A comparative study on glutaraldehyde crosslinking methods of three-dimensional Thai silk fibroin/gelatin scaffolds for medical application

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Abstract: Thai silk fibroin (SF), type A gelatin (GA), and the mixed SF/GA (50/50) scaffolds were fabricated by freeze-drying and crosslinked with glutaraldehyde (GTA) using 2 techniques, blending GTA with the SF/GA solution (blending) and immersion of SF/GA scaffolds in a GTA solution (immersion). Properties of the scaffolds were characterized while the concentration of GTA for the crosslinking by 2 methods were systematically optimized. We showed that GTA could successfully crosslink all scaffolds and the crosslinking degree depended on crosslinking method, GTA concentration, and scaffold type. The SF scaffolds achieved the high crosslinking degree by using the immersion technique. GTA blending technique could crosslink the GA and SF/GA scaffolds in dose-dependent manner. The SF and SF/GA scaffolds had significantly higher gel fraction than the GA scaffolds, particularly those crosslinked by immersion technique. In addition, all GTA-crosslinked scaffolds remained good water swelling ability with the swelling ratios around 6-14-fold. The SF and SF/GA scaffolds crosslinked by immersion technique seemed to have better swelling ability than the GA scaffolds. In summary, the method of crosslinking and concentration of GTA had crucial influence on crosslinking degree and properties of the obtained scaffolds. The GTA-crosslinked SF/GA scaffolds can be used in various medical applications.

Keywords: Gelatin; Silk fibroin; Scaffold; Glutaraldehyde; Crosslinking method