Development of thin film composite (tfc) membranes by interfacial polymerization (ip) process / Mazuin Abdul Rahim.

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DEVELOPMENT OF THIN FILM COMPOSITE (TFC) MEMBRANES BY INTERFACIAL POLYMERIZATION (IP) PROCESS

By

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Research Report submitted in partial fulfillment of the requirements for the degree of Bachelor of Technology (Environmental)

Department of Engineering Science
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JABATAN SAINS KEJURUTERAAN
FAKULTI SAINS DAN TEKNOLOGI
UNIVERSITI MALAYSIA TERENGGANU

BORANG PENGAKUAN DAN PENGESAHAN LAPORAN PROJEK PENYELIDIKAN I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

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CA	=	Cellulose acetate
C_b	=	Concentration of bulk solution ($molm^{-3}$)
$D_{eff, \infty}$	=	Effective bulk diffusivity ($m^2\ s^{-1}$)
DMF	=	*N*, *N*- dimethyl formamide
EPA	=	Environmental Protection Act
IP	=	Interfacial polymerization
J_w / J_v	=	Flux ($L/m^2.h$)
k	=	mass transfer coefficient
MF	=	Microfiltration
MPD	=	*m*-phenylene diamine
NaCl	=	Sodium chloride
NF	=	Nanofiltration
NMP	=	*N*-methylpyrrolidone
P_m	=	Permeability coefficient
PA	=	Polyamide
PS	=	Polysulfone
PVP	=	Polyvinylpyrrolidone
r	=	Radius of influence (cm)
RB 19	=	Reactive blue 19
Rreal	=	Real rejection (%)

RO	=	Reverse osmosis
SEM	=	Scanning Electron Microscope
TFC	=	Thin film composite
TEM	=	Transmission electron microscopy
TMC	=	Trimesoyl chloride
UF	=	Ultrafiltration
UV	=	Ultraviolet

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ABSTRACT

The thin film composite (TFC) has become a commercially important membrane material and have been accepted for a number of applications such as in the desalination of brackish water or seawater and wastewater process. TFC membrane is known to give excellent performance and superior economics as each layer of TFC membrane can be optimized independently. Nowadays, due to inadequate treatment of dye wastewater in textile industry, TFC membranes have become the most promising methods in treating such wastewater. In this study, own formulation TFC membranes were produced and applied in treating reactive dye solution. The TFC layer on a polysulfone support was fabricated using an interfacial polymerization (IP) reaction between aqueous phase and organic phase. The parameter being considered was the reaction time in the organic phase. Materials that were used are 2 wt% m-phenylene diamine (MPD) in water and 0.10% ((w/v) trimesoyl chloride (TMC) in hexane. The produced membranes were tested with water, NaCl solute (salt) and synthetic dyes solution (RB19). The maximum flux obtained by 10 sec reaction time with 286.72 $Lm^{-2}h^{-1}$, while maximum NaCl rejection was obtained by 60 sec reaction time with 60.63%. However, the produced TFC membranes successfully reject dyes with 99.9% rejection by 5 sec reaction time. The permeability of TFC membrane increased with the increased of pressure. The rejection of NaCl is between 20% and 60% while very high and successful rejection (>90%) of dyes solute. Unstable performance may be resulted from undesirable membrane properties. Better properties of membrane can be obtained by varying IP parameters and chemical used in order to enhance the performance.

ABSTRAK

Membran gabungan filem nipis secara komersialnya telah menjadi suatu bahan yang penting dan digunakan untuk pelbagai kegunaan seperti pennyahgaraman air payau atau air laut dan dalam proses merawat air dan air kumbahan. Ia diketahui mempunyai prestasi yang cemerlang dan lebih ekonomi kerana setiap lapisan boleh dipertingkatkan secara berasingan. Pada masa kini, membran gabungan filem nipis telah digunakan untuk merawat air buangan berwarna dari industri tekstil. Dalam kajian ini, membrane gabungan filem nipis dengan formulasi sendiri telah dihasilkan dan digunakan untuk merawat pewarna jenis reaktif. Membran gabungan filem nipis dihasilkan di atas penyokong polysulfone dihasilkan melalui tindakbalas pempolimeran antara permukaan larutan akues dan larutan organik. Parameter yang diambil kira ialah masa tindakbalas penghasilan filem nipis semasa pecelupan dalam larutan organik. Bahan yang digunakan ialah 2 wt% m-phenylene diamine dalam air (MPD) dan 0.10% (w/v) trimesoyl chloride (TMC) dalam hexane. Prestasi membrane akan diuji dengan air suling, larutan NaCl (garam) dan larutan pewarna tiruan (RB19). Fluks tertinggi diperolehi oleh 10 saat masa tindakbalas dengan 286.72 $Lm^{-2}h^{-1}$, manakala penyingkiran NaCl maksimum ialah 60.63% oleh 60 saat masa tindakbalas. Penyingkiran yang sangat cemerlang untuk pewarna dengan 99.9% penyingkiran maksimum oleh 5 saat masa tindakbalas. Kadar fluks bagi membran gabungan filem nipis yang dihasilkan meningkat pada tekanan tinggi. Hasil tapisan larutan garam hanya mampu menyingkir 20-60% garam manakala penyingkiran bahan pewarna berjaya mencapai lebih dari 90% warna. Prestasi yang tidak sekata mungkin disebabkan oleh ciri-ciri membran tersebut yang tidak bagus. Ciri-ciri membran yang lebih baik dapat diperolehi dengan mempelbagaikan parameter bagi tindakblas pempolimeran dan jenis bahan kimia yang digunakan bagi meningkatkan prestasinya.