POLY(L-LACTIDE-*CO*-GLYCOLIDE) MEMBRANES MODIFIED WITH RGD-POLY-(2-OXAZOLINE) FOR BIOMEDICAL APPLICATION

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Introduction

The demand for biomaterials for dental applications is still growing [1]. POx as well as arginine, glycine and aspartic acid sequences (RGD) are considered as very powerful molecules, which can change properties of membranes and improve cell adhesion [2]. The aim of this study was to prepare and evaluate the properties of a surface-modified resorbable poly(L-lactide-*co*-glycolide) (PLGA) membrane for guided tissue regeneration (GTR). For this purpose, we used poly(2-oxazoline) (POx) grafted with cell adhesive RGD sequences to modify the surface of PLGA membranes. The membranes were produced by one-step phase separation process between PLGA, poly(ethylene glycol) (PEG) and POx_RGD (or POx), dissolved in dichloromethane (DCM) followed by PEG leaching.

Materials and Methods

PLGA (85:15, Mn=100 kDa, d=1.9), PEG (400 Da), POx (methyl-P[MeOx37-b-BuOx-23-b-MeOx37-pipeidine(P2-P2) (Mn=8 kDa,d=1.14) or RGD-grafted POx (POx_RGD) were dissolved in DCM, casted on Petri dishes, dried in air and under vacuum, followed by soaking in UHQ-water for PEG leaching to obtain the membranes (M_POx) and (M_POx_RGD).

PLGA membranes (M) and PLGA foils without POx (Foil) as reference materials were prepared. Microstructure of the samples was observed under scanning electron microscopy (SEM). Water contact angle, Raman spectroscopy and Fourier transform infrared spectroscopy (FTIR) were used to characterise the materials. Cytocompatibility tests were performed with osteoblast-like MG-63 cells for 4, 24 and 72 h. Viability was measured by resazurin reduction; phalloidin/DAPI and live/dead staining tests were done.

Results and Discussion

Phase separation between PLGA and PEG followed by PEG leaching was found useful in producing porous asymmetric membranes. Addition of POx and POx-RGD to the system influenced topography of the M_POx and M_POx_RGD, by changing average pore size on the upper and lower sides of the membrane (FIG. 1). Addition of POx and POx_RGD also influenced wettability of the membranes and reduced water contact angle as compared to foil and non-modified membrane (FIG. 2). Application of Raman and FTIR spectroscopy allowed for characterization of chemical differences occurring between the investigated membranes (data not shown).

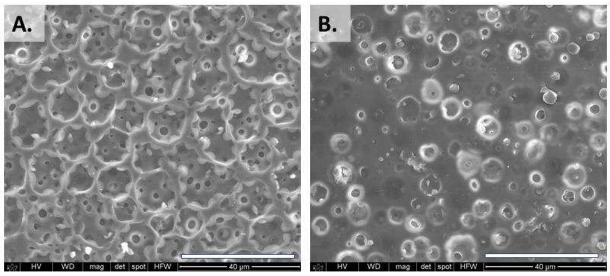

FIG. 1. SEM morphology of M_POx_RGD membrane, upper (A) and lower (B) side. Scale bar = 40 µm. Magnification 2000x.

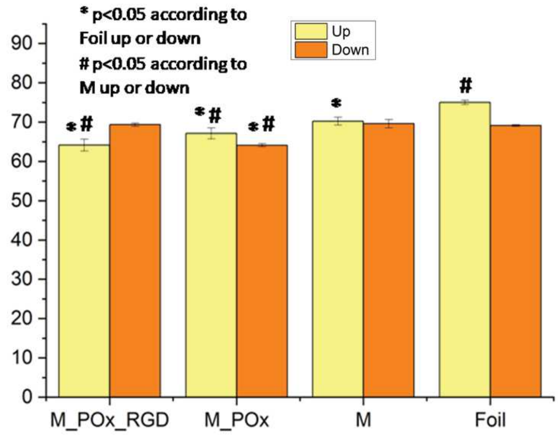

FIG. 2. Results of wettability for M_Pox_RGD membrane, M_POx membrane, PLGA membrane (M) and PLGA foil. Level of significance at the level * $p<0.05$ according to Foil up or down and membrane up or down.

Conclusions

One-step phase separation process resulted in M_POx_RGD membranes, which were found cytocompatible with osteoblast-like MG-63 cells. M_POx_RGD supported adhesion of the cells as compared to foil and M. Obtained membranes can be considered for GTR in stomatology, periodontology and in bone tissue engineering.

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