

Tissue engineering scaffold of chitosan/silk fibroin/poly(vinyl alcohol) for dental bone regeneration: Effect of crosslinker

Yeewa Sukkerd¹, Gareth Ross¹, Sararat Mahasaranon¹ and Sukunya Ross^{1*}

¹Biopolymer Group, Department of chemistry, Biomaterial Excellent Center, Faculty of science, Naresuan University, Phitsanulok 65000 Phone 0-5596-3445, Fax 0-5596-3401, *E-Mail: sukunyaj@nu.ac.th

Abstract

This work is concerned with the fabrication and characterization of a tissue engineering scaffold targeted for use in bone regeneration. The scaffold was designed to have an interconnecting porous structure and fabricated by natural and degradable materials like silk fibroin (SF) (helping to stimulate cell adhesion and proliferation) and chitosan ((CS) enhancing bone regeneration), cooperated with poly(vinyl alcohol)(PVA)(scaffold support) and a crosslinker (dimethyl urea, DMU) to strengthen the physical property of scaffolds. Effect of DMU concentration was preliminarily observed in CS/DMU scaffolds and then an appropriate concentration of DMU was chosen to fabricate in PVA/CS/SF scaffolds (5:1.4:3.75 %w/v). The porous structure of the scaffolds was created by lyophilization after mixing the desired compositions at 60°C for 1 h, in order to obtain a homogenous mixture. In this work, scaffolds CS scaffolds were crosslinked by DMU, it was found that 20 %w/w DMU promoted the high amounts of interconnecting porous structure with pore size diameter between 50-100 µm. When, PVA and SF were added to the scaffolds, the mixture solution added 20 %w/w DMU still contained the interconnected porous structures with pore size diameter between 10-100 µm. The results show that adding DMU into the scaffolds promoted regularity in the porous structure, while adding SF enhanced the size of the porous structure with interconnecting structures as well as promoting improved flexibility in the scaffolds. Due to its biodegradability, porosity and interconnectivity of this PVA/CS/SF/DMU scaffold, it has potential to be used as a tissue engineering scaffold for dental bone regeneration.

Keywords: Tissue engineering, Scaffold, Silk fibroin, Chitosan