxypropyl methylcellulose (HPMC).