REFERENCES

1. S.V. Verbich, S.S. Dukhin, A. Tarovski, O. Holt, O. Saether, and J. Sjoblom. Evaluation of Stability Ratio in Oil-in-Water Emulsions. Colloid and Surfaces A: Physicochemical and Engineering Aspects 123-124(1997): 209-223.
2. A. Kabalnov, and H. Wennerstrom. Macroemulsion Stability: The Oriented Wedge Theory Revisited. Langmuir 12(1996): 276-292.
3. S. Ajith, and A.K. Rakshit. Effect of NaCl on a Nonionic Surfactant Microemulsion System. Langmuir 11(1995): 1122-1126.
4. R.W. Capps, G.N. Mattelli, and M.L. Bradford. Reduce Oil and Grease Content in Wastewater. Hydrocarbon Processing (June 1993): 103-110.
5. M.J. Rosen. Surfactants and Interfacial Phenomena. 2nd ed. New York: John Wiley and Son, 1992.
6. W. Phoochinda. Removal of Emulsified Oil from Wastewater Using Froth Flotation. Master's Thesis in Petrochemical Technology. The Petroleum and Petrochemical College, Chulalongkorn University, 1999.
7. P.A. Winsor. Solvent Perperties of Amphiphilic Compounds. London: Butterworth, 1954.
8. K. Aramaki, H. Kuniedada, M. Ishitobi, and T. Tagawa. Effect of Added Salt on Three-Phase Behavior in a Sucrose Monoalkanoate System. Langmuir 13(1997): 2266-2270.
9. A.W. Adamson. Physical Chemistry of Surface. 4th ed. New York: John Wiley and Son, 1982.
10. J. Sjoblom. Emulsions and Emulsion Stability. Vol 61. New York: Marcel Dekker, 1996.

11. X. Zhu, B.E. Reed, W. Lin, P.E. Carriere, and G. Roark. Investigation of Emulsified Oil Wastewater Treatment with Polymer. Separation Science and Technology 34(1997): 2173-2187.

12. J.M. Benito, G. Rios, B. Gutierrez, C. Pazos, and J. Coca. Integrated Process for the Removal of Emulsified Oils from Effluents in the Steel Industry. Separation Science and Technology 34(1999): 3031-3043.

13. Pondstabodee, J.F. Scamehorn, S. Chavedej, and J.H. Harwell. Cleanup of Oily Wastewater by Froth Flotation: Effect of Microemulsion Formation. Separation Science and Technology 33(1998): 591-609.

14. P. Wungrattanasopon, J.H. Scamehorn, S. Chavedej, C. Saiwan, and J.H. Harwell. Use of Foam Flotation to Remove tert-Butylphenol from Water. Separation Science and Technology 31(1996): 1523-1540.

15. B.P. Binks, W.G. Cho, P.D.I. Fletcher, and D.N. Petser. Stability of Oil-in-Water Emulsion in a Low Interfacial System. Langmuir 16(2000): 1025-1034.

16. P. Paton, and F.I. Talens-Alesson. Colloidal Flocculation of Micellar Solutions of Anionic Surfactants. Surfactants and Detergents 1(1998): 339-402.

17. A.E. Greenberg, L.S. Clesceri, and A.D. Eaton. Standard Methods for Examination of Water and Wastewater. 18th ed., 1992.

18. A. Sein, and J.B.F.N. Engberts. Micelle to Lamellar Aggregate Transition of Anionic Surfactant in Dilute Aqueous Solution Induced by Alkali Metal Chloride and Tetraalkylammonium Chloride Salts. Langmuir 11(1995): 455-465.

19. J.K. Armstrong, B.Z. Chowdhry, M.J. Snowden, and S.A. Leharne. Effect of Sodium Chloride upon Micellization and Phase Separation Transitions in Aqueous Solutions of Triblock Copolymer: A High-Sensitivity Differential Scanning Colorimetry Study. Langmuir 14(1998): 2004-2010.

20. ประกาศกระทรวงอุตสาหกรรมฉบับที่ 2 (พ.ศ. 2539) ออกตามความในพระราชบัญญัติโรงงาน พ.ศ. 2535 เรื่องกำหนดคุณลักษณะของน้ำทิ้งที่ระบายออกจากโรงงาน.

APPENDICES

APPENDIX A

Table A-1 Volume fraction of aqueous phase and wax at 25°C.

The simulated wastewater (SW-1) contained 0.3 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Volume of aqueous phase, ml	0.0	9.0	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.90	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Volume fraction of wax	0.0	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

The simulated wastewater (SW-2) contained 0.9 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume of aqueous phase, ml	0.0	8.0	9.0	9.0	9.0	9.0	9.5	9.0	9.0	9.0
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.0	10.5	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.80	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Volume fraction of wax	0.0	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

The simulated wastewater (SW-3) contained 3.0 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	5.0	4.0	3.5	3.0	3.0	3.0	3.0	3.0	3.0
Volume of aqueous phase, ml	0.0	5.0	6.0	6.5	7.0	7.0	7.0	7.0	7.0	7.0
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.50	0.60	0.65	0.70	0.70	0.70	0.70	0.70	0.70
Volume fraction of wax	0.0	0.50	0.40	0.35	0.30	0.30	0.30	0.30	0.30	0.30

The simulated wastewater (SW-4) contaied 4.9 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	7.0	6.5	6.0	6.0	5.5	5.0	5.0	5.0	5.5
Volume of aqueous phase, ml	0.0	3.0	3.5	4.0	4.5	4.5	5.0	5.0	5.0	5.5
Total volume, ml	0.0	10.0	10.0	10.0	10.5	10.0	10.0	10.0	10.0	11.0
Volume fraction of aqueous	0.0	0.30	0.35	0.40	0.43	0.45	0.50	0.50	0.50	0.50
Volume fraction of wax	0.0	0.70	0.65	0.60	0.57	0.55	0.50	0.50	0.50	0.50

The simulated wastewater (SW-5) contained 7.1 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	8.0	7.0	7.0	6.0	6.0	6.5	6.5	6.0	5.5
Volume of aqueous phase, ml	0.0	2.0	3.0	3.5	4.0	5.0	6.0	6.0	5.5	5.5
Total volume, ml	0.0	10.0	10.0	10.5	10.0	11.0	12.5	12.5	11.5	11.0
Volume fraction of aqueous	0.0	0.20	0.30	0.33	0.40	0.45	0.48	0.48	0.48	0.50
Volume fraction of wax	0.0	0.80	0.70	0.67	0.60	0.55	0.52	0.52	0.52	0.50

Table A-2 Volume fraction of aqueous phase and wax at 30°C.

The simulated wastewater (SW-1) contained 0.3 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Volume of aqueous phase, ml	0.0	9.0	9.5	9.5	9.5	9.5	9.5	9.5	10.0	10.0
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.5	10.5
Volume fraction of aqueous	0.0	0.90	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Volume fraction of wax	0.0	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

The simulated wastewater (SW-2) contained 0.9 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	2.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume of aqueous phase, ml	0.0	8.0	8.5	9.5	9.5	9.5	9.5	9.5	9.0	9.0
Total volume, ml	0.0	10.0	10.0	10.5	10.5	10.5	10.5	10.5	10.0	10.0
Volume fraction of aqueous	0.0	0.80	0.85	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Volume fraction of wax	0.0	0.20	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10

The simulated wastewater (SW-3) contained 3.0 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	4.0	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0
Volume of aqueous phase, ml	0.0	6.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.5
Total volume, ml	0.0	10.0	10.5	10.5	10.0	10.0	10.0	10.0	10.0	10.5
Volume fraction of aqueous	0.0	0.60	0.67	0.67	0.70	0.70	0.70	0.70	0.70	0.71
Volume fraction of wax	0.0	0.40	0.33	0.33	0.30	0.30	0.30	0.30	0.30	0.29

The simulated wastewater (SW-4) contained 4.9 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	8.5	7.0	6.5	5.0	5.0	5.0	5.0	5.0	5.5
Volume of aqueous phase, ml	0.0	1.5	3.0	4.5	5.0	5.0	5.0	5.0	5.0	5.5
Total volume, ml	0.0	10.0	10.0	11.0	10.0	10.0	10.0	10.0	10.0	11.0
Volume fraction of aqueous	0.0	0.15	0.30	0.41	0.50	0.50	0.50	0.50	0.50	0.50
Volume fraction of wax	0.0	0.85	0.70	0.59	0.50	0.50	0.50	0.50	0.50	0.50

The simulated wastewater (SW-5) contained 7.1 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	9.0	9.0	7.5	6.0	6.0	5.5	6.0	6.0	6.0
Volume of aqueous phase, ml	0.0	1.0	1.0	2.5	4.5	4.5	4.5	5.5	5.5	5.5
Total volume, ml	0.0	10.0	10.0	10.0	10.5	10.5	10.0	11.5	11.5	11.5
Volume fraction of aqueous	0.0	0.10	0.10	0.25	0.43	0.43	0.45	0.48	0.48	0.48
Volume fraction of wax	0.0	0.90	0.90	0.75	0.57	0.57	0.55	0.52	0.52	0.52

Table A-3 Volume fraction of aqueous phase and wax at 40°C.

The simulated wastewater (SW-1) contained 0.3 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Volume of aqueous phase, ml	0.0	8.0	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.80	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Volume fraction of wax	0.0	0.20	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

The simulated wastewater (SW-2) contained 0.9 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	2.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume of aqueous phase, ml	0.0	8.0	8.5	9.0	9.0	9.0	9.5	9.0	9.0	9.0
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.0	10.5	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.80	0.85	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Volume fraction of wax	0.0	0.20	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10

The simulated wastewater (SW-3) contained 3.0 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Volume of aqueous phase, ml	0.0	6.0	6.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.60	0.60	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Volume fraction of wax	0.0	0.40	0.40	0.30	0.30	0.30	0.30	0.30	0.30	0.30

The simulated wastewater (SW-4) contained 4.9 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	8.0	6.0	6.0	6.0	5.0	5.0	5.0	5.0	5.5
Volume of aqueous phase, ml	0.0	2.0	4.0	4.0	5.5	5.0	5.0	5.0	5.0	5.5
Total volume, ml	0.0	10.0	10.0	10.0	11.5	10.0	10.0	10.0	10.0	11.0
Volume fraction of aqueous	0.0	0.20	0.40	0.40	0.48	0.50	0.50	0.50	0.50	0.50
Volume fraction of wax	0.0	0.80	0.60	0.60	0.52	0.50	0.50	0.50	0.50	0.50

The simulated wastewater (SW-5) contained 7.1 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of semisolid wax, ml	0.0	9.0	8.0	8.0	7.0	6.5	5.5	6.0	6.0	6.0
Volume of water, ml	0.0	1.0	2.0	2.0	3.0	3.5	4.5	5.5	5.5	5.5
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.0	10.0	11.5	11.5	11.5
Volume fraction of clear water	0.0	0.10	0.20	0.20	0.30	0.35	0.45	0.48	0.48	0.48
Volume fraction of semisolid wax	0.0	0.90	0.80	0.80	0.70	0.65	0.55	0.52	0.52	0.52

Table A-4 Volume fraction of aqueous phase and wax at 50°C.

The simulated wastewater (SW-1) contained 0.3 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Volume of aqueous phase, ml	0.0	8.0	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.80	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Volume fraction of wax	0.0	0.20	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

The simulated wastewater (SW-2) contained 0.9 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	2.0	1.5	1.0	1.0	1.0	1.0	1.0	0.5	1.5
Volume of aqueous phase, ml	0.0	8.0	8.5	9.0	9.0	9.0	9.0	9.0	9.5	8.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.80	0.85	0.90	0.90	0.90	0.90	0.90	0.95	0.85
Volume fraction of wax	0.0	0.20	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.15

The simulated wastewater (SW-3) contained 3.0 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	5.5	5.0	4.0	3.0	3.0	2.5	2.5	2.5	2.5
Volume of aqueous phase, ml	0.0	4.5	5.0	6.0	7.0	7.0	7.5	7.5	7.5	7.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.45	0.50	0.60	0.70	0.70	0.75	0.75	0.75	0.75
Volume fraction of wax	0.0	0.55	0.50	0.40	0.30	0.30	0.25	0.25	0.25	0.25

The simulated wastewater (SW-4) contained 4.9 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	8.0	7.0	6.5	6.0	5.5	5.0	5.0	5.0	5.0
Volume of aqueous phase, ml	0.0	2.0	3.0	4.0	4.0	4.5	5.0	5.0	5.0	5.0
Total volume, ml	10.0	10.0	10.0	10.5	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous	0.0	0.20	0.30	0.38	0.40	0.45	0.50	0.50	0.50	0.50
Volume fraction of wax	0.0	0.80	0.70	0.62	0.60	0.55	0.50	0.50	0.50	0.50

The simulated wastewater (SW-5) contained 7.1 % solid content.

NaCl, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	9.5	9.0	8.0	7.0	6.5	6.0	7.0	7.0	7.0
Volume of aqueous phase, ml	0.0	0.5	1.0	2.0	3.0	3.5	4.0	5.0	5.0	5.0
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.0	10.0	12.0	12.0	12.0
Volume fraction of aqueous	0.0	0.05	0.10	0.20	0.30	0.35	0.40	0.42	0.42	0.42
Volume fraction of wax	0.0	0.95	0.90	0.80	0.70	0.65	0.60	0.58	0.58	0.58

APPENDIX B

Table B-1 Volume fraction of aqueous phase and wax at 25°C.

The simulated wastewater (SW-1) contained 0.3 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume of aqueous phase, ml	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.5	9.5	9.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.5	10.5	10.5
Volume fraction of aqueous phase	0.80	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Volume fraction of wax	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

The simulated wastewater (SW-2) contained 0.9 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	3.0	2.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Volume of aqueous phase, ml	7.0	7.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous phase	0.70	0.75	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Volume fraction of wax	0.30	0.25	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

The simulated wastewater (SW-3) contained 3.0 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	6.0	5.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Volume of aqueous phase, ml	4.0	5.0	6.0	7.0	7.5	7.0	7.0	7.0	7.0	7.0
Total volume, ml	10.0	10.0	10.0	10.0	10.5	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous phase	0.40	0.50	0.60	0.70	0.71	0.70	0.70	0.70	0.70	0.70
Volume fraction of wax	0.60	0.50	0.40	0.30	0.29	0.30	0.30	0.30	0.30	0.30

The simulated wastewater (SW-4) contained 4.9 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	7.0	6.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Volume of aqueous phase, ml	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.5
Volume fraction of aqueous phase	0.30	0.40	0.40	0.50	0.50	0.50	0.50	0.50	0.50	0.52
Volume fraction of wax	0.70	0.60	0.60	0.50	0.50	0.50	0.50	0.50	0.50	0.48

The simulated wastewater (SW-5) contained 7.1 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	9.0	9.0	8.0	8.0	7.5	7.5	7.5	7.5	7.5	8.0
Volume of aqueous phase, ml	1.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5
Total volume, ml	10.0	11.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.5
Volume fraction of aqueous phase	0.10	0.18	0.20	0.20	0.25	0.25	0.25	0.25	0.25	0.24
Volume fraction of wax	0.90	0.82	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.76

Table B-2 Volume fraction of aqueous phase and wax at 30°C.

The simulated wastewater (SW-1) contained 0.3 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Volume of aqueous phase, ml	9.0	9.5	9.5	9.5	9.5	9.0	9.5	9.5	9.0	9.5
Total volume, ml	10.5	10.0	10.0	10.0	10.0	9.5	10.0	10.0	9.5	10.0
Volume fraction of aqueous phase	0.86	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Volume fraction of wax	0.14	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

The simulated wastewater (SW-2) contained 0.9 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	2.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume of aqueous phase, ml	7.5	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous phase	0.75	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Volume fraction of wax	0.25	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

The simulated wastewater (SW-3) contained 3.0 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.5
Volume of aqueous phase, ml	6.0	6.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	8.0
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.5
Volume fraction of aqueous phase	0.60	0.60	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.76
Volume fraction of wax	0.40	0.40	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.24

The simulated wastewater (SW-4) contained 4.9 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	7.0	6.0	5.5	5.0	5.0	5.0	5.0	5.0	5.0	5.5
Volume of aqueous phase, ml	3.0	4.0	4.5	5.0	5.0	5.0	5.5	5.0	5.0	5.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.5	10.0	10.0	11.0
Volume fraction of aqueous phase	0.30	0.40	0.45	0.50	0.50	0.50	0.52	0.50	0.50	0.50
Volume fraction of wax	0.70	0.60	0.55	0.50	0.50	0.50	0.48	0.50	0.50	0.50

The simulated wastewater (SW-5) 7.1 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt.%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	8.0	7.0	6.0	6.0	5.5	5.5	5.5	5.0	5.0	5.0
Volume of aqueous phase, ml	2.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0
Total volume, ml	10.0	10.0	10.0	10.0	10.5	10.5	10.5	10.0	10.0	10.0
Volume fraction of aqueous phase	0.20	0.30	0.40	0.40	0.48	0.48	0.48	0.50	0.50	0.50
Volume fraction of wax	0.80	0.70	0.60	0.60	0.52	0.52	0.52	0.50	0.50	0.50

Table B-3 Volume fraction of aqueous phase and wax at 40°C.

The simulated wastewater (SW-1) contained 0.3 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Volume of aqueous phase, ml	9.0	9.5	9.5	9.5	9.0	9.5	9.5	9.5	9.5	9.0
Total volume, ml	10.5	10.0	10.0	10.0	9.5	10.0	10.0	10.0	10.0	9.5
Volume fraction of aqueous phase	0.86	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Volume fraction of wax	0.14	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

The simulated wastewater (SW-2) contained 0.9 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	2.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume of aqueous phase, ml	7.5	9.0	9.0	9.0	9.0	9.0	9.5	9.0	9.0	9.0
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.5	10.0	10.0	10.0
Volume fraction of aqueous phase	0.75	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Volume fraction of wax	0.25	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

The simulated wastewater (SW-3) contained 3.0 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	7.0	5.0	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Volume of aqueous phase, ml	3.0	5.0	6.5	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous phase	0.30	0.50	0.65	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Volume fraction of wax	0.70	0.50	0.35	0.30	0.30	0.30	0.30	0.30	0.30	0.30

The simulated wastewater (SW-4) contained 4.9 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	7.5	7.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Volume of aqueous phase, ml	2.5	3.0	4.0	5.0	5.0	5.0	5.5	5.5	5.5	5.0
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.5	10.5	10.5	10.0
Volume fraction of aqueous phase	0.25	0.30	0.40	0.50	0.50	0.50	0.52	0.52	0.52	0.50
Volume fraction of wax	0.75	0.70	0.60	0.50	0.50	0.50	0.48	0.48	0.48	0.50

The simulated wastewater (SW-5) 7.1 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt.%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	9.0	8.0	6.5	6.0	5.5	5.5	5.5	5.5	5.5	5.5
Volume of aqueous phase, ml	1.0	2.0	3.5	4.0	4.5	4.5	4.5	4.5	4.5	4.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous phase	0.10	0.20	0.35	0.40	0.45	0.45	0.45	0.45	0.45	0.45
Volume fraction of wax	0.90	0.80	0.65	0.60	0.55	0.55	0.55	0.55	0.55	0.55

Table B-4 Volume fraction of aqueous phase and wax at 50°C.

The simulated wastewater (SW-1) contained 0.3 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Volume of aqueous phase, ml	0.0	8.0	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous phase	0.0	0.80	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Volume fraction of wax	0.0	0.20	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

The simulated wastewater (SW-2) contained 0.9 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	3.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume of aqueous phase, ml	0.0	6.5	8.5	9.0	9.0	9.0	9.0	9.0	9.5	9.0
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.5	10.0
Volume fraction of aqueous phase	0.0	0.65	0.85	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Volume fraction of wax	0.0	0.35	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10

The simulated wastewater (SW-3) contained 3.0 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	5.0	4.0	3.0	2.5	2.5	2.5	3.0	2.5	2.5
Volume of aqueous phase, ml	0.0	5.0	6.5	7.0	7.5	7.5	7.5	8.0	7.5	7.5
Total volume, ml	10.0	10.0	10.5	10.0	10.0	10.0	10.0	11.0	10.0	10.0
Volume fraction of aqueous phase	0.0	0.50	0.62	0.70	0.75	0.75	0.75	0.73	0.75	0.75
Volume fraction of wax	0.0	0.50	0.38	0.30	0.25	0.25	0.25	0.27	0.25	0.25

The simulated wastewater (SW-4) contained 4.9 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	7.0	5.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5
Volume of aqueous phase, ml	0.0	3.0	5.0	6.0	6.0	6.0	6.0	6.0	6.5	6.5
Total volume, ml	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Volume fraction of aqueous phase	0.0	0.30	0.50	0.60	0.60	0.60	0.60	0.60	0.65	0.65
Volume fraction of wax	0.0	0.70	0.50	0.40	0.40	0.40	0.40	0.40	0.35	0.35

The simulated wastewater (SW-5) 7.1 % solid content.

$AlNH_4(SO_4)_2.12H_2O$, wt.%	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Volume of wax, ml	0.0	9.0	8.0	6.5	6.0	6.0	5.0	5.0	5.0	5.0
Volume of aqueous phase, ml	0.0	1.0	2.0	3.5	4.0	4.5	5.0	5.0	5.0	5.0
Total volume, ml	0.0	10.0	10.0	10.0	10.0	10.5	10.0	10.0	10.0	10.0
Volume fraction of aqueous phase	0.0	0.10	0.20	0.35	0.40	0.43	0.50	0.50	0.50	0.50
Volume fraction of wax	0.0	0.90	0.80	0.65	0.60	0.57	0.50	0.50	0.50	0.50

VITA

Mr. Satit Praipuk was born on October 14, 1973 in Roi-Ed province. He received his Bachelor Degree in Chemistry from Department of Chemistry, Faculty of Science, Mahasarakham University in 1995. He jointed Mobil Oil Thailand Limited in 1996. He began his Master degree study in the Program of Petrochemistry and Polymer Science, Graduate School, Chulalongkorn University, in 1998 and completed the program in 2001.