Biomaterials and Biomechanics in Bioengineering, *Vol. 1, No. 2 (2014) 63-71*
(Formerly, Biomaterials and Biomedical Engineering)
DOI: http://dx.doi.org/10.12989/bme.2014.1.2.063

Synthesis and characterization of silk fibroin-bioactive glass hybrid xerogels

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(Received November 29, 2013, Revised March 25, 2014, Accepted April 4, 2014)

Abstract. This study aimed to develop a novel bioactive hybrid xerogel consisting of silk fibroin /SiO_2-CaO-P_2O_5 by sol-gel process at room temperature. Scanning electron microscopy (SEM), FT-IR Spectroscopy, pore measurement, mechanical property testing, in vitro bioactivity test and cytotoxicity assay were performed to characterize the xerogel for bone tissue engineering application. We have found that the xerogel possessed excellent pore structures and mechanical property. Once immersed in a simulated fluid (SBF), the xerogel exhibited profound bioactivity by inducing hydroxyapatite layers on its surfaces. The cell toxicity study also demonstrated that there was little toxic to MC3T3-E1 cells. These results indicate that silk fibroin /SiO_2-CaO-P_2O_5 hybrid xerogel potentially could be used as a bone tissue engineering material.

Keywords: hybrid; xerogel; silk fibroin; SiO_2-CaO-P_2O_5; bone tissue engineering

1. Introduction

The ability to regenerate and self-repair for bone is naturally powerful, but a considerable amount of bone loss or the development of adverse microenvironment could hinder the capacity of spontaneous healing, such as in trauma, infection, tumor resection, bone aging and congenital malformation. Even the current clinical solutions to these problems rely on autologous bone grafting and allografting, but all of them have their own disadvantages. Therefore, the search for new bone repair strategies is imperative. The approaches of bone tissue engineering hold the promise of great therapeutic potential indeed (Grabowski and Cornet 2013, Vallet-Regí *et al*. 2011, Thian and Best 2008). The development of a new class of scaffold materials is a key step in bone tissue engineering.

Bioactive glasses are a group of synthetic, surface-active, composition-dependent and silica-based bioactive materials, composed of SiO_2-CaO-P_2O_5 chemically bond to tissue without an intervening fibrous layer. There are versatile appealing characteristics for scaffold materials in

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 ISSN: 2288-3738 (Print), 2288-3746 (Online)

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