

New Biocompatible Membranes of Polyurethanes containing Phospholipid-like Moieties

Mi-kyung Lee, Eung-min Lee, Dong-wook Jung, and Soo-min Park

Department of Textile Engineering, Faculty of Applied Chemical Engineering, Pusan National University, #30 Changeon-dong, Kumjeong-ku, Pusan 609-735, Korea

Introduction

Segmented poly(urethanes)(SPU) are linear multiblock copolymers which consists of polyols soft segments and an alternating sequence of poly(urethanes) hard segments combining of diisocyanates and low molecular chain extenders. They are extensively used in medicine, especially in the labrication of desirable mechanical properties, as a results of their microphase separated structures, and unsurpassed patency rates, still warrants their extensive usage as blood contacting synthetic biomaterials.

On the other hand, phospholipids are the main components of the biomembrane and interesting substanes in biological and biomedical field^{1,2}. Recently, the phospholipid membranes have been used as a drug carrier, sensor, separation membrane³.

Experimental

Synthesis of Diols containing Phospholipid-like moieties

2-[Bis(2-hydroxyethyl)methylammonio]ethyl stearyl phosphate (SPD)

Oleyl-2-(N-methyldiethanolammonium)ethyl phosphate (OPD)

Synthesis of Segmented Polyurethanes containing Phospholipid-like moieties in the side chains

Characterization

IR Spectra

¹H NMR Spectra

X-ray photoelectron spectroscopy (XPS)

SEM measurement for Blood compatibility analysis

Results and Discussion

Thrombogenicity of the film surface was evaluated with PRP by in vitro adhesion test. The results of platelets retention at the surface with varying segmented polyurethanes and PVC film are shown in Fig. Platelet adhesion was minimized at the surfaces of segmented polyurethanes. On the contrary, no such suppressive effect on platelet adhesion was observed for PVC film. This significant differences in platelet adhesion behavior between PVC and segmented polyurethanes films strongly suggest that the formation of microdomain structure is a determinative factor for the antithrombogenic feature of segmented polyurethanes.

Furthermore, platelet adhesion was effectively reduced at the segmented polyurethanes surfaces with containing phospholipid-like moieties. In case of the film surface of polyurethane with OPD, platelets were less adhered to the surface. It suggests that platelets recognize the pattern of phospholipid structure and the adhesion is effectively suppressed at the surface of the segmented polyurethane.

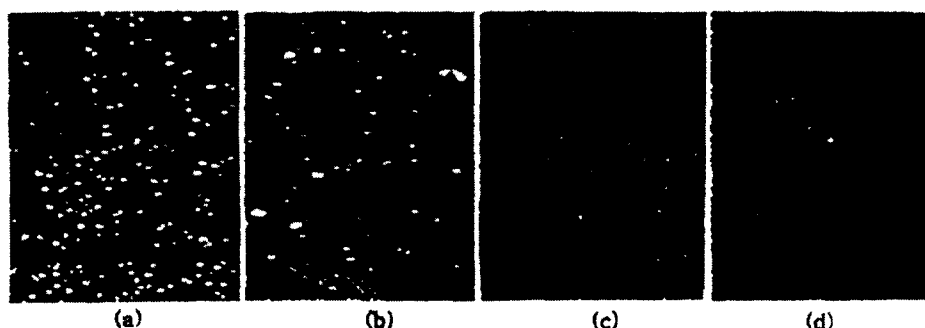


Fig. SEM photographs of film surfaces after contacting with PRP
(a)PVC (b)PBG-HDI-BD (c)PBG-HDI-SPD (d)PBG-HDI-OPD

Reference

1. D.Chapman, Ed., "Biological Membranes", Academic press, London (1986).
2. G.Gregoriadis and A.C.Allison, Ed., "Liposomes in Biological System", Wiley, New York(1980).
3. S.Nojima, J.Sunamoto, and K.Inoue, Ed., "The Liposome", Nankodo, Tokyo(19880).
4. H.J.Lucas, F.W.Mitchell, C.N.Scully, J.Am.Chem.Soc., 72, 5491(1950).
5. R.S.Edmundson, Chem. Ind.(London), 1828 (1962)