

INTISARI

Hydroxiapatite sebagai bahan biokeramik yang *compatible* dengan tubuh digunakan untuk kebutuhan medis. Bioplastik terbuat dari *cassava starch* yang bersifat *biodegradable*. *Sericin* adalah protein yang telah diketahui mampu meningkatkan interaksi sel dengan material. *Sericin* terbuat dari *cocoon* ulat sutera *bombyx mori*. Biokomposit yang dikembangkan terdiri dari komposisi [*Hydroxyapatite*/*Bioplastik*/*Sericin*] berbentuk pasta untuk dicetak menjadi spesimen menggunakan mesin *printer* ekstrusi tiga dimensi. Tujuan dari penelitian ini adalah mengkaji sifat mekanis dan struktur mikro dari pasta biokomposit [*Hydroxyapatite*/*Bioplastik*/*Sericin*] yang dicetak dengan menggunakan mesin *printer* ekstrusi 3 dimensi.

Subjek penelitian ini adalah pasta biokomposit yang terdiri dari *hydroxyapatite* (Sigma Aldrich), *cassava starch* (PT. Budi Starch & Sweetener TBK) dan *sericin* (*Bombyx mori*). Variasi komposisi biokomposit yaitu A(40% HA/60%bP); B(50%HA/50%bP); C(60%HA/40%bP) dan D (70%HA/30%bP) tiap variasi komposisi ditambah *sericin* 0,3% w/w dari suspensi HA. Pengaturan gerak mesin *printer* ekstrusi 3 D yaitu *infill speed* 60 mm/s, *print speed* 60 mm/s dan *layer height* 0,35 mm. Pengujian sifat mekanis yang dilakukan yaitu uji tarik dan uji lengkung. Dimensi spesimen uji lengkung disesuaikan dengan ASTM D 790 dan spesimen uji tarik disesuaikan dengan ASTM D 638 tipe 4. Pengamatan bentuk struktur mikro dan unsur menggunakan *scanning electron microscope* (SEM-EDX).

Komposisi C [Suspensi HA 60%:40% Bioplastik] ditambah *sericin* 0,3% w/w dari suspensi HA mempunyai nilai rerata tertinggi kekuatan tarik/ *tensile strength* (σ_t) sebesar $2,51 \pm 0,45$ MPa dan nilai rerata tertinggi kekuatan lengkung/*flexural strength* (σ_{fs}) yaitu sebesar $3,89 \pm 1,26$ MPa. Hasil pengamatan menggunakan SEM tidak nampak agglomerasi HA dan partikel HA murni juga tidak nampak. Pada pengujian SEM-EDX diketahui struktur mikro berbentuk jarum/*needle* mempunyai unsur dominan O (*Oxygen*), unsur Ca (*Calcium*), P (*Phospor*) dan C (*Carbon*) pada kulit atom K.

Kata kunci: biokomposit, *hydroxyapatite*, kekuatan tarik, kekuatan lengkung, struktur mikro, mesin *printer* ekstrusi 3 D

ABSTRACT

Hydroxyapatite as bioceramics material that is compatible to the body and usually had been used for medical needs. Bioplastics made from cassava starch which is biodegradable, while sericin is made from Bombyx mori silkworm cocoons, a protein that has been known to increase the interaction of cells with the material. Biocomposites developed consisting of the composition [Hydroxyapatite/ Bioplastics/Sericin] in pasta form to be printed into specimens using extrusion machine three-dimensional printer. The aim of this study is to examine the mechanical properties and microstructure of pasta biocomposites [Hydroxyapatite/Bioplasic/Sericin] were printed using 3 D printer extrusion machine.

The subjects were pasta biocomposite composed of hydroxyapatite (Sigma Aldrich), cassava starch and sericin (Bombyx mori). Variation of biocomposite composition is namely A (40 % HA/60 % bP); B (50 % HA/50 % bP); C (60 % HA/40 % bP) and D (70 % HA/30 % bP) each variation of composition were added with sericin 0.3 % w/w of the suspension HA. Motion 3 D bioprinter were set up with infill speed is 60 mm/s, print speed is 60 mm/s and the layer height is 0.35 mm. Mechanical properties test which is the flexural test and tensile test. Dimensions of flexural test specimen were adjusted on ASTM D 790 and tensile test specimens were adjusted on ASTM D638 Type 4. Observation of microstructure shape and element using a scanning electron microscope (SEM – EDX).

Results of tensile test and flexural test obtained a composition which has the highest mechanical properties. Composition C [HA Suspension 60 %:40 % Bioplasic] added sericin 0.3 % w / w of the suspension HA has the highest mean value of tensile strength (σ_t) were 2.51 ± 0.45 MPa and the highest mean value of flexural strength (σ_{fs}) is 3.89 ± 1.26 MPa. The results of microstructure observation with SEM has known at shape and size of the microstructure biocomposites. HA agglomeration is not appear and also particle HA does not appear on the observations using SEM. In the SEM - EDX testing known needle-shaped microstructure has a dominant element of O (Oxygen), the element Ca (Calcium), P (Phosphorus) and C (Carbon) at the skin of atom (K).

Keywords: *biocomposite, hydroxyapatite, tensile strength, flexural strength, microstructure, 3 D printer extrusion machine*