ANNUAL REPORT 2009-2010

(April 1, 2009 – March 31, 2010)

Chemical Engineering

Introduction

The Department of Chemical Engineering has a strong focus on excellence in education and research. The Department has a dynamic faculty with a wide range of research specializations. Research activities in the Department are supported by excellent research students (Ph.D., M.Tech. and Dual Degree), very competent technical staff, and good experimental and computational facilities.

The recruitment of students into the Ph.D. programme continues to show an uptrend and has contributed to the increase in research activity in the Department. The Department also received good funding for sponsored projects this year. This was reflected in increased numbers of International journal publication numbering hundred, which is significantly higher from the previous years of 71. This is equivalent to about 3 numbers of papers per faculty in a year.

The Department-Industry interactions were multifold this year including continuing education courses (both open and in-house programmes), consultancy, and technology transfer. The Manudhane Excellence Awards are now in their fifth year.

The activities and achievements of the Department for the year 2009-2010 are given in the following sections.

Academic Programmes

Degrees Awarded

B.Tech.	:	62
Dual Degree (B.Tech., M.Tech.)	:	22
M.Tech.	:	31
M.S. (by Research)	:	01
Ph.D.	:	18

R&D activities

The department is involved in a variety of frontier and traditional areas in chemical engineering research, under the broad areas of:
Biological Systems Engineering
Energy & Environment
Materials Engineering
Process Systems Engineering
Reactor Engineering
Transport Phenomena and Complex Fluids
The department received grants from various sources towards many new projects during the year apart from various ongoing projects.

The Department received grants from various sources towards many new projects during the year apart from various ongoing projects. The summary of which is as follows:

Sponsored Research Projects	85
Sponsored Projects	24 (New Projects)
Sanctioned Amount	Rs. 7,86,36,015
Completed Projects	13
Faculty involved	27

The details of these projects is given in the following table

Project Title	**Agency Name**	**Project Status**
Reverse Osmosis Thin Film Composite Membranes: Investigations into structure, property and function	DOW Chemical International Pvt. Ltd.	Ongoing
"Synthetic biology of cyanobacteria for solar ethanol"	Indo-French Centre for The Promotion of Advanced Research	Ongoing
“Development of Incremental Machine Direction Stretching Process for Manufacture of Fluoro Polymer Films”	Bhabha Atomic Research Centre	Ongoing
“Aerosol Routes for the Synthesis of Nanoparticles with Controlled Structural Properties: Application to Biodegradable Particles for Drug Delivery”	DST	Ongoing
“General Strategies for Nanoparticles of Controlled Size, Shape and Composition: Magnetite as a Case Study for MRI Applications”	DST	Ongoing
“Segregation and packing of granular mixtures during burden distribution”	TATA Steel Ltd., Jameshedpur	Ongoing

"Multi-scale simulation of III-V Compound Semiconductors alloys"	DST	Ongoing
"Intracellular changes occurring during adaptation of Mammalian cells to suspension culture"	DST	Ongoing
"Nucleation during granulation with viscous liquid binders under controlled shear flow"	Procter & gamble technology (Beijing) Co. Ltd., China	Ongoing
"Process and Catalyst development studies for synthesis of biodiesel"	TCE Consulting Engineers Ltd., Mumbai	Ongoing
"Experimental and Numerical Investigation of Oil Recovery from Fractured Reservoirs"	Oil & Natural Gas Commission, Ahmedabad	Ongoing
"DuPont young professor award"	DuPont	Ongoing
"Synthesis and use of Ferrofluids for the intensification of Gas-Liquid Mass Transfer processes"	Newreka Green-Synth technologies Pvt. Ltd. Mumbai	Ongoing
"Inter Facial Processes Controlling Lead Mobility In Environmental Systems"	McDonnell academy, St. Louis, USA.	Ongoing
"National Faculty Development Centre (NCP Scheme)"	AICTE, Delhi	Ongoing
"Electrification of Village Kolha using Straight Vegetable Oil and Bio-gas"	Donation	Ongoing

Consultancy projects:

The department undertook 31 jobs generating Rs. 1,79,92,424/-. The total number of faculty involved 12.

Extension activities:

CEP courses:

Convener: Prof. Sanjay Mahajani
Title: Advances in Distillation Systems: Principles & Practices
Convener: Prof. Moharir Arun Sadashiv
Title: Piping Engineering
Conveners: Prof. Mani Bhushan & Prof. Santosh K. Gupta
Title: Optimization Techniques for Chemical Engineering Applications
Convener: Prof. Malik Ranjan Kumar
Title: Petroleum Refining Processes
Convener: Prof. Moharir Arun Sadashiv
Title: Online Course on Piping Engineering

Convener: Prof. Moharir Arun Sadashiv
Title: Piping Engineering
Convener: Prof. Sandip Roy
Title: Advanced Pipeline Technology
Convener: Prof. Moharir Arun Sadashiv
Title: Piping Engineering
Convener: Prof. Anurag Mehra
Title: Elements of Chemical Engineering (Refreshers & Advances)
Convener: Prof. Anurag Mehra
Title: Elements of Chemical Engineering

Symposium

Research Scholars' Symposium 2010

Seminars:

Convener: Prof. P.W. Wangikar

Prof. Doraiswami Ramkrishna
"The Metabolic Modeling Landscape" 25 March, 2010
Dr. Anup K. Singh
"Lab-on-a-chip Devices for Medical Diagnostics & Studying Cell Signaling", 17 March, 2010
Prof. Nivedita R. Gupta
"Drops Rising in Channels" 4 March, 2010
Prof. Supreet Saini
"Coordinated Regulation and Control of gene expression in Salmonella Pathogenesis" 25 February, 2010
Prof. Rajagopalan Srinivasan
"Image-based Sensors for Control of Particulate Processes" 17 February, 2010
Prof. K. Kesava Rao
"Excess fluoride in drinking water: health effects, estimation and removal" 21 January, 2010
Prof. P. K. Das
"Development of Some Computational Algorithms for Multiphase Flow" 14 January, 2010
Dr. Prashant Valluri
"Spatiotemporal instabilities in two-phase flows", 7 January, 2010
Dr. Sanket Deshmukh
"Molecular Simulation Studies of Transport in Temperature-Sensitive Hydrogels" 6 January, 2010
Dr J. Ravi Prakash
"Unfolding of Polymeric Globules in Extensional Flow" 22 December, 2009
Prof. Tanmay Lele
"Force generation in the intracellular cytoskeleton" 15 December, 2009
Prof. Daren Chen
"Experimental Tools for Nanoparticle Research", 1 December, 2009
Dr. Sumit Sharma
"Structure and stability of proteins upon adsorption to hydrophobic surfaces" 27 November, 2009

Prof Nitin Kaistha
"Plantwide Control for Throughput Maximization: A Case Study" 5 November, 2009
Dr. Ravi Methekar
"Recent trends in Lithium-ion batteries" 29 October, 2009
Dr. Ujjal K. Ghosh
"Application of Chemical Engineering Research in Environmental Remediation", 8 October, 2009
Prof. Himadri B. Pakrasi
"Carbon Capture and Bioenergy Production by Photosynthetic Organisms", 22 September, 2009
Dr. Frank Schael
"Modular Micro Reaction Technology: From Lab to production" 10 September, 2009
Dr. Csaba Sinka
"Challenges in pharmaceutical powder processing" 20 August, 2009
Prof. Jong Wook Hong
"Integrated Nanofluidic Systems for Systems Biotechnology", 11 August, 2009
Dr. Karnail Singh
"Understanding Film Formation Mechanism in Latex Dispersions", 6 August, 2009
Dr. Manish Prasad
"Multi-Scale Modeling and Simulation of Aggregation Processes in Crystalline Semiconductor Materials" 4 May, 2009
Dr. Abhijit Chatterjee
"Bottom-up Multiscale Modeling based Rational design for chemical engineering applications" 23 April, 2009
Dr. Himanshu Khandelia
"Lipid Gymnastics and Regulation of Ion Pumps", 15 April, 2009
Dr. Prakash Karpe
"Green House Gas Emissions: Challenges to the Process Industry" 14 April, 2009

Visitors to the Department:

Prof. Doraiswami Ramkrishna
School of Chemical Engineering,
Purdue University, West Lafayette, IN 47907, USA
Dr. Anup K. Singh
Manager (Biosystems), Research & Development Department,
Sandia National Laboratories, Mailstop 9291 7011 East Ave, Livermore, CA, USA
Prof. Nivedita R. Gupta
Department of Chemical Engineering,
University of New Hampshire, Durham, NH, USA
Prof. Rajagopalan Srinivasan
Department of Chemical and Biomolecular Engineering,
National University of Singapore, Republic of Singapore 119077
Prof. K. Kesava Rao
Department of Chemical Engineering,
Indian Institute of Science, Bangalore
Prof. P. K. Das
Department of Mechanical Engineering,
Indian Institute of Technology Kharagpur, West Bengal

Dr J. Ravi Prakash
Monash University
Prof. Tanmay Lele
Department of Chemical Engineering,
University of Florida, USA
Prof. Daren Chen
Department of Energy, Environmental & Chemical Engineering,
Washington University in St. Louis, USA
Prof Nitin Kaistha
Department of Chemical Engineering,
Indian Institute of Technology Kanpur, Uttar Pradesh
Prof. Himadri B. Pakrasi
Director, I-CARES, Washington University,
Saint Louis, MO 63130, USA
Dr. Frank Schael
Ehrfeld Mikrotechnik BTS GmbH,
Mikroforum Ring 1, 55234 Wendelsheim, Germany
Dr. Csaba Sinka
University of Leicester, United Kingdom
Prof. Jong Wook Hong
Department of Mechanical Engineering,
Auburn University, USA

Conferences /Symposia/Workshops and Seminars (participated):

Mahesh S Tirumkudulu

- International Polymer and Colloids Group Conference, Il Ciocco, Italy, 6-11 July 2009
- SERC School-cum-Symposium on Rheology of Complex Fluids, IIT Madras, Chennai, January 4-9, 2010

Rochish M Thaokar

- Asian particle Technology (APT2009), New Delhi, India ; Synthesis of anisotropic nanoparticles using wormlike micellar surfactant systems
- American Physical Society, Division of fluid dynamics, DFD 2009 Minneapolis, US ;Large deformation studies of vesicles under electric field

Sameer Jadhav

- Joint ASCE-ASME-SES Conference on Mechanics and Materials, Virginia Tech, Blacksburg, VA, USA, June 2009
- ICONSAT 2010, IIT Bombay, Mumbai, February 2010

Sharad Bhartiya

- Delivered lectures in SERC Schools at IIT Bombay: 1. System identification (3 lectures) (PI: Prof. Banavar),Jan 19-24, 2010 2. Nonlinear programming: theory and applications (PI: Prof. M. Bhushan+Prof. S.K. Gupta) July 6-11, 2009
- Heat transfer equipment course (with Prof. R. Thaokar), United Phosphorous Ltd.), December 2009

Sanjay. M. Mahajani

- 26th Annual International Pittsburgh Coal Conference, Pittsburgh, PA, USA, Sept 2009

- International Conf. on Adv. in Energy Research (ICAER) - 2010, Mumbai, India; Responsible for organizing a half-day workshop on Gasification Technologies

K. V. Venkatesh

- Phenotypic Analysis of the Osmoadaptation in Saccharomyces Cerevisiae, Jignesh Parmar, Sharad Bhartiya and KV Venkatesh, ICSB, Aug. 31 - Sept. 3, 2009, Stanford, California, USA
- Mathematical Modeling of Cell Signaling Networks: Cell Cycle Regulation of Schizosaccharomyces pombe, Anbumathi P, Sharad Bhartiya and KV Venkatesh, ICSB, Aug. 31 - Sept. 3, 2009, Stanford, California, USA
- Characterization of Heterogeneity in Phenotypic States of Corynebacterium glutamicum, Meghna Rajvanshi, Kalyan Gayen and KV Venkatesh, ICSB, Aug. 31 - Sept. 3, 2009, Stanford, California, USA

Chandra Venkataraman

- Lead Author, for the review publication, "Bounding the Role of Black Carbon in Climate, International Global Atmospheric Chemistry project (2009-2010)

P Sunthar

- Delivered Lectures on "Brownian Dynamics Simulation" in SERC School on Molecular Dynamics Simulations, May 6-8, IISc Bangalore
- Presented paper on "Intrinsic Viscosity of Polymers in a Good Solvent Universal Values from Simulations" in Australia-Korea Rheology Conference, Nov 1--4 2009, Sydney Australia
- Delivered Lectures on "Polymer Rheology" in SERC School on Rheology of Complex Fluids, Jan 4--7 2010, IIT Madras, Chennai
- Participated in SERC Symposium on Complex Fluids, Jan 8--9 2010, IIT Madras, Chennai

Sandip Roy

- 2nd European Green Process Engineering & Process Intensification Conference, Venice - Italy, 14 - 17 June 2009

Vinay A. Juvekar

- International COMSOL conference, Nov 13-14,2009 (Bangalore)
- International Congress on Computational Mechanics and Simulation (ICCMS-09) Dec. 1-5,2009 (IIT Bombay)
- International Conference on Nanoscience and Technology, Feb17-20, 2010 (IIT Bombay)

Invited Lectures:

Invited Lectures: National

Santosh K. Gupta

- "Biomimetic Adaptation of NSGA-II-aJG using the Biogenetic Law of Embryology for Multi-objective Optimization", Advances in Chemical Engineering and Process Technology (ACEPT), National Chemical Laboratory, Pune, 4 – 6 June 2009.

Sanjay Mahajani

- "Process Intensification using Reactive Distillation" at UPL,Ankleshwar, India, May-2009
- "Selectvity Engg. using Reactive Distillation" in Adv. in Chem. Engg. & Process Tech. (ACEPT) at NCL-Pune, India, June-2009

- "Biodiesel Process" in Biodiesel workshop at Tara village, Panvel, India, February-2010

K. V. Venkatesh

- Chemotaxsis in E. coli, Rajitha Vipulla, Mahesh T and KV Venkatesh, CCMB-IISER-NCL Theoretical and Mathematical Biology Symposium, Pune, 2009
- Heterogeinity in Metabolic Networks, Meghana Rajvanshi and KV Venkatesh, NCL Diamond Jubilee Symposium-Advances in Chemical Engineering and Process Technology, June 4-6, NCL, Pune 2009
- Systems Biology of Osmotic signaling pathway, Jignesh Parmar, Sharad Bhartiya and KV Venkatesh, NCL Diamond Jubilee Symposium-Advances in Chemical Engineering and Process Technology, June 4-6, NCL, Pune 2009
- Invited Keynote lecture to Faculty of University of Pune, December 2009
- Distinguished UGC Fellow lecture, Department of Chemical Engineering, IISc. Bangalore, Feb 2010

Mahesh S Tirumkudulu

- "Instability of a Moving Liquid Sheet in the Presence of Acoustic Forcing", NCL, Pune, July 30, 2009
- "Cracking in drying colloidal films of hard and soft particles", IIT Madras, Chennai, January 8, 2010
- "Instability of a Moving Liquid Sheet in the Presence of Acoustic Forcing", Mechanical Engineering Department, IIT-Kanpur, Feb 15, 2010

Sameer Jadhav

- Invited lecture at IISER Pune, May 2009
- Invited lecture at Complex Fluids 2010, DST sponsored SERC School and Symposium, IIT Madras, January 2010

P Sunthar

- Delivered a talk on "Intrinsic Viscosity of Polymers in a Good Solvent: Cross-over Function from Simulations" in SERC Symposium on Molecular Simulations, May 9 2009, IISc Bangalore

Ravindra D. Gudi

- Invited to deliver guest lecture at NIT Trichy on Advanced Process Control and Optimization, January 2010

Vinay A. Juvekar

- ACEPT Symposium: Advances in Chemical Engineering and Process Technology,June 5-6,2009, NCL Pune

Kannan M. Moudgalya

- Synchronous distance education at IIT Bombay, OER for Network Enabled Education, IGNOU, 20 August 2009
- Spoken Tutorials: Strategies for promoting open source software and bridging digital divide, Scipy.in 2009, Trivandrum, 12 Dec. 2009

Chandra Venkataraman

- Invited Lecture, National Climate Research Conference, Indian Institute of Technology Delhi, March 5-6, 2010
- Plenary Lecture, Conference of the Indian Aerosol Science and Technology Association, Bose Institute, Darjeeling, March 22-24, 2010

Invited Lectures: International

Sameer Jadhav

- Invited lecture at Department of Chemical Engineering, Monash University, February 2010

Kannan M. Moudgalya

- Key Note Lecture: "National Mission on Education through ICT Open Source Software Mission", first Scilabtech User Conference, Supelec, France, 1 July 2009

Significant Awards and Distinctions:

Chandra Venkataraman

- H.H. Mathur Award for Research Excellence in Applied Science, a one-time career award from IIT Bombay, March 2009

Mahesh S Tirumkudulu

- Reviewed papers for Langmuir Journal

Ravindra D. Gudi

- Herdillia Award for Excellence in Basic Research presented by IIChE, December 2009

Sharad Bhartiya

- Invited as a visiting professor to LAGEP (Automatic Control Laboratory) in University of Lyon, France
- Awarded DST - SERC project on Modeling, identification, estimation and control of hybrid systems

Honorary Work

K. V. Venkatesh

- Associate Editor, BMC Systems Biology.
- Member Editorial Board, International Journal of Systems and Synthetic Biology
- International Judge for international Genetically ENgineered Machines competition (iGEM), MIT USA, November 2009

Ganesh A Viswanathan

- Reviewed papers for BMC Systems Biology

Sharad Bhartiya

- Member of IPC, Control Systems 2010, Sept 15-17, Stockholm, Sweden

Sanjay. M. Mahajani

- Reviewed papers for CES, I&ECR, Can. J. of Chem. Eng. and Chem. Product & Process Modeling

Ravindra D. Gudi

- Nominated to the Editorial Board as Associate Editor for IFAC Journal of Process Control

Vinay A. Juvekar

- Reviewed 1-paper for Industrial Engineering Chemistry Research, 1-paper for Asia Pacific Journal of Chemical Engineering, 1-paper for Chemical Product and Process Modeling, 1-paper for Chemical Engineering Journal

Kannan M. Moudgalya

- Member, Standing Committee, National Mission on Education through ICT, MHRD, Government of India

- Member, International Scientific Advisory Committee, Scilab

Chandra Venkataraman

- Member, Editorial Board, Aerosol Science and Technology
- Member, Editorial Board, Journal of Atmospheric Chemistry
- Member, Indian Network for Climate Change Assessment, Ministry of Environment and Forests, Government of India
- Member, Expert Committee for Enhancement of Scientific Capacity in the MoEF, Government of India
- Reviewer for the international journals: Atmospheric Environment, Aerosol Science and Technology, Environmental Science and Technology, Atmospheric Research

Faculty Members and their specializations:

Jhumpa Adhikari
Statistical Thermodynamics, Molecular Simulations

Preeti Aghalayam
Reactor Modelling, Multiphase Reaction, Catalysis, Renewable Resources, Pollution, Coal Gasification

Rajdip Bandyopadhyaya
Porous Media, Colloids, Aerosols, Thin films, Surface Science, Nanoparticles, Nano-composites, Molecular Simulations

Jayesh Bellare
Separations, Surface Science, Nanoparticles, Microscopy, Drug Delivery

Sharad Bhartiya
Process Control, Modelling, Identification

Mani Bhushan
Process Safety Analysis, Process Control, Optimisation, Identification

S Ganeshan
Heat and Mass Transfer

Ravindra D. Gudi
Process Safety Analysis, Process Control, Optimisation, Identification, Biochemical Engineering

Santosh Kumar Gupta
Reactor Modelling, Process Control, Optimisation

Sameer Jadhav
Surface Science, Computational Flow Modelling (CFD), Drug Delivery, Biomolecular Engineering

Vinay A. Juvekar
Surfactants, Separations, Rheology, Electrohydrodynamics, Multiphase Reaction, Surface Science, Polymer Physics

Devang V. Khakhar
Surfactants, Rheology, Granular Flow, Reactor Modelling, Polymer Processing, Nano-composites, Drug Delivery

Late **Kartic Chandra Khilar**
Surfactants, Porous Media, Colloids, Coatings, Green Engineering

Sanjay. M. Mahajani
Separations, Computational Flow Modelling (CFD), Multiphase Reaction, Catalysis, Renewable Resources, Coal Gasification

Ranjan Kumar Malik
Separations, Modelling, Energy Integration

Anurag Mehra
Surfactants, Multiphase Reaction, Nanoparticles, Molecular Simulations, Food Engineering
Sarika Mehra
Systems Biology, Computational Biology, Biomolecular Engineering
Arun Sadashio Moharir
Separations, Reactor Modelling, Optimisation, Modelling, Pollution
Kannan M. Moudgalya
Process Control, Modelling
Mamata Mukhopadhyay
Separations, Food Engineering
V. M. Naik
Surfactants, Separations, Electrohydrodynamics, Colloids, Surface Science, Polymer Processing, Nanoparticles, Food Engineering
Hemant Nanavati
Statistical Themodynamics, Polymer Processing, Polymer Physics, Nano-composites, Molecular Simulations, Renewable Resources
Janaky Narayanan
Surfactants, Rheology, Surface Science, Microscopy
Santosh Noronha
Renewable Resources, Green Engineering, Systems Biology, Computational Biology, Biomolecular Engineering, Biochemical Engineering
Sachin C. Patwardhan
Process Control, Modelling, Identification
V Govardhana Rao
Separations, Rheology, Heat and Mass Transfer
Sandip Roy
Surfactants, Separations, Process Safety Analysis, Surface Science, Statistical Thermodynamics, Renewable Resources
Hariharan S. Shankar
Pollution, Biochemical Engineering
P. Sunthar
Surfactants, Granular Flow, Fluid Mechanics and Stability, Computational Flow Modelling (CFD), Polymer Physics, Drug Delivery
A. K. Suresh
Heat and Mass Transfer, Multiphase Reaction, Catalysis, Nanoparticles, Biochemical Engineering
Rochish M Thaokar
Surfactants, Electrohydrodynamics, Computational Flow Modelling (CFD), Colloids, Statistical Themodynamics, Nanoparticles, Drug Delivery
Mahesh S Tirumkudulu
Surfactants, Rheology, Computational Flow Modelling (CFD), Colloids, Coatings, Thin films, Surface Science, Drug Delivery
Chandra Venkataraman
Aerosols, Surface Science, Nanoparticles, Nano-composites, Drug Delivery, Renewable Resources, Pollution, Climate Change
K. V. Venkatesh
Food Engineering, Systems Biology, Biomolecular Engineering, Biochemical Engineering
Madhu Vinjamur
Porous Media, Heat and Mass Transfer, Coatings, Food Engineering, Renewable Resources

Ganesh A Viswanathan
Reactor Modelling, Multiphase Reaction, Systems Biology, Computational Biology, Biomolecular Engineering
Pramod Wangikar
Process Control, Modelling, Computational Biology, Biomolecular Engineering, Biochemical Engineering

Publications:

Book chapters:

V. M. Naik
"Super functional materials: Creation and control of wettability, adhesion, and optical effects by meso-structuring of surfaces", *Current Trends in Science*; Bangalore, Indian Academy of Sciences, pp. 129 - 148, (2009)

Articles in Journals

Articles in Journals (National):

Jain, M.P., Sathiyamoorthy, D., Govardhana Rao, V.
"Studies on Hydrochlorination of Silicon in a Fluidized Bed Reactor", *Indian Chemical Engineer*, vol. 51, issue 4, pp. 272-280, (2009)

Articles in Journals (International):

Mohite, L.V., Juvekar, .V.A.
"Quantification of Thermodynamics of Aqueous Solutions of Poly(ethylene glycols): Role of Calorimetry", *Fluid Phase Equilibria*, vol. 278, pp. 41-53, (2009)
Baxla, S.P., Roy, A.A., Gupta, T., Tripathi, S.N., Bandyopadhyaya, R.
"Analysis of Diurnal and Seasonal Variation of Submicron Outdoor Aerosol Mass and Size Distribution in a Northern Indian City and Its Correlation to Black Carbon", *Aerosol and Air Quality Research*, vol. 9, issue 4, pp. 458-469, (2009)
Juvekar, V.A., Patil, R.S., Gurumoorthy, A.V.P., Contractor, A.Q.
"Analysis of Multiple Reactions on a Bipolar Electrode", *Ind. Eng. Chem. Res.* , vol. 48, issue 21: American Chemical Society, pp. 9441–9456, November 4, (2009)
Juvekar, V.A., Patil, R.S., Gurumoorthy, A.V.P., Contractor, A.Q.
"Analysis of multiple reactions on a bipolar electrode", *Industrial and Engineering Chemistry Research*, vol. 48, issue 21, pp. 9441 - 9456, (2009)
Dhumal, S.S., Suresh, A.K.
"A comprehensive model for kinetics and development of film structure in interfacial polycondensation", *Polymer*, vol. 50, issue 24, pp. 5851 - 5864, (2009)
Nemade, P.D., Kadam, A.M., Shankar, H.S.
"Adsorption of arsenic from aqueous solution on naturally available red soil", *Journal of Environmental Biology*, vol. 30, issue 4, pp. 499 - 504, (2009)

Nandola, N.N., Bhartiya, S.
"A computationally efficient scheme for model predictive control of nonlinear hybrid systems using generalized outer approximation", *Industrial and Engineering Chemistry Research*, vol. 48, issue 12, pp. 5767 - 5778, (2009)

Kuchibhatla, A., Abdul Rasheed, A.S., Narayanan, J., Bellare, J., Panda, D.
"An analysis of FtsZ assembly using small angle X-ray scattering and electron microscopy", *Langmuir*, vol. 25, issue 6, pp. 3775 - 3785, (2009)

Ramteke, M., Gupta, S.K.
"Biomimicking altruistic behavior of honey bees in multi-objective genetic algorithm", *Industrial and Engineering Chemistry Research*, vol. 48, issue 21, pp. 9671 - 9685, (2009)

Sharma, S., Patil, D.J., Soni, V.P., Sarkate, L.B., Khandekar, G.S., Bellare, J.R.
"Bone healing performance of electrophoretically deposited apatite-wollastonite/chitosan coating on titanium implants in rabbit tibiae", *Journal of Tissue Engineering and Regenerative Medicine*, vol. 3, issue 7, pp. 501 - 511, (2009)

Ramteke, M., Gupta, S.K.
"Biomimetic adaptation of the evolutionary algorithm, NSGA-II-aJG, using the biogenetic law of embryology for intelligent optimization", *Industrial and Engineering Chemistry Research*, vol. 48, issue 17, pp. 8054 - 8067, (2009)

Kulić, I.M., Mani, M., Mohrbach, H., Thaokar, R., Mahadevan, L.
"Botanical ratchets", *Proceedings of the Royal Society B: Biological Sciences*, vol. 276, issue 1665, pp. 2243 - 2247, (2009)

Narayanan, J., Hassan, P.A., Manohar, C.
"Catanionic Surfactants as Nanospring Suspensions: A Model", *Langmuir*, vol. 25, issue 13: American Chemical Society - ACS Publications, pp. 7260-7264, (2009)

Parmar, N.H., Tirumkudulu, M.S., Hinch, E.J.
"Coating flow of viscous Newtonian liquids on a rotating vertical disk", *Physics of Fluids*, vol. 21, issue 10, (2009)

Rampure, M.R., Mahajani, S.M., Ranade, V.V.
"CFD simulation of bubble columns: Modeling of nonuniform gas distribution at sparger", *Industrial and Engineering Chemistry Research*, vol. 48, issue 17, pp. 8186 - 8192, (2009)

Narayanan, J., Hassan, P.A., Manohar, C.
"Catanionic surfactants as nanospring suspensions: A model", *Langmuir*, vol. 25, issue 13, pp. 7260 - 7264, (2009)

Sharma, S., Soni, V.P., Bellare, J.R.
"Chitosan reinforced apatite-wollastonite coating by electrophoretic deposition on titanium implants", *Journal of Materials Science: Materials in Medicine*, vol. 20, issue 7, pp. 1427 - 1436, (2009)

Sarkar, A., Tirumkudulu, M.S.
"Consolidation of charged colloids during drying", *Langmuir*, vol. 25, issue 9, pp. 4945 - 4953, (2009)

Raut, J.S., Akella, S., Singh, A.K., Naik, V.M.
"Catastrophic drop breakup in electric field", *Langmuir*, vol. 25, issue 9, pp. 4829 - 4834, (2009)

Singh, K.B., Bhosale, L.R., Tirumkudulu, M.S.
"Cracking in drying colloidal films of flocculated dispersions", *Langmuir*, vol. 25, issue 8, pp. 4284 - 4287, (2009)

Sharma, M., Khilar, K.C.
"Development and Characterization of Polyethyl metha acrylate-Iron oxide (III) based Hydrophobic Liquid Nanocomposite Films", *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, vol. 346, (2009)

Badwe, A.S., Gudi, R.D., Patwardhan, R.S., Shah, S.L., Patwardhan, S.C.
"Detection of model-plant mismatch in MPC applications", *Journal of Process Control*, vol. 19, issue 8, pp. 1305 - 1313, (2009)

Muddu, M., Anuj Narang, A., Patwardhan, S.C.
"Development of ARX models for Predictive Control using Fractional Order and Orthonormal Basis Filter Parameterization.", *Ind. Eng. Chem. Res.*, vol. 48, pp. 8966-8979, (2009)

Badwe, A., Gudi, R.D., Shah, S.L., Patwardhan, R.S., Patwardhan, S.C.
"Detection of Model-Plant Mismatch in MPC Applications.", *Journal of Process Control*, vol. 19, pp. 1305-1313, (2009)

Deshmukh, K.S., Gyani, V.C., Mahajani, S.M.
"Esterification of butyl cellosolve with acetic acid using ion exchange resin in fixed bed chromatographic reactors", *International Journal of Chemical Reactor Engineering*, vol. 7, (2009)

Suman, T., Srinivas, S., Mahajani, S.M.
"Entrainer based reactive distillation for esterification of ethylene glycol with acetic acid", *Industrial and Engineering Chemistry Research*, vol. 48, issue 21, pp. 9461 - 9470, (2009)

Sagar, G.H., Bellare, J.R.
"Estimation of mechanical strength of unilamellar and multilamellar AOT/Water vesicles and their rupture using micropipet aspiration", *Journal of Physical Chemistry B*, vol. 113, issue 42, pp. 13805 - 13810, (2009)

Das, A.K., Shenoy, U.V., Bandyopadhyay, S.
"Evolution of resource allocation networks", *Industrial and Engineering Chemistry Research*, vol. 48, issue 15, pp. 7152 - 7167, (2009)

Raha, S., Pradip,, Kapur, P.C., Khilar, K.C.
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