

**PREPARATION AND CHARACTERIZATION OF LOW
PRESSURE REVERSE OSMOSIS SURFACTANT MEMBRANE
FOR WATER DESALINATION**

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I hereby declare that the work in the thesis is my own except for the quotations and summaries which have been duly acknowledged.

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ABSTRAK

Kajian ini memberi tumpuan kepada pembangunan dan pencirian membrane osmosis berbalik surfaktan bertekanan rendah untuk penyahgaraman air. Kesan utama daripada kepekatan polimer polysulfone (PSF), jenis dan kepekatan surfaktan kepada penyahgaraman air telah dikaji. Analisis ujian berskala mikro mengenai keberkesanan membrane osmosis berbalik surfaktan bertekanan rendah yang baru telah dinilai berdasarkan penyahgaraman air masin pada tekanan operasi sebanyak 5 bar. Seterusnya, kesan ketara oleh surfaktan terhadap struktur morfologi, analisis terma dan sifat kimia fizikal telah dibincangkan menggunakan Mikroskop Imbasan Elektron (SEM), Analisis gravimetrik Thermal (TGA) dan Fourier Transform-Spektroskopi Inframerah (FTIR). Dari segi kepekatan polimer, membran PSP1 menunjukkan prestasi terbaik untuk penyahgaraman air berbanding membrane PSP3 iaitu 87.25% pada penyingkiran garam. Kemudian, kepekatan surfaktan telah diubah dari 1.0 wt. % hingga 3.0 wt. % untuk mengkaji kesannya terhadap prestasi membran. Pengoptimuman telah mengesahkan 2 wt. % surfaktan adalah kepekatan yang optimum untuk semua jenis surfaktan dalam menghasilkan membran dengan prestasi yang tinggi. Diantara berbagai jenis surfaktan, dapat dirumuskan bahawa CTAB menghasilkan penambahbaikan yang tinggi kepada prestasi membrane. Membrane PSP1-C2 adalah membrane yang terbaik untuk digunakan dalam penyahgaraman air masin, disokong dengan morfologi struktur yang berliang dan kestabilan suhu yang baik.

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ABSTRACT

This research focused on the development and characterization of low pressure reverse osmosis surfactant membrane for water desalination. The major effects of polysulfone (PSF) polymer concentration, surfactant types and concentration on the water desalination had been investigated. The micro-scale test analysis on the effectiveness of the newly low pressure reverse osmosis-surfactant membranes were appraised based on saline water desalination at 5 bar of operating pressure. Subsequently, the significant effects of surfactant towards morphological structure, thermal analysis and physico-chemical properties of the membranes had been discussed using Scanning Electron Microscope (SEM), Thermal Gravimetric Analysis (TGA) and Fourier-Transform Infrared spectroscopy (FTIR), respectively. Primarily, in terms of polymer concentration, membrane PSP1 obtained the best performance of membrane for saline water desalination as compared to PSP3 which was 87.25 % on seawater rejection. Then, surfactants concentration varied from 1.0 wt. % to 3.0 wt. % in order to study their effects on membrane performances. The optimization confirmed that 2 wt. % of surfactant is the optimum concentration for all types of surfactant in producing membranes with high performances. Among the types of surfactant, it can be said that CTAB gave highest improvement in membrane performance. Membrane PSP1-C2 is the best membrane to be used in saline water desalination, supported by the high porosity structural morphology, and good thermal stability and physico-chemical property.

الملخص البحث

ركز هذا البحث علي تطور ووصف الضغط الاسموزي المنخفض العكسي لسطح الغشاء لاجل تحلية المياه .
 التأثيرات الكبيره لتركيز البوليمر بي اس اف وانواع السطحيات وتركيزها علي تحلية المياه تمت دراستها. تحليل
 اختبار مقياس الميكرو علي فعالية الضغط الاسموزي المنخفض العكسي الجديد علي سطح الاغشيه كانت علي
 المياه المالحة و مياه البحر عند 5 بار ضغط موثر. وبالتالي فان اهمية تأثيرات التركيب التشكيلي والتحليل
 الحراري والوران الجزئي للاغشيه تمت مناقشتها باستخدام المسح الالكتروني الضوئي اس اي ام والتحليل
 الحراري الوزني تي جي اي والاشعه تحت الحمراء اف تي اي ار علي التوالي . في البدايه عند استخدام تركيز
 البوليمر PSP1 نسبة وزنيه من بي اس اف تحصلنا علي افضل سطح للغشاء لتحلية المياه مقارنة مع النسبه
 الوزنيه PSP3 من بي اس اف التي اعطت نسبة 87.25% علي مياه البحر وبالتالي فن تركيز السطحيات
 المختلف من 1.0 % الي 3.0 % مطلوبه لدراسة تأثيرتها علي فعالية الغشاء . النسبه الوزنيه من بي اس اف مع
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LIST OF ABBREVIATION

CTAB	Cetyl trimethyl ammonium bromide
FTIR	Fourier Transform Infrared
LPROS	Low Pressure Reverse Osmosis Surfactant
MF	Microfiltration
NF	Nanofiltration
PEG	Polyethylene glycol
PES	Polyethersulfone
ppm	Part per million
ppt	Part per thousand
PSF	Polysulfone
PVP	Polyvinyl Pyrrolidone
RO	Reverse Osmosis
SDS	Sodium dodecyl sulphate
SEM	Scanning Electron Microscope
TDS	Total dissolved solid
TGA	Thermal Gravimetry Analysis
UF	Ultrafiltration