Jeffrey Knutsen

Education

- Ph.D. Chemical and Biological Engineering, University of Colorado, 2005
- B.S. Chemical Engineering, University of Minnesota, 1999

Professional Recognition

- Screencasts and concept tests available at www.learncheme.com
- Colorado Center for Biorefining and Biofuels (C2B2) seed grant, 2007-2008
- Leadership in Biotechnology Certificate, University of Colorado, 2002
- NIH Leadership in Pharmaceutical Biotechnology Fellow, 2001-2004
- Biotechnology Small Grant – Colorado Institute for Research in Biotechnology, 2000
- National Science Foundation Scholarship, 2000-2004
- Graduate Assistance in Areas of National Need Fellow, 2000-2004
- Beverly Sears Dean's Small Grant Award, 2002
- Outstanding Teaching Assistant for Graduate Courses, 2002
- Outstanding Paper Awards, Graduate Student Annual Research Symposium, 2002, 2003

Research Interests

My interests focus primarily on the implementation of novel teaching strategies in the classroom, especially the use of electronic resources such as concept tests, screencasts, and the use of a tablet computer to facilitate a more dynamic presentation of course material. I am currently developing a number of screencasts to eventually facilitate a "flipped classroom" that moves lectures outside the classroom via a series of short videos. Class time is then available for more valuable activities such as discussions of conceptual questions, workshops, and projects. I am especially interested in promoting more open-ended problems, which better approximate engineering challenges that extend beyond the classroom environment. Thus far my favorite courses include Fluid Dynamics, Heat Transfer, Thermodynamics, and first-year design.

Outside the classroom, my interests have included the rheological characterization of biomass slurries, the fluid mechanics of tangential flow filtration, and separation strategies for the recovery and reuse of enzymes related to the conversion of lignocellulosic biomass to fuel.

Selected Publications

- Knutsen JS and MW Liberatore (2010) "Rheology Modification and Enzyme Kinetics of High-Solids Cellulosic Slurries: An Economic Analysis." Energy & Fuels 24: 6506-6512.
- Knutsen JS and MW Liberatore (2010) "Rheology modification and enzyme kinetics of high solids cellulosic slurries." Energy & Fuels 24: 3267-3274.
- Smith BT, JS Knutsen and RH Davis (2010) "Empirical Evaluation of Inhibitory Product, Substrate, and Enzyme Effects During the Enzymatic Saccharification of Lignocellulosic Biomass." Applied Biochemistry and Biotechnology 161: 468-482.

- Knutsen JS and MW Liberatore (2009) “Rheology of High-Solids Biomass Slurries for Biorefinery Applications.” Journal of Rheology 53: 877-892.
- Knutsen JS and RH Davis (2009) “Direct Visual Observation of Microfiltration Membrane Fouling and Cleaning.” Chapter 2 in Monitoring and Visualizing Membrane Based Processes. ed. C Güell, M Ferrando and F López. Weinheim. Wiley-VCH.
- Knutsen JS and RH Davis (2006) “Deposition of foulant particles during tangential flow filtration.” Journal of Membrane Science 271: 101-113.

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Telephone: (303) 653-3435
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Date and Place of Birth: May 23, 1977 in New Brighton, Minnesota

Education:

Postdoctoral **Colorado School of Mines / National Renewable Energy Laboratory 2008-2011**
Topic: Fundamental Understanding of Rheology of Biomass Slurries for Bio-Refinery Applications
Chemical and Biological Engineering, University of Colorado 2008-2010
Topic: Sugar and Enzyme Recovery During Saccharification with High Solids Loading

Ph.D. **Chemical and Biological Engineering, University of Colorado 2005**
Thesis: Membrane Bioseparations: Cellulase Recovery, Particle Deposition, and Second Osmotic Virial Coefficients
Academic advisor: Prof. Robert H. Davis

B.S. **Chemical Engineering, University of Minnesota, 1999, With Distinction**

Courses taught at the University of Colorado Boulder (as planned through Fall 2012):

- Fall 2012:
  - Fluid Mechanics (MCEN 3021)
  - Thermodynamics (MCEN 3012)
- Spring 2012:
  - Mechanical Engineering Heat Transfer (MCEN 3022)
  - Junior-level Dynamics (MCEN 3043)
  - Sophomore-level Dynamics (MCEN 2043)
- Fall 2011:
  - Thermodynamics 1 (MCEN 3012)
  - Chemical Engineering Heat Transfer (CHEN 3210)
- Summer 2010:
  - Chem Eng Fluid Mechanics / Fluid Mech for Eng (CHEN 3200/GEEN 3853)
- Spring 2010:
  - First Year Engineering Projects (GEEN 1400)
- Summer 2009:
  - Chem Eng Fluid Mechanics / Fluid Mech for Eng (CHEN 3200/GEEN 3853)
- Fall 2002: TA Graduate mass transport – *Outstanding Teaching Assistant for Graduate Courses*
- Spring 2000: TA Undergraduate mass transfer

Courses taught at the Colorado School of Mines:

- Summer 2011:
  - Chemical Engineering Field Sessions I & II (CHEN 312/313)
- Spring 2011, Spring 2010, Spring 2009:
  - Chemical Process Principles Laboratory (CHEN 202)
  - Chemical Engineering Thermodynamics Laboratory (CHEN 358)

Relevant pedagogical coursework and seminars attended:

- Fundamentals of College Teaching (SYGN 600) CO School of Mines, Fall 2009
- "Effective teaching: A Workshop" RM Felder and R Brent, CU Boulder – Feb 19-20, 2009
- Pedagogy seminar series, CO School of Mines, 2009 –2011

Professional Experience:
Scientific & Engineering Consultant, ChemRisk, Inc., Boulder, CO, 2005-2008
Research Assistant, FeRx, Inc., Aurora, CO, Summer 2002
Research Assistant, National Renewable Energy Laboratory, Golden, CO, Summer-Fall 2001

Selected Grants & Awards:
Colorado Center for Biorefining and Biofuels (C2B2) seed grant with RH Davis, 2007-2008
Leadership in Biotechnology Certificate, University of Colorado, 2002
NIH Leadership in Pharmaceutical Biotechnology Fellow, 2001-2004
Biotechnology Small Grant – Colorado Institute for Research in Biotechnology, 2000
National Science Foundation Scholarship, 2000-2004
Graduate Assistance in Areas of National Need Fellow, 2000-2004
Beverly Sears Dean's Small Grant Award, 2002
Outstanding Teaching Assistant for Graduate Courses, 2002
Outstanding Paper Awards, Graduate Student Annual Research Symposium, 2002, 2003

Peer-Reviewed Technical Articles and Book Chapters:

1. Williams PRD, J Sahmel, JS Knutsen, J Spencer and AL Bunge (2010) "Dermal Absorption of Benzene in Occupational Settings: Estimating Flux and Applications for Risk Assessment." *Critical Reviews in Toxicology* **41:** 111-142.
2. Knutsen JS and MW Liberatore (2010) "Rheology Modification and Enzyme Kinetics of High-Solids Cellulosic Slurries: An Economic Analysis." *Energy & Fuels* **24:** 6506-6512.
3. Knutsen JS and MW Liberatore (2010) "Rheology modification and enzyme kinetics of high solids cellulosic slurries." *Energy & Fuels* **24:** 3267-3274.
4. Smith BT, JS Knutsen and RH Davis (2010) "Empirical Evaluation of Inhibitory Product, Substrate, and Enzyme Effects During the Enzymatic Saccharification of Lignocellulosic Biomass." *Applied Biochemistry and Biotechnology* **161:** 468-482.
5. Paustenbach DJ, JS Knutsen, DM Hollins, JE Sahmel and AK Madl (2010). "Comparison of modeled and measured concentrations of airborne benzene from the use of petroleum-based solvents spiked with low levels of benzene." *Chemico-Biological Interactions* **184:** 296-298.
6. Sahmel J, M Boeniger, JS Knutsen, W ten Berge and MC Fehrenbacher (2009). "Dermal Exposure Modeling." in *Mathematical Models for Estimating Occupational Exposure to Chemicals, 2nd Edition*. ed. CB Keil, CE Simmons and TR Anthony. Fairfax, VA, American Industrial Hygiene Association.
7. Knutsen JS and MW Liberatore (2009) "Rheology of High-Solids Biomass Slurries for Biorefinery Applications." *Journal of Rheology* **53:** 877-892.
8. Roche CM, CJ Dibble, JS Knutsen, JJ Stickel and MW Liberatore (2009) "Particle Concentration and Yield Stress of Biomass Slurries During Enzymatic Hydrolysis at High-Solids Loadings." *Biotechnology and Bioengineering* **104:** 290-300.
9. Stickel JJ, JS Knutsen, MW Liberatore, W Luu, DW Bousfield, DJ Klingenberg, CT Scott, TW Root, MR Ehrhardt and TO Monz (2009) "Rheology measurements of a biomass slurry: an inter-laboratory study." *Rheologica Acta* **48:** 1005-1015.
10. McAtee BL, EP Donovan, SH Gaffney, W Frede, JS Knutsen, and DJ Paustenbach (2009) "Historical Analysis of Airborne Beryllium Concentrations at a Copper Beryllium Machining Facility (1964–2000)." *Annals of Occupational Hygiene* **53:** 373-382.
11. Knutsen JS and RH Davis (2009) "Direct Visual Observation of Microfiltration Membrane Fouling and Cleaning." Chapter 2 in *Monitoring and Visualizing Membrane Based Processes*. ed. C Güell, M Ferrando and F López. Weinheim. Wiley-VCH.

12. Murbach DM, AK Madl, KM Unice, JS Knutsen, PS Chapman, JL Brown and DJ Paustenbach (2008) "Airborne Concentrations of Asbestos Onboard Maritime Shipping Vessels (1978-1992)." *Annals of Occupational Hygiene* **52:** 267-279.
13. S Gaffney, E Moody, M McKinley, J Knutsen, A Madl and D Paustenbach (2008) "Worker Exposure to Methanol Vapors During Cleaning of Semiconductor Wafers in a Manufacturing Setting." *Journal of Occupational and Environmental Hygiene* **5:** 313-324.
14. Williams PRD, JS Knutsen, C Atkinson, AK Madl and DJ Paustenbach (2007) "Airborne Concentrations of Benzene Associated with the Historical Use of Some Formulations of Liquid Wrench." *Journal of Occupational and Environmental Hygiene* **4:** 547-561.
15. Ferriby LL, JS Knutsen, M Harris, KM Unice, P Scott, P Nony, LC Haws and DJ Paustenbach (2007) "Evaluation of PCDD/F and dioxin-like PCB serum concentration data from the 2001-2002 National Health and Nutrition Examination Survey of the United States population." *Journal of Exposure Science and Environmental Epidemiology* **17:** 358-71.
16. Knutsen JS and RH Davis (2006) "Deposition of foulant particles during tangential flow filtration." *Journal of Membrane Science* **271:** 101-113.
17. Knutsen JS and RH Davis (2004) "Cellulase retention and sugar removal by membrane ultrafiltration during lignocellulosic biomass hydrolysis." *Applied Biochemistry and Biotechnology* **113-116:** 585-599.
18. Knutsen JS and RH Davis (2002) "Combined sedimentation and filtration process for cellulase recovery during hydrolysis of lignocellulosic biomass." *Applied Biochemistry and Biotechnology* **98:** 1161-1172.
19. Mores WD, JS Knutsen and RH Davis (2001) "Cellulase recovery via membrane filtration." *Applied Biochemistry and Biotechnology* **91-93:** 297-309.
20. Chaffin KA, JS Knutsen, P Brant and FS Bates (2000) "High-strength welds in metallocene polypropylene/polyethylene laminates." *Science* **288:** 2187-2190.
21. Crawford NRM, JS Knutsen, et al. (1998) "Splitting the coordinated nitric oxide in $Co(CO)_3(NO)$ leads to a nanocrystalline conductive oxonitride of cobalt." *Chemical Vapor Deposition* **4:** 181-185.

Conference Presentations:

1. Knutsen JS and MW Liberatore. Rheology modification and enzyme kinetics of high solids cellulosic slurries. The Society of Rheology 82nd Annual Meeting, October 24-28, 2010. Santa Fe, NM.
2. Knutsen JS and MW Liberatore. Linear and nonlinear rheological investigations of high-solids biomass slurries for bio-refinery applications. The Society of Rheology 82nd Annual Meeting, October 24-28, 2010. Santa Fe, NM.
3. Knutsen JS, MW Liberatore, JJ Stickel, CJ Dibble and CM Roche. Investigating the changing rheology of high-solids biomass slurries during enzymatic saccharification. 31st Symposium on Biotechnology for Fuels and Chemicals, May 3-6, 2009. San Francisco, CA.
4. Knutsen JS and MW Liberatore. Enzo-rheology: Investigations of High-Solids Biomass Slurries for Bio-Refinery Applications. The XVth International Congress on Rheology, August 3-8, 2008. Monterey, CA.
5. Knutsen JS, JR Kuykendall, BD Kerger and DJ Paustenbach. Comparing Equal Delivered Doses of Airborne Benzene for 8 hr/day Steady Exposure vs. Peak Exposure Regimens Using a PB-PK Model. American Industrial Hygiene Conference and Exposition, May 31 – June 5, 2008. Minneapolis, MN.

6. Knutsen JS, DM Murbach, DJ Paustenbach and AK Madl. Comparison of Modeled and Measured Concentrations of Airborne Benzene from the Use of Petroleum-Based Solvents Spiked with Low Levels of Benzene. American Industrial Hygiene Conference and Exposition, May 31 – June 5, 2008. Minneapolis, MN.
7. Knutsen JS and TE Widner. Characterization of Operations in the First U.S. Building that Produced Plutonium Components for Atomic Weapons to Support Estimation of Airborne Effluents and Doses to Members of the Public. Abstract #MAB4-O-08. International Conference on Environmental Epidemiology and Exposure, September 2-6, 2006. Paris, France.
8. Paustenbach DJ, JR Kuykendall, BL Finley, JM Warmerdam, PP Moy. (presented by J.S. Knutsen). Factors Affecting Bioaccessibility and Bioavailability of Hexavalent Chromium and Dioxin Contaminants in Soil and Their Relevance to Risk Assessment. Abstract #MS1-05. International Conference on Environmental Epidemiology and Exposure, September 2-6, 2006. Paris, France.
9. Knutsen JS and RH Davis. Motion of a sphere over a rough permeable surface due to viscous shear flow – A new model for membrane fouling. North American Membrane Society annual meeting, June 26-30, 2004. Honolulu, HI.
10. Knutsen JS and RH Davis. Cellulase Retention and Sugar Removal During Lignocellulosic Biomass Hydrolysis. 25th Symposium on Biotechnology for Fuels and Chemicals, May 4-7, 2003. Breckenridge, CO.
11. Knutsen JS and RH Davis. Cellulase Retention and Sugar Removal by Ultrafiltration During Lignocellulosic Biomass Hydrolysis. North American Membrane Society annual meeting, May 11-15, 2002. Long Beach, CA.
12. Knutsen JS and RH Davis. Combined sedimentation and filtration process for cellulase recovery during hydrolysis of lignocellulosic biomass. 23rd Symposium on Biotechnology for Fuels and Chemicals, May 6-9, 2001. Breckenridge, CO.
13. Knutsen JS, WD Mores and RH Davis. Cellulase recovery via membrane filtration. North American Membrane Society annual meeting, May 23-27, 2000. Boulder, CO.