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BLOOD COMPATIBILITY OF CELLULOSE MEMBRANE WITH PHOSPHONOLIPID POLAR GROUPS

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Abstract

Requirements for the hemodialysis membrane are excellent permeability for water and solute, mechanical strength and blood compatibility. Many synthetic polymer membranes have been invertigated to raise the efficiency of dialysis, however, 85% of the worldwide hemodialysis still uses cellulose membrane. Though the cellulose membrane has both good permeability and mechenical properties, its blood compatibility needs to be improved for hemodialysis.

In this paper, 2-(methacryloyloxy)ethyl-2-(trimethyl ammonium) ethyl phosphate(MTP) and Glycidylmethacrylate(GMA) were grafted on the cellulose membranes to make blood compa- tible membranes.

Experimental

Vinyl monomer containing phospholipid, MTP was synthesized according to the procedures proviously reported. Glycidyl methacrylate was purified by distillation under reduced pressure.

Grafting of MTP and GMA on cellulose membrane was carried using cerium ammonium nitrate as an initiator.

In a pyrex tube, the membrane, disired amount of MTP and GMA solution and 1.0m mol/ml cerium ammonium nitrate solu- tion were placed. After argon gas was bubbled through the mixed solution for 10 min, the solution was heated at 40℃ for 1 hr. The Grafted membrane was characterized using FT-IR spectroscopy.

A permeation experiment was carried out using the U-shaped glass cell. Evaluation of nonthrombogenicity on the surface of the membrane was carried out using whole cell prepared from white

rabbits.

Results and Discussion

permeability of biocomponents :

The permeation coefficient of glucose through the membrane decreased with an increase in the grafted MTP and GMA distribution, when it was changed by the MTP and GMA concentration in the feed (Table 1). It is considered that the poly(MTP)and poly(GMA)chain grafted on the surface became longer with an increase in graft monomer concentration in the feed.

Table 1. Graft polymerization of MTP and GMA on cellulose membrane[a)]

Code No.	[MTP]in feed (m mol/l)	[GMA]in feed (m mol/l)	Permeation coeffient[b)] ($\times 10^7$ cm^2/sec)
MGC- 0	=	=	11.20
MGC-10	10.0	30.0	11.00
MGC-20	20.0	20.0	10.92
MGC-30	30.0	10.0	10.90

a) $[ce^{4+}]$=1.0m mol/l
40 × 1hr

b) glucose

Evalueation of whole cell adhesion:

SEM pictures of MTP and GMA grafted cellulose membrane after contact with whole cell were shown in Fig 1. The whole cell adhesion induced by contacting membrane surface reduced with increase of MTP and GMA concentration in feed. Thus, phosphonolipid moiety plays an important role for nonthrombogenicity of cellulose membrane. It is considered that the mechanism of an exellant nonthrombogenicity appeared on MTP and GMA is due to the formation of biomembrane like surface by graft and arrangement of phosphonolipid molecular from serum on the MTP-grafted membranes.

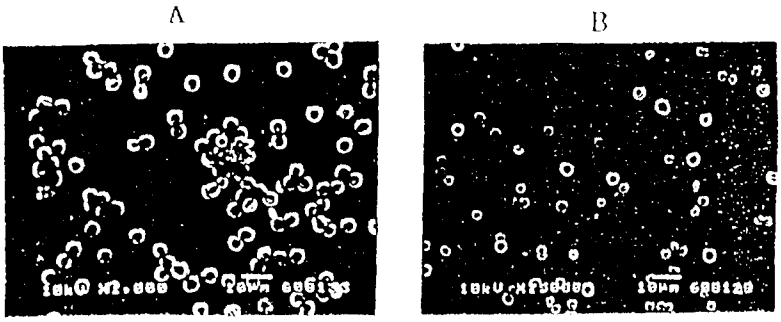

Fig 1. SEM pictures of MTP, GMA grafted cellulose membrane after contacting whole cell for 1hr.
A : Cellulose Membrane
B : MTP and GMA grafted cellulose Membrane.
(MGC-30)

Reference

1) N.T. Thuang and P. Chabrier, Bull. Soc. Chim. Fr. 667(1974)