THIN FILM COMPOSITE (TFC) MEMBRANES:EFFECTS OF MONOMER AND SOLVENTS IN INTERFACIAL POLYMERIZATION PROCESS FOR DYE REMOVAL

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Laporan Penyelidikan ini disediakan untuk mematuhi
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PENGAKUAN DAN PENGESAHAN LAPORAN PROJEK PENYELIDIKAN I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

THIN FILM COMPOSITE (TFC) MEMBRANES: EFFECTS OF MONOMER AND SOLVENTS IN INTERFACIAL POLYMERIZATION PROCESS FOR DYE REMOVAL oleh Mashitah Abdullah, No.Matrik UK7709 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Kejuruteraan sebagai memenuhi sebahagian daripada keperluan memperolehi Ijazah Sarjana Muda Teknologi (Alam Sekitar), Fakulti Sains dan Teknologi , Universiti Malaysia Terengganu.

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ED	electro dialysis
IP	interfacial polymerization
MF	microfiltration
MPD	*m*-phenyldiamine
NaCl	Sodium Chloride
NF	nanofiltration
NMP	N-Methyl-2-Pirrolidon
PA	Polyamide
PIP	piperazine
PSF	Polysulfone
RO	reverse osmosis
RO16	Reactive Orange 16
SHP	Steric Hindrance Pore
TFC	Thin Film Composite
TMC	*trimesoyl chloride*
UF	ultrafiltration

LIST OF SYMBOLS

A_k	Membrane porosity
$H_{F,} H_D$	Steric parameters related to wall correction factors under diffusion and convection conditions, respectively
P_s	Solute permeability
$S_{F,} S_D$	Distribution coefficient of solute by steric hindrance effect under diffusion and convection condition, respectively
r_p	Pore radius, m
η	Ratio of solute radius to membrane pore radius
σ	Reflection coefficient, %

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ABSTRACT

Thin film composite (TFC) membrane consists of a very thin film which is formed on top of a porous support and commonly made of polysulfone (PSF) where the active layer is an aromatic crosslinked polyamide (PA) film. Hence, PA TFC membranes cause higher water flux and rejection of ion and organic compared to CA membranes. In this study, the effects of different monomers and solvents towards performance of TFC membranes in salt rejection and dyes removal were investigated. TFC membranes were synthesized directly from interfacial polymerisation aromatic polyamide. The preparation condition of TFC membranes are studied with reference to different monomer of trimesoyl chloride (TMC) and solvents of hexane and cyclohexane. Interpretation of experimental data for the separation of sodium chloride (NaCl) with steric hindrance pore (SHP) model permit an assumption of membrane in terms of effective pore radius and membrane thickness. This study has shown the NaCl and reactive orange 16 (RO 16) rejection increase and flux decrease where the optimum rejection was showed by 0.2% TMC which dissolved in hexane with the rejection until 86.9% for NaCl while 97.2% for RO 16. SEM images exhibited that the membrane synthesized with TMC concentration at 0.2% TMC with hexane has a thicker polymerization layer. This membrane provides a superior performance membrane with respect to excellent rejection either for salt or reactive dyes.

ABSTRAK

Membran komposit lapisan nipis terdiri daripada lapisan yang sangat nipis yang terbentuk di atas membran sokongan yang poros dan selalunya diperbuat daripada polisulfon di mana lapisan aktif ini merupakan lapisan poliamida tindakan silang aromatik. Maka, membran komposit lapisan nipis poliamida ini menyebabkan fluks dan penyingkiran air lebih tinggi terhadap prestasi membran. Dalam kajian ini, kesan perbezaan monomer dan pelarut terhadap prestasi membran komposit lapisan nipis dalam penyingkiran garam dan pewarna dikaji. Membran komposit lapisan nipis yang mempunyai poliamida dihasilkan dengan monomer *m-phenyldiamine* (MPD) dan *trimesoyl chloride* (TMC) yang dilarutkan dalam pelarut heksana dan sikloheksana melalui teknik pempolimeran antara permukaan ke atas polysulfon sebagai lapisan penyokong. Sifat membran dikaji dengan menggunakan air suling, natrium klorida dan pewarna serta melalui pengimbas elektron mikroskopik. Kajian ini menunujukkan penyingkiran garam dan *reactive orange 16* (RO16)meningkat dan fluks menurun dengan peningkatan kepekatan monomer dalam turutan 0.1% TMC> 0.15% TMC> 0.2% TMC. Penyingkiran optimum ditunjukkan oleh monomer yang berkepekatan 0.20% TMC iaitu sehingga 86.9% untuk NaCl manakala 97.2% untuk RO16. Membran komposit lapisan nipis menunjukkan struktur seperti jejari, lompang makro dan span melalui pemerhatian pengimbas elektron mikroskopik. Maka membran komposit lapisan nipis yang dihasilkan ditentukan oleh struktur bahan kimia di dalam lapisan membran di mana monomer yang lebih tinggi mempengaruhi peningkatan penyingkiran samada bagi garam ataupun pewarna teraktif.