

Wardhani, Inten Firdhausi. 2019. **Uji *In Vitro Scaffold Berpasta IBS dengan Metode 3D Printing untuk Mengatasi Spinal Tuberculosis***. Skripsi ini dibawah bimbingan Dyah Hikmawati, S.Si, M.Si dan Dr. Ir. Aminatun, M.Si., Program Studi S-1 Teknik Biomedis, Departemen Fisika Fakultas Sains dan Teknologi, Universitas Airlangga.

ABSTRAK

Indonesia menduduki peringkat ketiga jumlah penderita *Tuberculosis* (TB) terbanyak di dunia. Bukan hanya paru-paru, penyakit ini juga dapat ditemukan pada tulang belakang (*spinal tuberculosis*). *Spinal tuberculosis* dapat berakibat pada terganggunya sistem syaraf serta destruksi tulang belakang. Penelitian bertujuan untuk mengombinasikan *scaffold* tulang hasil cetak 3D dengan pasta *Injectable Bone Substitute* (IBS). Lima variasi ukuran pori *scaffold* (600, 800, 1.000, 1.200, dan 1.400 μm) dicetak dengan bahan filamen *Poly lactide Acid* (PLA) menggunakan 3D *printing* dengan teknik FDM. Pasta IBS disintesis dengan mencampurkan nano hidroksiapatit (HA), gelatin, *hydroxypropyl methylcellulose* (HPMC), dan streptomisin. Hasil uji FTIR *scaffold* berpasta IBS menunjukkan bahwa sampel ini mengandung gugus fungsi yang khas dari masing-masing bahan penyusunnya, yakni *stretching* C-H dari PLA, PO_4^{3-} dari nanoHA, amina dari gelatin, eter dari streptomisin, *stretching* C-OH dari HPMC. Karakteristik *scaffold* hasil cetak 3D memiliki porositas berkisar pada 55,570% hingga 68,013%. Uji morfologi menunjukkan pasta IBS yang telah *setting* masih menyisakan mikropori pada permukaan *scaffold*. Uji pelepasan obat menunjukkan bahwa *scaffold* dapat menjadi media penghantar obat anti-TB yang diperkuat dengan hasil positif dari uji anti-TB. Uji sitotoksisitas membuktikan bahwa *scaffold* dan pasta IBS bersifat nontoksik. Hasil uji degradasi menunjukkan bahwa selama 18 hari, *scaffold* mengalami proses degradasi yang ditandai dengan perubahan pH. Dengan demikian, dapat dinyatakan bahwa *scaffold* tulang hasil cetak 3D berpasta IBS dapat dijadikan sebagai alternatif penyembuhan dan penghantar obat *spinal tuberculosis*.

Kata kunci: spinal tuberculosis, scaffold tulang, 3D printing, IBS, penghantar obat

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ABSTRACT

Indonesia ranked the 3rd highest number of tuberculosis (TB) sufferers worldwide. Not only the lungs, this disease could also be found in the spine (spinal tuberculosis). Spinal tuberculosis could cause disruption of the nervous system and spinal destruction. This study was aimed on an innovation of combining 3D printed bone scaffold with Injectable Bone Substitute (IBS) paste. Five variations of the scaffold pore sizes (600, 800, 1000, 1200, and 1400 μm) based on Polylactide Acid (PLA) filament were printed using 3D printing with FDM method. IBS paste was synthesized by mixing nano hydroxyapatite (HA), gelatin, hydroxypropyl methylcellulose (HPMC), and streptomycin. FTIR test for IBS associated-scaffold showed that this sample contains a functional group that is typical of each constituent material, i.e. stretching C-H from PLA, PO_4^{3-} from nanoHA, amine from gelatin, ether from streptomycin, and stretching C-OH from HPMC. The 3D printed scaffold characteristic have porosity ranging from 55.860% to 68.017%. Morphological test showed that IBS paste which had been setting still left micropore on the surface of the scaffold. Drug release test indicated that scaffold could be a medium for delivering anti-TB drugs that was also reinforced by positive results from the anti-TB test. Cytotoxicity test proved that the scaffold and IBS paste are nontoxic. The degradation test result showed that for 18 days, the scaffold undergoes a degradation process characterized by pH changing. Thus, it could be stated that IBS associated- 3D printed bone scaffold can be used as an alternative healing and drug delivery agent for spinal tuberculosis.

Keywords: spinal tuberculosis, bone scaffold, 3D printing, IBS, drug delivery