Dr. Santanu Paria

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Education

Ph.D (Chemical Engineering) ***Indian Institute of Technology, Bombay***, Powai, Mumbai, India, July 1999 - September 2003.

M. Tech. (Chemical Technology) ***University of Calcutta***, Calcutta, India, 1996.

B. Tech. (Chemical Technology) ***University of Calcutta***, Calcutta, India, 1994.

Publications

(a) Refereed Journals

14. Rajib Ghosh Chaudhuri and ***Santanu Paria***. "Dynamic contact angle on hydrophilic and hydrophobic surfaces by aqueous surfactant solution in absence and presence of electrolytes." *Submitted.*

13. K. Jagajjanani Rao and ***Santanu Paria***. "Solubilization of Naphthalene in presence of plant and plant – synthetic mixed surfactant systems." *Submitted.*

12. ***Santanu Paria,*** "Surfactant-Enhanced Remediation of Organic Contaminated Soil and Water." *Advances in Colloid and Interface Science*, 138, 24-58, 2008.

11. ***Santanu Paria*** and Pak K. Yuet, "Adsorption of Nonionic Surfactants onto Sand and its Importance in Naphthalene Removal." *Industrial & Engineering Chemistry Research*, 46, 108-113, 2007.

10. ***Santanu Paria*** and Pak K. Yuet, "Solidification/Stabilization Treatment of Organic and Inorganic Contaminants using Portland Cement: A Literature Review." *Environmental Reviews*, 14, 217-255, 2006. **No. of Citations: 03.**

9. ***Santanu Paria***, "The mixing behavior of n-alkylpyridinium bromide – NP-9 mixed surfactant systems." *Colloids and Surfaces A: Physiochemical and Engineering Aspects*, 281, 113-118, 2006. **No. of Citations: 01.**

8. ***Santanu Paria*** and Pak K. Yuet, "Solubilization of Naphthalene by Pure and Mixed Surfactants." *Industrial & Engineering Chemistry Research*, 45, 3552-3558, 2006. **No. of Citations: 03.**

7. ***Santanu Paria*** and Pak K. Yuet, "Effects of Chain Length and Electrolyte on the Adsorption of n-Alkylpyridinium Bromide Surfactants at the Sand-Water Interfaces." *Industrial & Engineering Chemistry Research*, 45, 712-718, 2006. **No. of Citations: 02.**

6. ***Santanu Paria***, C. Manohar and Kartic C. Khilar, "Kinetics of Adsorption of Anionic, Cationic and Non-ionic Surfactants." *Industrial & Engineering Chemistry Research*, 44, 3091-3098, 2005. **No. of Citations: 03.**

5. ***Santanu Paria***, C. Manohar and Kartic C. Khilar, "Adsorption of Anionic and Non-ionic Surfactants on a Cellulosic Surface." *Colloids and Surfaces A: Physiochemical and Engineering Aspects*, 252, 221-229, 2005. **No. of Citations: 04.**

4. ***Santanu Paria*** and Kartic C. Khilar, "A Review on Experimental Studies of Surfactant Adsorption at the Hydrophilic Solid-Water Interface." *Advances in Colloid and Interface Science*, 110, 75-95, 2004. **No. of Citations: 55.**

3. ***Santanu Paria***, C. Manohar and Kartic C. Khilar, "Effect of Cationic Surfactant on the Adsorption Characteristics of Anionic Surfactant on Cellulose Surface." *Colloids and Surfaces A: Physiochemical and Engineering Aspects*, 232, 139-142, 2004. **No. of Citations: 05.**

2. ***Santanu Paria***, C. Manohar and Kartic C. Khilar, "Studies on Adsorption of Surfactants onto Cellulosic Surface and its Relevance to Detergency." *JIES* (Journal of Institution of Engineers Singapore), Chemical Engineering 43, 34-44, 2003.

1. Ashish Batra, ***Santanu Paria***, C. Manohar and Kartic C. Khilar**,** "Removal of Surface Adhered Particles by Surfactants and Fluid Motions." *AIChE Journal*, 47, 2557-2565, 2001. **No. of Citations: 06.**

(Total Citations received up to Aug. 2008, 82)

(b) Conference

1. ***Santanu Paria***, Kartic C. Khilar and C. Manohar, **"Adsorption of Surfactants on Cellulosic Surface: Experiments and Theory."** Indo-French Workshop on Advances in the Understanding of Adsorption Phenomena at the Solid/Liquid Interfaces held in TRDDC, Pune, February 11-16, 2001, India.
2. **Santanu Paria,** and K. Jagajjanani Rao, "**Adsorption of Nonionic Surfactants on Sand for the Application of Organic Contaminated Soil and Groundwater Remediation,"** International Symposium on Recent Trends in Surface & Colloid Science, held in Indian Statistical Institute, Kolkata, November 15-16, 2007, India.

Postdoctoral Research

Postdoctoral Fellow, Department of Chemical Engineering, Dalhousie University, Canada. (From Oct., 2003 to March 2005).

Courses Taught in NITRKL

Mass Transfer, Advanced Mass Transfer, Colloids and Interfacial Engineering (UG & PG), Nanoscience and Technology (UG & PG), Chemical Process Calculations, Mass Transfer Laboratory.

Research Interest

Nano Technology, Environmental applications of Surfactants, Solubilization in micellar system, Adsorption at the solid/liquid interface, Self-assembly of surfactant at the solid/liquid by AFM, Surfactants in Mineral Beneficiation, Mixed Surfactant Systems, Interfacial Phenomena, Surfactants in Biotechnology, Microemulsion.

Brief description of the research areas

(i) Nano Technology: Preparation of different shape nanoparticles in surfactant-assisted media (mainly in reverse microemulsion). The preparation of different nanoparticles with controlled size/shape/functionality/material of construction is most important for many

applications like catalyst, nanofluids, pharmaceuticals, biological applications (selective drug delivery, controlled drug released etc), electronics etc.

We are also interested to see the application of different shape nanoparticles in nano fluids as heat transfer fluids.

(ii) Environmental Applications of Surfactants: The area is mainly focused on surfactant enhanced soil and groundwater remediation. Recently contaminated soil and groundwater due to organic contaminants have become major environmental issue, since most of the countries used groundwater as a cheap source of drinking water. Recently, among the in situ treatment approaches, surfactant flushing has been recognized as one of the promising technologies. Fundamental studies on different surfactants adsorption on soil constituents, solubilization of organic contaminants in surfactant systems, partitioning of contaminants in soil and micellar phase, use of bio surfactants can enhanced the basic understanding of surfactant enhanced remediation (SER) process.

(iii) Surfactant Adsorption: Adsorption of surfactants at the solid–liquid interfaces is an important phenomenon in many practical applications of surfactant-assisted areas, such as, detergency, flotation of ore, oil recovery, and dispersions such as paints and pigments. In particular, the adsorption is a crucial step for removal of particulates and oily soils in detergency. The main focus of this is to study the adsorption behavior of different single and mixed surfactants, some special types of surfactants on different solid-liquid interface. In many industrial applications mixed surfactants are used because of better performance, less consumption and economically viable. Most of cases mixed surfactants systems are used after trial and error experiments. The selection of mixed surfactant systems will be easy when the fundamentals of the mixed system will be well explored. Also to study the effects of different parameters on adsorption.

Another part of this area is to characterize the adsorption behavior using ***Atomic Force Microscope***. Atomic Force Microscope is the one of the modern instruments, which can generates molecular level picture of the adsorbed surfactant molecules on a solid surface. More over, the electrical interaction between the solid surface and the surfactant molecules also can be measured using the Atomic Force Microscope. The main objective

of this part is to study the self-assembly of surfactants molecule on atomically smooth surfaces and to measure the electrical forces.

(iv) Surfactants in Mineral Beneficiation: In many cases, surfactants are used to produce high quality coal for power plant and other application by reducing ash level. Understanding of surface property of coal and mechanism of surfactant adsorption on coal surface can improve the surfactant enhanced coal beneficiation process, dewatering of coal. Recently, Govt. of India has announced to increase the iron production enormously (110 MT/Y) by 2019-2020. Whereas, reduction of alumina in Indian iron ore and utilization of iron ore slimes are major problem in iron ore processing industry. Use of surfactants may reduce the alumina in iron and also may increase the iron ore recovery from the slime. Use of surfactants can also reduce the viscosity of the slurry, which can be useful in slurry transport.

(v) Solution Properties of Mixed Surfactant Systems: Mixed surfactant systems are used in many applications due to their better performance and less consumption than the pure surfactants. The mixed surfactant systems always show synergistic behavior, resulting reduces the total amount of surfactant used in a particular application, which in turn thus reduces both cost and environmental impact. Due to the synergistic behavior, the physical properties of mixed surfactant systems such as CMC and interfacial tensions are often substantially lower than would be expected based on the properties of pure components. In general, for practical applications the mixtures of dissimilar surfactants are used. The mixtures of dissimilar surfactants show more non-ideal behavior is of both theoretical interest and practical importance.

On going sponsored research projects

Project title: Fundamental studies on surfactant adsorption on soil for environmental and other applications.

Funding agency: UGC

Project Cost: Rs. **12 Lakh**

Principal investigator: Dr. Santanu Paria, Co-PI: Dr. Japes Bera (Ceramic Engineering)

2. Project title: "Preparation and Characterization of SiO_2 and TiO_2 Hollow Nanoparticles in Reverse Microemulsion."

Finding agency: DST

Project Cost: Rs. **46 Lakh**

Principal investigator: Dr. Santanu Paria

Research Group

- **Ph.D**
  - **Nihar Ranjan Biswal (On going)**

Research Area: Surfactant enhanced soil and ground water remediation

- **M. Tech (*Research*)**
  - **Jagajjanani Rao K (On going)**

Research Area: Solubilization and biodegradation of organic contaminants in presence of surfactants.

  - **Minaketan Ray (On going)**

Research Area: Nanotechnology

- **M. Tech (*Regular*)**
  - **Rajib Ghosh Choudhuri (On going)**

Research Area: Nanotechnology

Paper reviewing from international journals

American Chemical Society: Environmental Science and Technology, Journal of Physical Chemistry B, Industrial & Engineering Chemistry Research, Langmuir.

Elsevier Science: Chemosphere, Colloids and Surfaces A, Environmental Pollution, Journal of Environmental Management.

Springer: Applied Microbiology and Biotechnology.

Invited Lecture/Seminar Given

"Application of Surfactants in Soil and Groundwater Remediation." Department of Chemical Engineering, NIT Rourkela, Rourkela, Orissa, on 29 th April, 2005.

Work Experiences

1. **National Institute of Technology**, Rourkela-769008, Orissa, India. From July 13, 2006 as ***Assistant Professor*** in the Department of Chemical Engineering.
2. **National Metallurgical Laboratory** (Council of Scientific & Industrial Research), Jamshedpur-831 007, Jharkhand, India. From January 2006 – July 12, as ***Scientist-C*** in the Mineral Processing Division.
3. **Dalhousie University**, Halifax, Canada. From Oct. 2003 to March 2005, as ***Postdoctoral Fellow***.
4. **Mafatlal Industries Limited** (Chemical division), Dewas, M. P. India. From Feb. 1997 to June 1999, as ***Production Executive***.
5. **Spectrum Alkyds and Resins Limited**, Aurangabad, Maharastra. India. From March 1996 to Jan. 1997, as ***Technical Executive***.