

Poly(amino acid) based nano gel fibers for tissue engineering

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The importance of nanotechnology is well recognized in the area of biomedical applications. The interest in the development of biocompatible and biodegradable polymer matrices has increased with their usability in wide range. In many biological applications, such as tissue engineering, there is a desire for well-defined 3D scaffolds with high surface area for cell attachment and growth. The use of electrospinning enables the possibility to prepare such tailored meshes, however the use of water soluble polymers is inappropriate because of their fast dissolution in biological fluids. By utilizing reactive electrospinning technique, chemically crosslinked gel fibers can be created which without enzymatic or chemical degradation will not dissolve in physiological conditions.

Poly(amino acid)-based polymers that have desirable chemical, mechanical and biological properties have recently emerged as promising new class of biomaterials [1]. In our work we have utilized the anhydrous form of poly(aspartic acid), the poly(succinimide) as base polymer. In order to imitate the structure of the backbone of the connective tissue, electro-spinning technique was applied to prepare artificial extracellular matrix. To prevent the polymer fibers from dissolution poly(succinimide) molecules were grafted by thiol side chains. During the electro-spinning process at 10 kV (0.8 ml/h flow rate and 15 cm target distance) cross-linking reaction took place between the side chains. The mean value and distribution of the fibre diameter were determined with AFM and light microscope after the sample preparation [3]. Investigation of swelling behaviour due to the change of pH was carried out on the macroscopic matrix of nanofibers. In vitro biocompatibility test with human fibrosarcoma (HT1080) and human fibroblast cells was performed. It was followed by in vivo experiments on 6-6 albino rats for 72 h and 1 week period. We have found that cross-linked poly(succinimide) based fiber matrix hydrolyzes in 72 hours and turns into poly(aspartic acid) based hydrogel matrix degrades in 1 week. Our novel biocompatible and biodegradable artificial scaffold seems to be a promising poly(amino acid) based fiber matrix for tissue replacement.

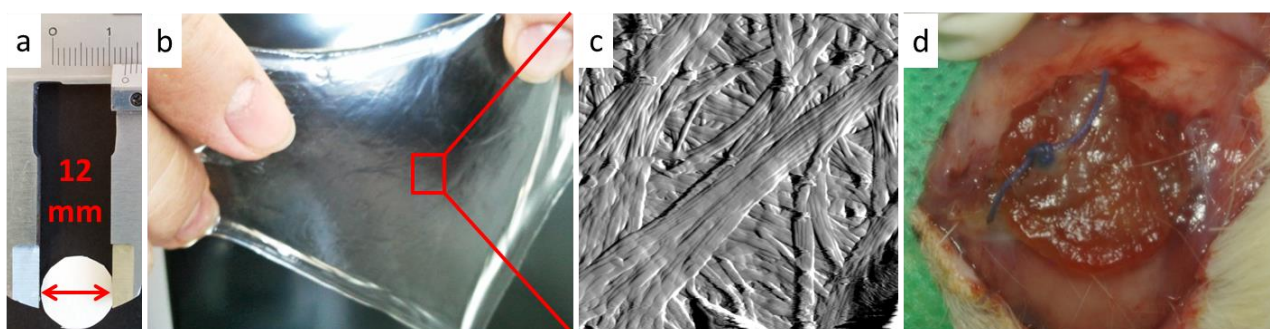


Figure 1.: (a) dry PSI based matrix before implantation, (b) the poly(aspartic acid) based system in wet state after preparation, (c) the AFM image of the dried PASP based fibers and (d) hydrolysed sample after 72 h *in vivo*.

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