

REFERENCES

- Aplan, F.F. (1997) Flotation. In Handbook of Separation Techniques for Chemical Engineering; 3rd Ed.; Schweitzer, P.A. (Ed.) New York: McGraw-Hill.
- Basu S. and Malpani P.R. (2001) Removal of Methyl Orange and Methylene Blue Dye from Water using Colloidal Gas Aphron- Effect of Processes Parameter. Separation Science and Technology, 36, 2997-3013.
- Beneventi, D, Manera, L., Carré, B, and Gandini, A. (2003) Dynamic surface tension of flotation deinking systems: from model surfactant mixtures to process waters. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 219, 201-213.
- Benn, F.W.A. and Cornell, W.L. (1993) Removal of Heavy Metals from Missouri Lead Mill Tailings by Froth Flotation. Separation Science and Technology, 28, 733-746.
- Bourrel, M. and Schechter, R.S. (1988) The R-Ratio. In Microemulsions and Related Systems. New York: Marcel Dekker.
- Carleson, T.E. (1989) Adsorptive Bubble Separation Processes. In Surfactant Based Separation Process; Scamehorn, J.F. and Harwell, J.H. (Eds.) New York: Marcel Dekker.
- Costa, C. A. and Rubio, J. (2005) Deinking flotation: influence of calcium soap and surface-active substances. Minerals Engineering, 18, 59-64.
- Chambers, D.J. (1994) Foams for Well Stimulation, In Foam: Fundamentals and Applications in the Petroleum Industry; Schramm L.L. (Ed.) Washington, DC: American Chemical Society.
- Chavadej, S., Ratanarojanatam, P., Phoochinda, W., Yanatatsaneejit, U., and Scamehorn, J.F. (2004a) Clean-up of Oily Wastewater by Froth Flotation: Effect of Microemulsion Formation II: Use of Anionic/Nonionic Surfactant Mixtures. Separation Science and Technology, 39, 3003-3020.
- Chavadej, S., Phoochinda, W., Yanatatsaneejit, U., and Scamehorn, J.F. (2004b) Clean-up of Oily Wastewater by Froth Flotation: Effect of Microemulsion Formation III: Use of Anionic/Nonionic Surfactant Mixtures and Effect of

- Relative Volumes of Dissimilar Phases. Separation Science and Technology, 39, 3021-3036.
- Choi, S.J. and Choi, Y.H. (1996) Removal of Direct Red from Aqueous Solution by Foam Separation Techniques of Ion and Adsorbing Colloid Flotation. Separation Science and Technology, 1, 2105-2116.
- Clarence, A.M. and Neogi, P. (1985) Surfactants. In Interfacial Phenomena: Equilibrium and Dynamic Effects. New York: Marcel Dekker.
- Dai Y., Deng T., Wang j., and Xu K. (2004) Enhancement of Oxygen Gas-Liquid Mass Transfer with Colloidal Gas Aphron Dispersions. Colloids and Surfaces A, 240, 165-171.
- Feng, D. and Aldrich, C. (2000) Removal of Diesel from Aqueous Emulsions by Flotation. Separation Science and Technology, 35, 2159-2172.
- Hadj-Ziane, A.Z. and Moulay, S. (2004) Microemulsion breakdown using the pervaporation technique: application to cutting oil models. Desalination, 170, 91-97.
- Hashim M.A. and Gupta B. S. (1998) The Application of Colloidal Gas Aphrons in the Recovery of Fine Cellulose Fibres from Paper Mill Wastewater. Bioresource Technology, 64, 163-252.
- Hoar, T.P. and Schulman, J.H. (1943) Transparent water-in-oil dispersions: The oleopathic hydro-micelle. Nature, 152, 102-103
- Huang, L., Lips, A., and Co, C. (2004) Microemulsification of Triglyceride Sebum and the Role of Interfacial Structure on Bicontinuous Phase Behavior, Langmuir, 20, 3559-3563.
- Irwin, R.J., Van Mouwerik, M., Stevens, L., Seese, M.D., and Basham, W. (1997) Environmental Contaminants Encyclopedia. National Park Service, Water Resources Division, Fort Collins, Colorado.
- Jarudilokkul, S., Rungphetcharat, K., and Boonamnuayvitaya, V. (2004) Protein Separation by Colloidal Gas Aphrons using Nonionic Surfactant. Separation and Purification Technology, 35, 23-29.
- Jauregi P. and Varley J. (1999) Colloidal Gas Aphrons: Potential Applications in Biotechnology. Trends in Biotechnology, 17, 389-395.

- Johnson, N.M. (1986) Assessing the Capabilities of Microbial Degradation of Used Lubricating Oil on Soil, M.S. thesis, University of Illinois Urbana-Champaign.
- Kabil, M.A. and Ghazy, S.E. (1994) Separation of Some Dyes from Aqueous Solutions by Flotation. Separation Science and Technology, 29, 2533-2539.
- Kirk-Othmer (1981), Lubrication and Lubricants. In Kirk-Othmer Encyclopedia of Chemical Technology, Booser, E.R. (Ed.) New York: Wiley Interscience.
- Leu, M.H., Chang, J.E., and Ko, M.S. (1994) Removal of Heavy Metals from a Chelated Solution with Electrolytic Foam Separation. Separation Science and Technology, 19, 2245-2261.
- Miñana-Pérez, M., Antón, R.E., Graciaa, A., Lachaise, J., and Salager, J.L. (1995) Solubilization of Polar Oils with Extended Surfactants, Colloid Surfaces A 100, 217-224.
- Noble M.J. and Varley J. (1999) Colloidal Gas Aphrons Generated from the Anionic Surfactant AOT for the Separation of Proteins from Aqueous Solution. Journal of Chemical Technology and Biotechnology, 74, 231-237.
- Pal, R. and Maliyah, J. (1990) Oil Recovery from Oil in Water Emulsions Using flotation column. Canadian Journal of Chemical Engineering, 68, 959-967.
- Patterson, J.W. (1975) Treatment Technology for Oily Wastes. In Wastewater Treatment Technology. Michigan: Ann Arbor.
- Perez, M., Rodriguez-Cano, R., Romero, L.I., and Sales, D. (2006) Anaerobic thermophilic digestion of cutting oil wastewater: Effect of co-substrate. Biochemical Engineering Journal, 29, 250-257.
- Pondstabodee, S., Scamehorn, J.F., Chavadej, S., and Harwell, J.H. (1998) Removal ortho-dichlorobenzene by froth flotation under Winsor's type III conditions. Separation Science and Technology, 33, 591-609.
- Prince, L.M. (1977) Micoemulsion: Theory and Practice. New York: Academic Press.
- Prud'homme, R.K. and Khan, S.A. (1996) Foams: Theory, Measurements, and Applications. New York: Marcel Dekker.

- Rios, G., Pazos, C., and Coca, J. (1998) Destabilization of cutting oil emulsions using inorganic salts as coagulants. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 138, 383-389.
- Rosen, M.J. (2004) Emulsification by Surfactants. In Surfactant and Interfacial Phenomena. 3rd Ed., New York: John Wiley and Sons.
- Samuthjarindr, J. (2001) Relationship between foam stability and froth flotation efficiency. MS thesis. Department of Chemical Technology, Faculty of Science, Chulalongkorn University.
- Sasol North America. <http://www.sasoltechdata.com/tds/ALFOTERRA.pdf> [retrieved 5 March 2008]
- Scamehorn, J.F. and Harwell, J.H. (1989) Surfactant Based Separation Processes. New York: Marcel Dekker.
- Scamehorn, J.F. and Harwell, J.H. (2000) In Surfactant-Based Separations: Science and Technology. Washington, DC: American Chemical Society.
- Schramm, L.L. and Wassmuth, F. (1994) Foams: Basic Principles, In Foam: Fundamentals and Applications in the Petroleum Industry; Schramm L.L. (Ed.) Washington, DC: American Chemical Society.
- Sebba F. (1971) Microfoams-an unexpected colloid system. Journal of Colloid and Interface Science, 35, 643-646.
- Sebba F. (1987) Foams and Biliquid Foams-Aphrons. Chichester: John Wiley and Sons.
- Sharma, M.K. (1991) Particle Technology and Surface Phenomena, 2nd Ed. New York: John Wiley and Sons.
- Somasundaran, P. and Ananthapadmanabhan, K.P. (1987) Bubble and Foam Separations-Ore Flotation, In Handbook of Separation Process Technology; Rousseau, R.W. (Ed.) New York: John Wiley and Sons.
- Song, C., Hsu, C.S., and Mochida, I. (2000) Applied Energy Technology Series. In Chemistry of Diesel Fuels. New York: Taylor & Francis.
- Vartanian, P.F. (1991) The Chemistry of Modern Petroleum Product Additives. Journal of Chemical Education, 68, 1015-1020.

- Vazquez-Duhalt, R. and Greppin, H. (1986) Biodegradation of Used Motor Oil by Bacteria Promotes the Solubilization of Heavy Metals. The Science of the Total Environment, 52, 109-121.
- Yanatatsaneejit, U. (2004) Microemulsion Formation of Surfactant/Oily Wastewater System and Relation to Clean-Up by Froth Flotation. Ph D. Dissertation. The Petroleum and Petrochemical College, Chulalongkorn University.
- Yanatatsaneejit, U., Witthayapanyanon, A., Rangsunvigit, P., Acosta, E.J., Sabatini, D.A., Scamehorn, J.F., and Chavadej, S. (2005a) Ethylbenzene Removal by Froth Flotation under Conditions of Middle-Phase Microemulsion Formation I: Interfacial Tension, Foamability, and Foam Stability. Separation Science and Technology, 40, 1537-1553
- Yanatatsaneejit, U., Chavadej, S., Rangsunvigit, P., and Scamehorn, J.F. (2005b) Ethylbenzene Removal by Froth Flotation under Conditions of Middle-Phase Microemulsion Formation II: Effect of Air Flow Rate, Oil to Water Ratio, and Equilibration time. Separation Science and Technology, 40, 1609-1620.
- Yorar, B. (1997) Flotation, In Encyclopedia of Separation Technology Vol. 2: Ruthven, D.M. (Ed.) New York: John Wiley and Sons.
- Wilson, A.J. (1996) Experimental Techniques for the Characterization of Foams, In Foam: Theory, Measurements, and Application; Prud'homme, R.K. and Khan, S.A. (Eds.) New York: Marcel Dekker.
- Winsor, P.A. (1968). Binary and Multicomponent Solutions of Amphiphilic Compounds, Solubilization and the Formation, Structure, and Theoretical Significance of Liquid Crystalline Solution. Chemical Reviews, 68, 1-40.
- Witthayapanyanon, A., Acosta, E.J., Harwell, J.H., and Sabatini, D.A. (2006) Formulation of Ultralow Interfacial Tension Systems Using Extended Surfactants. Journal of Surfactants and Detergents, 9, 331-339.
- Wungrattanasopon, S., Scamehorn, J.F., Chavadej, S., Saiwan, C., and Harwell, J.H. (1996) Use of foam flotation to remove *tert*-butylphenol from water. Separation Science and Technology, 31, 1523-1540.
- Zouboulis, A.I., Lazaridis, N.K., and Zamboulis, D. (1994) Powdered Activated Carbon Separation from Water by Foam Flotation. Separation Science and Technology, 29, 385-400.

CURRICULUM VITAE



Name: Miss Sunisa Watcharasing

Date of Birth: July 31, 1981

Nationality: Thai

Education:

- 1998-2001 B.Sc. in Chemical Engineering, Faculty of Science, Chulalongkorn University, Bangkok, Thailand.
- 2002-2003 M.Sc. in Petrochemical Technology, The Petroleum and Petrochemical College, Chulalongkorn University, Bangkok, Thailand.
- 2004-2007 Ph.D. candidate in Petrochemical Technology, The Petroleum and Petrochemical College, Chulalongkorn University, Bangkok, Thailand.

Publications:

1. **Watcharasing, S.**, Angkathunyakul, P., Chavadej, S. (2008) Diesel Oil Removal from Water by Froth Flotation under Low Interfacial Tension and Colloidal Gas Aphron Conditions. Separation and Purification Technology (in Press).
2. **Watcharasing, S.**, Chavadej, S., Scamehorn, J.F. (2008) Diesel Oil Removal by Froth Flotation under Low Interfacial Tension Conditions II: Continuous Mode of Operation, Separation Science and Technology (in Press).
3. **Watcharasing, S.**, Weerawat, K., Rangsunvigit, P., Chavadej, S., Scamehorn, J.F. Motor Oil Removal from Wastewater by Continuous Froth Flotation using Extended Surfactant: Effects of Operational Parameters and Air Bubble Size. Separation and Purification Technology (in preparation).
4. **Watcharasing, S.**, Lapee-e, A., Rangsunvigit, P., Chavadej, S., Scamehorn, J.F. Cutting Oil Removal by Continuous Froth Flotation under Low Interfacial Tension Conditions: I Dynamic Surface Tension, Entering, Bridging, Spreading Coefficients and Foam Characteristics. Separation and Purification Technology (in preparation).

5. **Watcharasing, S.,** Lapee-e, A., Rangsunvigit, P., Chavadej, S., Scamehorn, J.F. Cutting Oil Removal by Continuous Froth Flotation under Low Interfacial Tension Conditions: II Extended Surfactant and Mass Transfer Surface Area. Separation and Purification Technology (in preparation).

Proceedings:

1. **Watcharasing, S.,** Yanatatsaneejit, U., Chavadej, S., Rangsunvigit, P., Scamehorn, J.F. (2004) Diesel Removal by Continuous Froth Flotation: Effect of Ultralow Interfacial Tension and Foam Characteristics. Proceedings of the 10th APCChE Congress, October 17 – 21, 2004, Kitakyushu, Japan.
2. Yanatatsaneejit U., **Watcharasing, S.,** Chavadej S., Rangsunvigit P., and Scamehorn J.F. (2005) Removal of Diesel in Froth Flotation Operation: Comparison between Batch and Continuous Modes of Operation. Proceedings of the 7th World Congress of Chemical Engineering, July 10 – 14, 2005, Glasgow, Scotland.
3. **Watcharasing, S.,** Chavadej, S., Scamehorn, J.F. (2006) Oily Wastewater Treatment by Continuous Froth Flotation and Relation to Foam Characteristics. Proceedings of the 13th RSCE, December 3-5, 2006, School of Chemical and Biomedical Engineering, Nanyang Technological University (NTU), Singapore.

Presentations:

1. **Watcharasing, S.,** Yanatatsaneejit, U., Chavadej, S., Scamehorn, J.F. Rangsunvigit, P. (2005) Diesel Removal by Continuous Froth Flotation: Effect of Low Interfacial Tension (IFT) and Foam Characteristics. The 96th AOCS Annual Meeting & Expo, May 1-4, 2005, Salt Lake City, Utah, USA. (*Oral Presentation*).
2. **Watcharasing, S.,** Chavadej, S., Scamehorn, J.F. (2005) Oily Wastewater Treatment by Continuous Froth Flotation and Relation to Foam Characteristics. RGJ Seminar Series XXXVIII Mechanical & Chemical Engineering Research, November 18, 2005, Suranaree University of Technology, Thailand. (*Oral Presentation*)

3. **Watcharasing, S., Yanatatsaneejit, U., Chavadej, S., Scamehorn, J.F. Rangsunvigitt, P. (2006)** Oily Wastewater Treatment by Continuous Froth Flotation and Relation to Foam Characteristics. The 97th AOCS Annual Meeting & Expo, April 30 - May 3, 2006, America's Center, Saint Louis, Missouri, USA. (*Oral Presentation*)
4. **Watcharasing, S., Kongkowitz, W., Chavadej, S., Scamehorn, J.F. (2007)** Bubble Size Distribution in a Froth Flotation Column under Ultralow Interfacial Tension Conditions and Relation to Foam Characteristics. The 98th AOCS Annual Meeting & Expo, May 13-16, 2007, Québec city, Canada. (*Oral Presentation*)
5. **Watcharasing, S., Kongkowitz, W., Chavadej, S., Rangsunvigitt, P., Scamehorn, J.F.(2007)** Removal of Motor Oil from Water using Continuous Froth Flotation under Microemulsion Conditions. The 2nd ICAPP 2007, June 25-28, 2007, Bangkok, Thailand. (*Poster Presentation*)
6. **Watcharasing, S., Kongkowitz, W., Chavadej, S., Scamehorn, J.F. (2007)** Bubble Size Distribution and Bubble Velocity in a Froth Flotation Column under Ultra-Low Interfacial Tension Conditions in Relation to Oil Removal. ASCIC 2007, October 28-30, 2007, Jinan, China. (*Oral Presentation*)

Awards:

1. **“Best Presentation Award”** at RGJ Seminar Series XXXVIII Mechanical & Chemical Engineering, November 18, 2005, Suranaree University of Technology, Thailand.
2. **“Surfactants & Detergents Division Student Travel Award Winner”** from The Surfactants and Detergents Division of the 98th AOCS Annual Meeting & Expo, May 13 - 16, 2007, Québec city, Canada.