Karakterisasi komposit hydroxyapatite/silk fibroin dengan metode in situ berbantukan iradiasi gelombang mikro = Characterization of hydroxyapatite/silk fibroin composites by in situ method assisted by microwave irradiation

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Abstrak

Teknik rekayasa jaringan digunakan untuk memperbaiki jaringan rusak dengan menggunakan pengganti biologis. Saat ini,para peneliti mengembangkan implan untuk rekayasa jaringan. Material berbasis polimer sebagai bahan implan banyak menarik perhatian karena biaya realtif murah, sumber berlimbah dan dapat diterima tubuh. Pendekatan material rekayasa jaringan tulang didasari dengan substansi dari material penyusun tulang. Pada penelitian ini digunakan hidroksiapatit yang berfungsi sebagai filler karena mampu memberikan kekerasan yang baik dan meningkatkan kemampuan adhesi (perekatan) sel. Silk Fibroin berfungsi sebagai matriks yang berfungsi untuk meningkatkan elastisitas dan sifat mekanik komposit. Hidroksiapatit berhasil ditumbuhkan pada silk fibroin dengan metode in-situ berbantukan iradiasi gelombang mikro (720 W; 15 menit). Larutan SF yang telah diekstraksi dengan Adjisawa reagent dicampurkan dengan larutan kalsium fosfat yang telah dipreparasi menggunakan Ca(OH)2 dan (NH4)2HPO4 sebagai prekursor. Pengaruh rasio SF terhadap kekerasan komposit HA/SF diamati pada variasi rasio (v/v) yaitu HA90/SF10, HA80/SF20, dan HA70/SF30. Hasil XRD didapatkan bahwa ukuran kristal (L) dan indeks kristalinitas (CI) menurun seiring bertambahnya rasio SF pada komposit. Indeks kristalinitas terbesar terhitung pada sampel HA90/SF10 yaitu 32,6 dan 0.885. FTIR dipilih pada sampel HA70/SF30 didapatkan gugus fungsional utama yaitu pada bilangan gelombang 569, 608, 900, dan 1036, amida I pada bilangan gelombang 1636, amida II pada bilangan gelombang 1527 dan amida III pada bilangan gelombang 1264 yang menandakan bahwa HA dan SF saling mengikat menggambarkan bahwa kandungan SF mempengaruhi ukuran partikel, dimana semakin banyak kandungan SF maka semakin menurun ukuran partikel yang terbentuk. Hasil uji mekanik microvickers menunjukkan bahwa semakin banyak rasio SF dalam komposit HA/SF mengakibatkan semakin tinggi nilai kekerasan komposit ditandai dengan nilai kekerasan sampel HA70/SF30 yaitu 0,0335 GPa, sampel HA80/SF20 sebesar 0,0278 GPa dan sampel HA90/SF10 sebesar 0,0266.

.....Tissue engineering techniques are used to repair damaged tissue using biological substitutes. Currently, researchers are developing implants for tissue engineering. Polymer-based materials as implant materials have attracted a lot of attention because of their relatively low cost, wasteful sources and acceptable to the body. The bone tissue engineering material approach is based on the substance of the bone building material. In this study, hydroxyapatite was used as a filler because it was able to provide good hardness and increase cell adhesion. Silk Fibroin serves as a matrix that serves to increase the elasticity and mechanical properties of the composite. Hydroxyapatite was successfully grown on silk fibroin by in-situ method assisted by microwave irradiation (720 W; 15 minutes). The SF solution that had been extracted with Adjisawa reagent was mixed with a calcium phosphate solution that had been prepared using Ca(OH) 2 and (NH4)2HPO4 as a precursor. The effect of the SF ratio on the hardness of the HA/SF composite was observed in the variation of the ratio (v/v) namely HA90/SF10, HA80/SF20, and HA70/SF30. XRD results

showed that the crystal size (L) and crystallinity index (CI) decreased with increasing SF ratio in the composite. The largest crystallinity index was calculated for the HA90/SF10 sample, namely 32.6 and 0.885. FTIR was chosen on the HA70/SF30 and the main functional groups were found at wave numbers 569, 608, 900, and 1036 ,amide I at wave number 1636 ,amide iI at wave number 1527 and amide III at wave number 1264 which indicates that HA and SF bind to each other. The SEM results show that SF content affects particle size, where the more SF content, the particle size was decrease. The results of the microvickers mechanical test showed that the higher the ratio of SF in the HA/SF composite, the higher the hardness value of the composite was indicated by the hardness value of the HA70/SF30 sample, which was 0.0335 GPa, the HA80/SF20 sample of 0.0278 GPa and the HA90/SF10 sample of 0.0278 GPa. 0.0266.