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PRELIMINARY CHARACTERIZATION OF PLGA SCAFFOLD FOR INTERVERTERBRAL DISCS TISSUE ENGINEERING

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ABSTRACT

Poly(lactic-co-glycolic acid) or (PLGA) has attracted considerable interest for biomedical applications due to its biodegradability and approval for clinical use. This study aimed to characterize PLGA in terms of swelling capacity, compression test and scanning electron microscopy (SEM). The PLGA scaffold was fabricated using the solvent casting, salt leaching technique. For swelling test, the scaffolds were subjected to soaking in water for 48 hours. Compression test was performed using Instron E300 Machine. Results indicated that PLGA had swelling ability more than 100% [201.82%±48.51]. Compressive strength of PLGA showed average load of 84.01N±39.33. SEM demonstrated interconnected pores in the scaffold. Further tests need be done to characterize PLGA and its combination with other materials in terms of degradation and thermal properties.

1.0 Introduction

Low back pain (LBP) often associated with degeneration of the intervertebral discs (IVD). It is a major public health problem that affects a large number of people. Estimated 25% to 80% of adults over the course of their life experience significant LBP [1]. The underlying causes are primarily from genetic inheritance, aging, nutritional compromise, and loading history [1]. Most available treatments are limited to alleviate the symptoms rather treating the causes. Tissue engineering emerges as a tool for tissue regeneration. Biomaterial scaffolds is one the main components in tissue engineering [1]. PLGA is biocompatible and biodegradable material that has considerable mechanical properties. Most importantly, it is a FDA approved copolymer and extensively used in biomedical applications [2]. This study intended to characterized PLGA based on swelling capacity, compression testing and morphology observation.

2.0 Materials and Method

PLGA was prepared using solvent casting, salt leaching method [3]. Sieved sodium chloride (NaCl) particles (250 μm) was dispersed in a PLGA/methylene chloride solution (0.2% w/v), and then cast into silicone moulds. The scaffolds were immersed in deionized water for 48 hours to leach out NaCl, freeze-dried and kept at 4°C until use. Swelling test was performed by measuring the weight of the scaffolds after 24 hours soaking in water. The wet weight was measured and converted into percentage. The compression test was conducted at a compression speed of 1mm/s and trigger force 0.5N using Instron E300 Machine. The morphology of scaffold was observed using SEM.

3.0 Results

Swelling test demonstrated all PLGA scaffolds have more than 100% swelling percentage (Figure 1). Compression test showed PLGA has an average strength of 84.01N (Figure 2). SEM results demonstrated interconnected pores in PLGA scaffold (Figure 3).

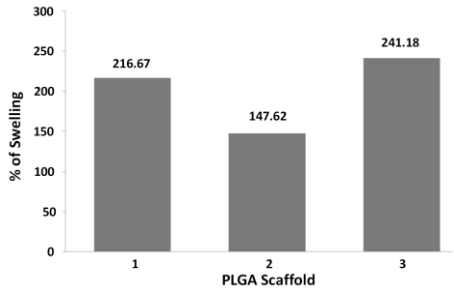

Fig. 1 Swelling test result for PLGA scaffold.

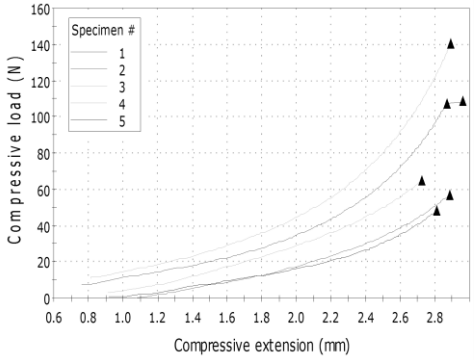

Fig. 2 Compression testing of PLGA scaffold

4.0 Discussions & Conclusions

PLGA demonstrated water retention ability twice that its weight. This can be a good indication for maintaining the IVD tissue irrespective of PLGA characteristics, which are less hydrophilic, less water absorption and degrade more slowly [4]. The compressive testing indicated that PLGA is able to resist load of 80N, which correspond to axial load. SEM showed interconnected pores although the pores are not well develop due to the swelling phenomenon. Formation of good pores is important particularly for cell attachment and migration [2]. PLGA may become promising tool for IVD regeneration and need to be evaluated further.

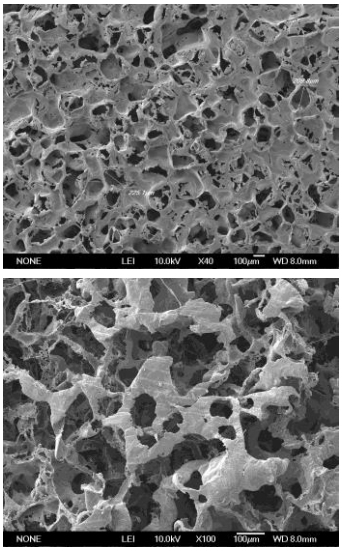

Fig. 3 Morphology and surface area of PLGA scaffold showing interconnectivity of the pores.

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