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Catalyst Free Plasma Assisted Copolymerization of Poly (ε-caprolactone)-Poly (ethylene glycol) for Biomedical Applications

Farzaneh Arefi-Khonsari[1], Sudhir Bhatt[2], Jerome Pulpytel[2], Mirshahi Massoud[3]

[1]UPMC-ENSCP, Paris, France [2]UPMC - ENSCP, Paris, France [3]UMRS 872, Paris, France

farzi-arefi@chimie-paristech.fr

Poly (ε-caprolactone)-poly (ethylene glycol) (PCL-PEG) copolymers have great potential applications in the fields of nanotechnology, tissue engineering, pharmaceutics and medicinal chemistry.In the present work we address on the development of catalyst free ROP strategy to obtain nano sized, amphiphilic and biocompatible PCL-PEG copolymer coatings at ambient temperature.PCL-PEG coatings have been developed by catalyst free ROP of ε-CL in the presence of diethylene glycol methyl ether (DEGME) in a low pressure inductively excited rf (13.56MHz) pulsed discharge to avoid excessive fragmentation of the two precursors used.Experiments were performed at different ε-CL/EG monomer feed ratio and effective power.The resulting PCL-PEG coatings were characterized by FTIR-ATR, XPS, ellipsometry and WCA.The chain propagation and molecular weight of copolymers were determined by 1H NMR spectroscopy and MALDI ToF measurements.The degree of polymerization for PCL and PEG were calculated from the 1H NMR spectral analysis which was around 7 and 23 repeat units respectively.The copolymer coatings were stable after 30 min of soaking in water.NIH:OVCAR-3, HBMEC and Embryologic fibroblast cells were cultured in physiological conditions and were seeded in a microplate which was loaded with autoclaved coated glass cover slips for 24, 48 and 72 hours.The fluorescent images of cytoskeleton stain were used to study the cell adhesion and proliferation on the plasma coated surfaces.The results show that by gradually varying the ε-CL/EG partial pressure ratio of the monomers from 100% to 25%, the C-O/C-C ratio increased and the cell adhesion follow the same trend.Thus, PCL-PEG plasma copolymers are promising materials that can be used to control cell adhesion.The global objective of this work is to tailor the surface properties of PCL by copolymerizing it with PEG in the pulsed plasma environment to improve its applicability in tissue engineering and biomedical science.

Keywords
Catalyst free ROP
plasma co-polymerization
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