PRODUCTION, CHARACTERIZATION AND UTILIZATION OF EPOXY SPHERICAL MEMBRANE FILTER PREPARED BY AN ADVANCED AQUEOUS METHOD

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Production, Characterization and Utilization of Epoxy Spherical Membrane Filter prepared by an Advanced Aqueous Method

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TABLE OF CONTENTS

	PAGE
THESIS DECLARATION	i
ACKNOWLEDGEMENT	ii
TABLE OF CONTENTS	iii
LIST OF TABLES	viii
LIST OF FIGURES	x
LIST OF ABBREVIATIONS	xv
LIST OF SYMBOLS	xviii
LIST OF EQUATIONS	xx
ABSTRAK	xxi
ABSTRACT	xxii
CHAPTER 1 INTRODUCTION	
1.1 Introduction	1
1.1.1 Porous Medium	1
1.1.2 Membrane Filtering and Separation for Wastewater Treatment	4
1.2 Problem Statement	5
1.3 Objectives	7
1.4 Scope of Study	7
CHAPTER 2 LITERATURE REVIEW	
2.1 Emulsions	9
2.1.1 Emulsion Polymerization	9
2.1.2 Types of Emulsion	12
2.1.2.1 Water in Oil In Water (W/O/W) Emulsion	13

2.1.3 Emulsion Stability 14
2.2 Homogenization 17
2.3 Thermoset -Epoxy 19
2.4 Curing Agent/ Hardener - Polyamide 21
2.5 Calcium Carbonate 23
2.6 Wastewater Treatment 24
2.7 Membrane 26
2.8 Porous Medium 29
2.8.1 General Concept of Porous Medium 29
2.8.2 Types and Properties of Porous Materials 30
2.8.3 Application of Porous Medium 31
2.8.3.1 Application - Filter and Separator 32
2.8.3.2 Types of Porous Membrane for Wastewater Treatment 33
2.8.4 Preparation and Fabrication of Porous Polymeric 35
2.9 Significant of Study 37

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction 38
3.2 Materials 38
3.2.1 Epoxy Resin 38
3.2.2 Epoxy Hardener/ Curing Agent 39
3.2.3 Calcium Carbonate 40
3.2.4 Distilled Water 40
3.2.5 Filtrated/ Separating Materials 41
3.2.5.1 Carbon Black 41
3.2.5.2 Copper, Metal Powder 41
3.2.5.3 Palm Oil 42
3.2.5.4 Engine Oil 43
3.3 Preparation of Epoxy Spherical Membrane (ESM) 43
3.4 Epoxy Spherical Membrane (ESM) Testing and Characterization 44
3.4.1 Epoxy Emulsion 44
3.4.1.1 Emulsion Viscosity 44

3.4.1.2 Gel Time 45

3.4.2 Characterization and Testing on Epoxy Spherical Membrane (ESM) matrices 45

3.4.2.1 Epoxy Spherical Membrane (ESM) Densities 45

3.4.2.2 Morphology Characterization 46

3.4.2.3 Thermal Analysis 47

3.4.2.4 Mechanical Properties - Compression Test 47

3.5 Preparation of Epoxy Spherical Membrane Column (ESMC) 48

3.6 Epoxy Spherical Membrane Column (ESMC) Filtering and Separating Properties 48

3.6.1 Particulate Filtering 49

3.6.2 Oil Separation Behavior 49

3.6.3 Effect of Type and Diameter of Column on Filtering Behavior 50

CHAPTER 4 RESULTS AND DISCUSSION

4. 1 Introduction 52

4.2 Effect of Calcium Carbonate Content 52

4.2.1 Emulsion Properties 53

4.2.1.1 Emulsion Viscosity 53

4.2.1.2 Gel Time 55

4.2.2 Epoxy Spherical Membrane (ESM) Physical Properties 56

4.2.2.1 Morphology of Epoxy Spherical Membrane (ESM) 56

4.2.2.2 Bulk Density, Relative Density and Total Pore Volume 58

4.2.3 Epoxy Spherical Membrane (ESM) Thermal Properties 59

4.2.3.1 Differential Scanning Calorimetry (DSC) 59

4.2.3.2 Thermal Gravimetric Analysis (TGA) 61

4.2.4 Epoxy Spherical Membrane (ESM) Mechanical Properties - Compression Properties 64

4.3 Effect of Resin/ Water Ratio and Homogenization Speed 66

4.3.1 Emulsion Properties 66

4.3.1.1 Emulsion Viscosity 66
4.3.1.2 Gel Time 68
4.3.2 Epoxy Spherical Membrane (ESM) Physical Properties 70
4.3.2.2 Morphology of Epoxy Spherical Membrane (ESM) 70
4.3.2.1 Bulk Density, Relative Density and Total Pore Volume 71
4.3.3 Epoxy Spherical Membrane (ESM) Thermal Properties 73
4.3.3.1 Differential Scanning Calorimetry (DSC) 73
4.3.3.2 Thermal Gravimetric Analysis (TGA) 75
4.3.4 Epoxy Spherical Membrane (ESM) Mechanical Properties - Compression Properties 77
4.4 Effect of Homogenization Temperature and Epoxy/ Polyamide Ratio 79
4.4.1 Emulsion Properties 80
4.4.1.1 Emulsion Viscosity 80
4.4.1.2 Gel Time 82
4.4.2 Epoxy Spherical Membrane (ESM) Physical Properties 83
4.4.2.1 Morphology of Epoxy Spherical Membrane (ESM) 83
4.4.2.2 Bulk Density, Relative Density and Total Pore Volume 84
4.4.3 Epoxy Spherical Membrane (ESM) Thermal Properties 86
4.4.3.1 Differential Scanning Calorimetry (DSC) 86
4.4.3.2 Thermal Gravimetric Analysis (TGA) 87
4.4.4 ESM Mechanical Properties - Compression Properties 88

CHAPTER 5 FILTRATION AND SEPARATION BEHAVIOR OF EPOXY SPHERICAL COLUMN (ESC)

5.1 Introduction 91
5.2 Effect of Epoxy Spherical Membrane (ESM) Microstructure towards Different Types of Filtrated 93
5.2.1 Particulates Filtering 93

5.2.1.1 Carbon Black (CB) Filtering 94
5.2.1.2 Copper Powder (Cu) Filtering 98
5.2.2 Oil Separation 101
5.2.2.1 Palm Oil (PO) Separation 102
5.2.2.1 Engine Oil (EO) Separation 104
5.3 Effect of Column Types and Diameter on Epoxy Spherical Membrane Column (ESMC) Filtering Behavior 106

CHAPTER 6 CONCLUSIONS AND RECOMMENDATION
6.1 Production of Epoxy Spherical Membrane (ESM) 112
6.2 Epoxy Spherical Membrane Column (ESMC) Filtration and Separation Application 113
6.3 Recommendation and Suggestion for Future Works 114

REFERENCES 116

LIST OF PUBLICATIONS 144

LIST OF AWARDS 145

APPENDIX A 146

APPENDIX B 148

APPENDIX C 150

APPENDIX D 153

APPENDIX E 156

LIST OF TABLES

NO.		PAGE
2.1	Advantages and disadvantages of emulsion polymerization.	10
2.2	Types of emulsion breakdown phenomena.	15
2.3	Types of membrane process.	26
2.4	Applications of hierarchically structured porous materials.	31
3.1	Properties of epoxy resin 331.	38
3.2	Properties of epoxy hardener A062.	39
3.3	Physical and chemical properties.	42
3.4	Formulation of epoxy emulsion.	44
4.1	Thermal properties of epoxy spherical membrane (ESM) for different calcium carbonate content.	59
4.2	Decomposed properties of epoxy spherical membrane (ESM) under oxidative environment for different calcium carbonate content.	61
4.3	Thermal properties of epoxy spherical membrane (ESM) for different water ratio/ homogenization speed.	73
4.4	Decomposed properties of epoxy spherical membrane (ESM) under oxidative environment for different water Ratio.	75
4.5	Thermal properties of epoxy spherical membrane (ESM) for different epoxy to polyamide ratio.	86
4.6	Decomposed properties of epoxy spherical membrane (ESM) under oxidative environment for different emulsifying temperature/ epoxy to polyamide ratio.	87

5.1	Percentage of collected water and condition of carbon black (CB) in different epoxy spherical membrane column (ESMC) (%).	95
5.2	Percentage of collected water and condition of copper powder (Cu) in different epoxy spherical membrane column (ESMC) (%).	99
5.3	Palm oil-solution (PO) filtering behaviour using different epoxy spherical membrane column (ESMC) after 2 hours.	103
5.4	Engineoil-solution (EO) filtering behaviour using different epoxy spherical membrane column (ESMC) after 2 hours.	105
5.5	Percentage of collected water and condition of copper powder (Cu) in different epoxy spherical membrane column (ESMC) (%).	109

LIST OF FIGURES

NO.		PAGE
2.1	Schematic representation of polymerization of an emulsion.	11
2.2	Types of emulsions.	12
2.3	Schematic representative of W/O/W emulsions	13
2.4	Flocculation, partly coalescence and coalescence in emulsion system.	14
2.5	Schematic representation of the various breakdown processes in emulsions.	16
2.6	Illustration of dispersion in using homogenization.	18
2.7	Chemical structure of Bisphenol A diglycidyl ether (DGEBA).	19
2.8	Structures of Versamids-vegetable based polyamide, where R = other dimer units and amine units.	21
2.9	Reaction of amide and epoxy.	22
2.10	Types of pores.	29
3.1	Illustration of filtering/ separation of epoxy spherical membrane column (ESMC).	48
3.2	Flow chart of preparation and characterization of epoxy spherical membrane (ESM) and epoxy spherical membrane column (ESMC).	51
4.1	Schematic of W/O/W epoxy emulsion and inner view of epoxy droplets.	53
4.2	The effect of different calcium carbonate content towards the emulsion viscosity of epoxy emulsion.	54
4.3	The effect of different calcium carbonate content towards the gel time of epoxy emulsion.	55

4.4	Scanning electron micrograph of cross-sectional area of ESM filled with different calcium carbonate content magnify at 50X: (a) 0phr, (c) 10phr, (e) 25phr, (g) 50phr and (i) 75phr calcium carbonate content; and magnify at 5000X: (b) 0phr, (d) 10phr, (f) 25phr, (h) 50phr and (j) 75phr calcium carbonate content.	56
4.5	The effect of different calcium carbonate content towards bulk density, relative density and total pore volume of epoxy spherical membrane (ESM).	58
4.6	DSC thermograph of epoxy spherical membrane (ESM) for different calcium carbonate content.	60
4.7	TGA thermograph of epoxy spherical membrane (ESM) under oxidative environment for different calcium carbonate content.	62
4.8	DTG thermograph of epoxy spherical membrane (ESM) combust under oxidative environment for different calcium carbonate content.	63
4.9	The effect of calcium carbonate content toward the compression strength and modulus of epoxy spherical membrane (ESM).	64
4.10	The effect of different calcium carbonate content towards the compressive strain at break of epoxy spherical membrane (ESM).	65
4.11	The effect of different resin to water ratio/ homogenization speed towards the emulsion viscosity of epoxy emulsion.	67
4.12	The effect of different resin to water ratio/ homogenization speed towards the gel time of epoxy emulsion.	69
4.13	Scanning electron micrograph of cross-sectional area of epoxy spherical membrane (ESM) for different resin to water ratio magnify at 100X: (a) 5R:5W, (c) 4R:6W, (e) 3R:7W and (g) 3R:7W 15k rpm; and magnify at 500X: (b) 5R:5W, (d) 4R:6W, (f) 3R:7W and (h) 3R:7W 15k rpm.	70
4.14	The effect of different resin to water ratio/ homogenization speed towards the bulk density, relative density and total pore volume of epoxy spherical membrane (ESM).	72

4.15	DSC thermograph of epoxy spherical membrane (ESM) for different resin to water ratio/ homogenization speed.	74
4.16	TGA thermograph of Epoxy Spherical Membrane (ESM) under oxidative environment for different resin to water ratio.	75
4.17	DTG thermograph of epoxy spherical membrane (ESM) combust under oxidative environment for different resin to water ratio.	76
4.18	The effect of different resin to water ratio/ homogenization speed towards the compression strength and modulus of epoxy spherical membrane (ESM).	77
4.19	The effect of different resin to water ratio/ homogenization speed towards the compression strain at break of epoxy spherical membrane (ESM).	78
4.20	The effect of different emulsifying temperature/ epoxy to polaymide ratio towards the emulsion viscosity of epoxy emulsion.	80
4.21	Interaction of polyamide with water molecule.	81
4.22	The effect of different emulsifying temperature/ epoxy to polyamide ratio towards the gel time of epoxy emulsion.	82
4.23	Scanning electron micrograph of cross-sectional area of ESM magnify at 100X: (a) LT 10E:6PA, (c) RT 10E:6PA and (e) RT 10E10PA; and magnify at 1000X: (b) LT 10E:6PA, (d) RT 10E:6PA and (f) RT 10E10PA.	83
4.24	The effect of different emulsifying temperature/ epoxy to polyamide ratio towards bulk density, relative density and total pore volume of epoxy spherical membrane (ESM).	85
4.25	DSC thermograph of epoxy spherical membrane (ESM) for different epoxy to polyamide ratio.	86
4.26	TGA thermograph of epoxy spherical membrane (ESM) under oxidative environment for different emulsifying temperature/ epoxy to polyamide ratio.	88
4.27	The effect of different emulsifying temperature/ epoxy to polyamide ratio towards compression strength and modulus for epoxy spherical membrane (ESM).	89

4.28 The effect of different emulsifying temperature/ epoxy to polyamide ratio towards compression strain at break for epoxy spherical membrane (ESM). 90

5.1 Illustration of filtering mechanism of epoxy spherical membrane column (ESMC). 92

5.2 Flow rate of filtrate behavior in carbon black (CB) filtration of different Epoxy Spherical Membrane Column (ESMC). 94

5.3 Percentage of carbon black (CB) in different epoxy spherical membrane column (ESMC). 95

5.4 Optical micrograph of surface for filtered epoxy spherical membrane column ESMC with carbon black: magnification at 4X (a) ESMC-0, (b) ESMC-25 and (c) ESMC-50. 97

5.5 Cross section of filtered epoxy spherical membrane column (ESMC) with carbon black magnify at 2500X: (a) ESMC-25 and (b) ESMC-50. 97

5.6 Flow rate of filtrate behavior in copper powder (Cu) filtration of different epoxy spherical membrane column (ESMC). 98

5.7 Percentage of copper powder (Cu) in different epoxy spherical membrane column (ESMC). 100

5.8 Cross section of filtered epoxy spherical membrane column (ESMC) with copper powder magnification at 4X: (a) ESMC-0, (b) ESMC-25 and (c) ESMC-50. 101

5.9 Palm oil solution (PO) separation behavior of different epoxy spherical membrane column (ESMC). 103

5.10 Engine oil solution (EO) separation behavior of different epoxy spherical membrane column (ESMC). 105

5.11 Flow rate of filtrate behavior in copper powder (Cu) filtration of different glass types and diameter of epoxy spherical membrane column (ESMC). 107

5.12 Figure caption of column's sidewall and bottom view of glass types and diameter of epoxy spherical membrane column (ESMC) after filtered with copper powder solution: 27mm diameter PP column (a) ESMC-0, (d) ESMC-25 and (g) ESMC-50; 27mm diameter glass column (b) ESMC-0, (e) ESMC-25 and (h) ESMC-50; 37mm diameter glass column (c) ESMC-0, (f) ESMC-25 and (i) EMC-50. 110

LIST OF ABBREVIATIONS

10E:6PA	10 Epoxy: 6 Polyamide
10E:10PA	10 Epoxy: 10 Polyamide
3R:7W	3 Resin: 7 Water
4R:6W	4 Resin: 6 Water
5R:5W	5 Resin: 5 Water
API	American Petroleum Institute
ASTM	American Standard for testing and Materials
ATRP	Atomic transfer radical polymerization
BLD	Blue dextran
BSI	British standard institute
CA	Cellulose acetate
$CaCO_3$	Calcium carbonate
C_p	Specific heat capacity
DGEBA	Diglycidyl ether of bisphenol A
DSC	Different scanning calorimetric
DTGA	Derivative thermal gravimetric analysis
E	Epoxy
ECMR	Electrocatalytic membrane reactor
EO	Engine oil solution
ESM	Epoxy spherical membrane
ESMC	Epoxy spherical membrane column

ESMC-0	Epoxy spherical membrane column without calcium carbonate
ESMC-25	Epoxy spherical membrane column filled with 25phr calcium carbonate
ESMC-50	Epoxy spherical membrane column filled with 50phr calcium carbonate
FTIR	Fourier Transform Infrared Spectroscopy
GCC	Ground calcium carbonate
GMA	Glycol methacrylate
HFP	Hexafluoropropylene
HIPE	High internal phase emulsion
IMS	Integrated membrane systems
LRP	Living radical polymerization
LT	Low temperature
MBR	Bioreactor membrane
MF	Microfiltratiom
NIPS	Non-solvent induced phase separation
O	oil
O/W	Oil-in-water
O/W/O	Oil-in-water-in oil
OSN	Organic solvent nanofiltration
PA	Polyamide
PACM	1, 4,40-methylenebiscyclohexanamine
PAN	Polyacrylonitrile
PCC	Precipitated calcium carbonate

PDMS	Polydimethylsiloxane
PE	Polyethylene
PEG	Poly (Ethylene Glycol)
PES	Polyethersulfone
PHEMA	Poly(2- hydroxyethyl methacrylate)
PIPS	Polymerization induced phase separation
PIs	Polyimides
PLA	*Poly(Lactic acid*)
PLGA	Poly(Lactic acid-co-Glycolic acid)
PLGA	Poly (lactide-co-glycolide)
PLLA	Poly(L-lactic acid)
PMMA	Poly(methyl methacrylate)
PP	Polypropylene
PS	Polystyrene
PSU	Polysulfone
PO	Palm oil solution
PVDF	Polyvinylidene fluoride
R	Resin
RBD	Refined, bleached and deodorized
RT	Room temperature
SAE	Society of Automotive Engineers
SEM	Scanning electron microscopy
T_g	Glass transition temperature
TGA	Themalgravimetric analysis

THF	Tetrahydrofuran
TIPS	Thermally induced phase separation
UF	Ultrafiltration
UV	Ultraviolet
W	Water
W/O	Water-in-oil
W/O/W	Water-in-oil-in-water

LIST OF SYMBOLS

%	Percentage
℃	Celcius
Al	Aluminium
Al_2O_3	Aluminium oxide
$CaCO_3$	Calcium carbonate
Ca^{2+}	Calcium ion
cm^3	Centimeter cubic
eq	Equivalent
eg	Example
g	Gram
g/ml	Gram/ Mililitre
hrs	Hours
J	Joule
kg	Kilogram
kN	Kilo Newton
kV	Kilo Volt
$MgCl_2$	Magnesium chloride
$MgSO_4$	Magnesium sulfate
mM	Mili Molar
mm	Mili Meter
mmol	Mili Moles

Pa	Pascal
s	Second
N	Newton
NaCl	Sodium Chloride
nm	Nanometer
pH	Potential Hydrogen
phr	Parts Per Hundred
ppm	Parts Per Million
rpm	Rotation Per Minute
TiO_2	Titanium Oxide
wt.	Weight
vol.	Volume
Zn	Zinc
ZrO_2	Zirconium Dioxide
μm	Micrometer

LIST OF EQUATIONS

NO.		PAGE
2.1	Porosity	29
3.1	Bulk density	46
3.2	Filtrate's flow rate	49
3.3	Oil filtrate's flow rate	49

Penghasilan, Pencirian dan Penggunaan Penapis Membran Sfera Epoksi disediakan dengan Kaedah Akueus Termaju

ABSTRAK

Zaman sekarang, masyarakat mula mempersoalkan keselamatan air. Bahan pencemar berbahaya dalam air dapat mengancam nyawa hidupan dan ia tidak boleh diabaikan Walaupun banyak produk yang canggih telah dicipta digunakan dalam terapi air sisa, tetapi kos pengendalian membran yang tinggi dan kekurangan bekalan mengehadkan perkembangan aplikasi tersebut. Dengan itu, idea baru untuk membran sfera epoksi (ESM) yang mempunyai liang berskala mikro dihasil untuk industri rawatan air sisa. Dalam kajian tersebut, kaedah akueus lanjutan digunakan untuk menghasilkan ESM berdasarkan teknik emulsi air di dalam minyak dalam air (W/O/W). Kaedah ini mudah dan mesra alam kerana tiada pelarut digunakan dan tiada pelepasan produk yang meruap. ESM sesuai dihasilkan dalam kuatiti yang besar. Epoksi dan poliamida berada dalam bentuk cecair bawah suhu bilik membolehkan emilsifikasi berlaku. Poliamida yang reaktif berasal daripada minyak sayur dipilih di mana ia bertemu dengan semua syarat untuk membolehkan proses emulsifikasi tanpa kehadiran surfaktan dan pengemulsi. Kalsium karbonat diisi dalam ESM sebagai penggalak pengemulsi untuk menghasilkan zarah epoksi yang halus. Ia dapat meningkatkan sifat-sifat mekanikal, kestabilan terma, keupayaan koagulan minyak semasa penapisan dan dapat kurangkan kos pembuatan. Air suling bertindak sebagai fasa tersebar dalam titisan epoksi dan fasa berterusan dalam sistem emulsi. Air suling sebagai template dalam ESM dan mengewap mewujudkan liang yang kompleks dalam ESM ketika mengawetan. Membran sfera epoksi turus (ESMC) dibina daripada zarah-zarah epoksi dengan struktur liang yang kompleks membolehkan prinsip membran sfera diaplikasi untuk penapisan dan pemisahan. ESMC didapati berkesan dalam penapisan karbon hitam dan serbuk tembaga dengan kadar aliran efluen yang rendah. Pemisahan minyak kelapa sawit dengan air dan minyak enjin dengan air berjaya dipisahkan dengan daya graviti di mana air jernih mengalir keluar dahulu kemudian diikuti dengan minyak. Ruang turas kaca mempersembahkan kecekapan penapisan yang lebih baik daripada ruang turas PP. Diameter ruang turus yang lebih besar membenarkan kadar aliran yang pantas tetapi kekurangan keberkesanan penapisan.