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LIST OF PUBLICATIONS AND AWARDS

PUBLICATIONS:

- 1) Asymmetric PVDF Ultrafiltration (UF) Membranes: Effect of Additives & Surfactants, *International Journal of Chemical and Environmental Engineering*, Volume 5, No.6.
- 2) Performance, Morphological and Molecular Studies of Active PVDF Ultrafiltration (AUF) Membranes for Proteins Separation, *Journal of Applied Science and Agriculture*, Volume 10, No.5, Special 2015, Pp:82-88.
- 3) Preparation, Characterization and Performance Studies of Active PVDF Ultrafiltration-Surfactant Membranes via PVP as Additive, *The Malaysian Journal of Analytical Sciences* (accepted)

AWARDS:

- Mac 2014** : National Innovation and Invention Competition through Exhibition (i- CompEx)
- April 2014** : International Engineering Invention & Innovation Exhibition (i-ENVEX)
: Achievements - Gold Prize
- Special Award Romanian Inventors Forum
- May 2014** : 25th International Invention, Innovation & Technology Exhibition (ITEX)
: Achievement - Gold Medal
- November 2014** : Orally presented the paper in the 5th International Chemical & Environmental Engineering Conference (ICEEC) 2014 at Royal Hotel, Kuala Lumpur
- February 2015** : Orally presented the paper in the International Postgraduate Conference on Industrial Technology 2015 at Langkawi Seaview Hotel, Kedah.
- : Orally presented the paper in the International Conference on Applied Sciences & Industrial technology 2015 (Chemistry & Environment Symposium) at Grand Lexis, Port Dickson, Negeri Sembilan.

APPENDIX A

A.1: Preparation 1 L of 0.5 M Sodium Phosphate Buffer (pH 7.2)

Chemicals	Concentration	Molecular Mass, M_r (g/mol)	Manufacturer
$\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$	1 M	141.96	HmbG Chemicals
$\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$	1 M	156.02	Merck

Solution A : 1 M disodium phosphate dehydrate ($\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$)

$$\begin{aligned} g &= M_r \times M \times L \\ &= 141.96 \text{ g/mol} \times 1 \text{ M} \times 1 \text{ L} \\ &= 141.96 \text{ g (dissolved in 1 L distilled water)} \end{aligned}$$

Solution B : 1 M sodium dihydrogen phosphate dihydrate ($\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$)

$$\begin{aligned} g &= M_r \times M \times L \\ &= 156.02 \text{ g/mol} \times 1 \text{ M} \times 1 \text{ L} \\ &= 156.02 \text{ g (dissolved in 1 L distilled water)} \end{aligned}$$

Mixed solution A and B for 1 L of Sodium Phosphate Buffer (0.5 M, pH 7.2) as follows:

- Solution A : 342 mL
- Solution B : 158 mL
- Distilled H_2O : 500 mL

APPENDIX B

B.1: Calculation of PWP

Membrane		Pressure (kPa)					
		50	100	150	200	250	300
PN1	Time (s)	120	84	82	80	79	77
	Time (h)	0.0333	0.0233	0.0228	0.0222	0.0219	0.0214
	PWP (Lm ⁻² h ⁻¹)	216.51	309.30	316.85	324.77	328.88	337.42
PN2	Time (s)	173	107	80	69	65	62
	Time (h)	0.0481	0.0297	0.0222	0.0192	0.0181	0.0172
	PWP (Lm ⁻² h ⁻¹)	150.18	242.82	324.77	376.54	399.72	419.06
PN3	Time (s)	229	144	79	67	62	57
	Time (h)	0.0636	0.0400	0.0219	0.0186	0.0172	0.0158
	PWP (Lm ⁻² h ⁻¹)	113.46	180.43	328.88	387.78	419.06	455.82
PN4	Time (s)	309	205	150	126	119	113
	Time (h)	0.0858	0.0569	0.0417	0.0350	0.0331	0.0314
	PWP (Lm ⁻² h ⁻¹)	84.08	126.74	173.21	206.20	218.33	229.92

$$PWP, J_v = \frac{\text{Volume permeation rate, L}}{\text{Membrane area (m}^2\text{)} \times \text{time (h)}}$$
$$= \frac{0.01 \text{ L}}{0.0013856 \times 0.0333}$$
$$= 216.51 \text{ Lm}^{-2}\text{h}^{-1}$$

B.2: Calculation of Permeate Flux

Membrane		1.0 bar	Cf (g/mL)	Cp (g/mL)	BSA Rejection (%)
PN1	Time (s)	30	1.0000	0.2285	77
	Time (h)	0.0083			
	Flux (Lm ⁻² h ⁻¹)	519.63			
PN2	Time (s)	116	1.0000	0.2045	80
	Time (h)	0.0322			
	Flux (Lm ⁻² h ⁻¹)	134.39			
PN3	Time (s)	260	1.0000	0.1636	84
	Time (h)	0.0722			
	Flux (Lm ⁻² h ⁻¹)	59.96			
PN4	Time (s)	156	1.0000	0.1796	82
	Time (h)	0.0433			
	Flux (Lm ⁻² h ⁻¹)	99.93			

$$\text{Permeate Flux} = \frac{\text{Volume permeation rate, L}}{\text{Membrane area (m}^2\text{)} \times \text{time (h)}}$$
$$= \frac{0.006 \text{ L}}{0.0013856 \times 0.0083}$$
$$= 519.63 \text{ Lm}^{-2}\text{h}^{-1}$$

B.3: Calculation of Protein Rejection

Membrane		1.0 bar	C_r (g/mL)	C_p (g/mL)	BSA Rejection (%)
PN1	Time (s)	30	1.0000	0.2285	77
	Time (h)	0.0083			
	Flux (Lm ⁻² h ⁻¹)	519.63			
PN2	Time (s)	116	1.0000	0.2045	80
	Time (h)	0.0322			
	Flux (Lm ⁻² h ⁻¹)	134.39			
PN3	Time (s)	260	1.0000	0.1636	84
	Time (h)	0.0722			
	Flux (Lm ⁻² h ⁻¹)	59.96			
PN4	Time (s)	156	1.0000	0.1796	82
	Time (h)	0.0433			
	Flux (Lm ⁻² h ⁻¹)	99.93			

$$\begin{aligned} R(\%) &= \left(1 - \frac{C_p \text{ (g/mL)}}{C_r \text{ (g/mL)}}\right) \times 100 \\ &= \left(1 - \frac{0.2285}{1.000}\right) \times 100 \\ &= 77\% \end{aligned}$$