

Hidrogel PVA/Gelatin Terenkapsulasi Propolis Untuk Perancah Rekayasa Jaringan Patch Jantung = Propolis-Incorporated Gelatin/PVA Hydrogel for Cardiac Patch Scaffold Tissue Engineering

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Abstrak

Ekstrak flavonoid yang terkandung didalam propolis telah terbukti dapat meningkatkan fungsi jantung pasca myocardial infarction (MI). Penelitian ini bertujuan untuk mempelajari pengaruh propolis terhadap karakteristik swelling, profil rilis, degradasi, dan toksisitas hidrogel polivinil alkohol (PVA)-gelatin untuk aplikasi perancah patch jantung. Perancah hidrogel PVA/gelatin difabrikasi menggunakan metode freeze thaw dengan penambahan propolis sebanyak 3%, 7%, dan 10%. Inkorporasi propolis didalam matriks hidrogel menyebabkan penurunan swelling ratio hidrogel menjadi sekitar 254%, 221% dan 190% saat penambahan propolis sebanyak 3%, 7%, dan 10% secara berurutan. Kemampuan swelling ini mampu menjadikan hidrogel sebagai sistem penghantar obat yang melepas propolis melalui mekanisme sustained released. Dalam durasi 6 jam, perancah hidrogel mampu melepas propolis sebanyak 4,30%, 4,86%, dan 5,68% seiring dengan meningkatnya kandungan propolis 3%, 7%, dan 10%. Penambahan konsentrasi propolis terbukti memodifikasi laju degradasi hidrogel dimana seiring penambahan propolis, weight loss yang diamati semakin tinggi. Sampel dengan propolis 3%, 7%, dan 10% mengalami pengurangan berat sebanyak 31%, 41%, dan 48% secara berurutan. Degradasi yang terjadi pada hidrogel mengikuti mekanisme surface erosion sehingga memungkinkan patch terdegradasi dalam lingkungan biologis seiring perbaikan jaringan jantung. Hasil uji sitotoksitas mendapati nilai viabilitas sel pada kadar propolis 3%, 7% dan 10%, adalah 77%, 94%, dan 80% secara berurutan. Nilai viabilitas sel menunjukkan bahwa propolis tidak menghambat metabolisme sel HEK-293 dan tidak bersifat toksik. Penelitian ini menunjukkan propolis dapat dienkapsulasi ke dalam matriks hidrogel sebagai sistem penghantaran obat maupun sebagai perancah patch jantung yang berpotensi mempercepat regenerasi jaringan baru.

.....Flavonoid extracts contained in propolis have been shown to improve heart function after myocardial infarction (MI). This study aims to study the effect of propolis on swelling characteristics, release profile, degradation, and toxicity of hydrogels made from polyvinyl alcohol (PVA)-gelatin for cardiac patch scaffold applications. The PVA/gelatin hydrogel scaffolds were fabricated using the freeze thaw method with the addition of 3%, 7% and 10% propolis. The incorporation of propolis in the hydrogel matrix led to a decrease in the swelling ratio of the hydrogel to around 254%, 221% and 190% when the concentration of propolis was 3%, 7% and 10% respectively. This swelling behavior turns the hydrogel into a drug delivery system that releases propolis through a sustained release mechanism. Within 6 hours, the hydrogel scaffolds were able to release 4.30%, 4.86%, and 5.68% of propolis as the propolis concentration increased by 3%, 7%, and 10%. The addition of propolis concentration has been shown to modify the hydrogel degradation rate as when propolis is added, the observed weight loss is higher. Samples with 3%, 7%, and 10% propolis experienced a weight reduction of 31%, 41%, and 48%, respectively. The degradation that occurs in the hydrogel follows the surface erosion mechanism so that it enables the patch to degrade in a biological environment as cardiac tissue repairs. Cytotoxicity test results found cell viability values at propolis levels of 3%, 7% and 10% were 77%, 94% and 80% respectively. This research shows that propolis can be

incorporated into a hydrogel matrix as a drug delivery system or as a cardiac patch scaffold which has the potential to accelerate the regeneration of new tissue.