
Byung-Hwan Um, PhD

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EDUCATION

Ph.D., Chemical Engineering, Auburn University, AL, August, 2007.
M.S., Chemical Engineering, Colorado State University, CO, August, 2002.
B.S., Chemical Engineering, Gyeongsang National University, Korea, February, 1998.

PROFESSIONAL EXPERIENCES

Research Associate, Department of Chemical Engineering, Forest Bioproducts Research Initiative (FBRI, <http://www.forestbioproducts.umaine.edu/index.htm>), The University of Maine, Orono, ME 04496, September 01, 2007-present.

- **Research Grant and Topic :**
 - Forest Bioproducts Research Initiative.
 - Research Contract: National Science Foundation (EPSCoR, USA).
 - Contract #: 0554545 (\$ 10.6 million).
 - Period: 08/2006~08/2008.
- **Research Plan:**
 - Work on project involving conversion of mixed northeast hardwood to fuel-ethanol using biotechnology (pretreatment, acid and enzymatic hydrolysis and ethanol fermentation).
 - Investigate the extent of hemicellulose recovery by pre-extraction using Green Liquor and characterize the digestibility of the xylan present in the hydrolyzates.
 - Optimize process during the hydrolysis for concentrated hydrolyzates using commercial reagents (H₂SO₄ and Enzymes)
 - Maximize ethanol yield using *Escherichia coli* K011.
 - A computer model is developed for the secondary hydrolysis process using ASPEN Plus software.

ACADEMIC AND WORK EXPERIENCES

Ph.D. Dissertation Research Scope

- Auburn University, Auburn, AL, Spring 2004 ~ Summer, 2007.
- Academic and Research Advisor: Dr. Thomas R Hanley (2003-2005, Provost for Academic Affair at Auburn University, 2005-present, Professor, in Chemical Eng. at Auburn University, AL).

- **Doctoral Dissertation:** Optimization of Ethanol Production from Concentrated Substrate.
- *Research Topic:*
 - Simulation of the full scale bioreactor using Computational Fluid Dynamics.
 - Cell culture and ethanol fermentation (*Zymomonas mobilis* 39679 pZB4L).
 - Enzymatic hydrolysis of cellulose fiber.
 - Rheology of high concentrated lignocellulosic suspensions.
- *Primary Achievement:*
 - Initiated and continued research and development driven efforts in the process.
 - Sugar and ethanol determination by **HPLC and YSI**, pH determination spectrophotometer color intensity specific gravity by densitometer viscosity measurement turbidity fermentation metabolite detection and titratable acidity.
 - Bioreactor simulation via **FLUENT and MixSim**.

M.S. Thesis Research Scope

- Colorado State University, Fort Collins, CO, Fall 1999 - Summer 2002.
- Academic and Research Advisor: Dr. M. Nazmul Karim (2004-present, Chairman and Professor, in Chemical Eng. at Texas Tech University, TX).
- **Master Thesis:** Modeling of Dilute Acid Pretreatment and Enzymatic Hydrolysis of Corn Stover.
- *Research Topic:*
 - Pretreatment of corn stover by various acids (sulfuric and phosphoric acid) at the mild temperature in the batch mode.
 - Enzymatic hydrolysis of cellulose fiber.
 - Determined the kinetics of the sulfuric acid pretreatment of corn stover and compare it with phosphoric acid pretreated corn stover.
- *Primary Achievement:*
 - Initiated and continued research and development driven efforts in the process.
 - Sugar determination by **HPLC and YSI**.
 - Simulation using Matlab program.

Research Assistant, Immediate Response Spill Technologies, Louisville, KY

- Mixing and Bioreactor Lab. University of Louisville, KY, March 2002-December 2003.
- Research Advisor: Dr. Thomas R. Hanley
- *Research Topic:*
 - Solidification Mechanism and Solidifier Effectiveness for Fuels and Oils.
- *Primary Achievement:*
 - Investigated the mechanism for solidification using temperature and volume change during solidification to characterize solidifier effectiveness, resulting in improved solidifier performance at lower cost. Gasoline, diesel fuel, mineral oil, and crude oil are included in the analysis..

Research Assistantship, Mixing and Bioreactor Lab. University of Louisville, KY

- Mixing and Bioreactor Lab. University of Louisville, KY, March 2002-December 2003.
- Principle Investigator: Dr. Thomas R. Hanley
- **Research Grant and Topic:**
 - Reactor Design for Biorefineries using Computational Fluid Dynamics.
 - Research Contract : National Renewable Energy Laboratory (NREL, USA)
 - Contract # : XCO-1-3101-6-01 (\$ 599,844)

- Period : 03/2001~03/2004
- **Laboratory Management:**
 - Experimental design and record keeping skills were developed to allow the identification of cost saving variables and process improvements.
 - Tracked time expenditure on projects and developed monthly progress reports.
 - Maintained laboratory supplies inventory.

Research Assistantship, Research Institute of Industrial Technology, Korea

- Gyeongsang National University, Chinju, Korea, May 1995~ June 1999.
- Research Advisor: Dr. Sung-Bae Kim. (1991-present, Professor, in Chemical Eng. at Gyeongsang National University, ROK)
- **Research Topic:**
 - Pretreatment of woody biomass by ammonia-hydrogen peroxide percolation process
 - Pretreatment of corn stover and newspaper by alkaline hydrogen peroxide under percolation process.
 - Enzymatic hydrolysis of cellulose fiber.

TEACHING EXPERIENCES

Teaching Assistant, Colorado State University, Fort Collins, CO

- **Process Simulation**, Undergraduate, August 20, 2001-December 12, 2001
- **Primary Achievement:**
 - Trained MATLAB program and graded all lab assignments, homework, and exams.
 - The lab requirements were a particular challenge as the maintenance of the language software and materials for the lab was an additional requirement of the computer lab-teaching assistant.
- **Reactor Design**, Undergraduate, January 16, 2001-May 12, 2001.
- **Primary Achievement:**
 - Trained Polymath Program and designed the lab curriculum graded all lab assignments, homework, and exams.
 - Helped the course instructor evaluate the group projects and I graded homework, exam, and lab assignments.

PRESENTATIONS

- **Byung-Hwan Um**, and Thomas. R. Hanley: Rheological Parameter Determination for *Zymomonas mobilis* Fermentation Broths with High Substrate Loading, 29th Symposium on Biotechnology for Fuels and Chemicals, Denver, CO, April 29 – May 02, 2007.
- Thomas. R. Hanley, and **Byung-Hwan Um**: Flow Pattern Simulation in a High Solid Cellulose-to-Ethanol Bioreactor Using Computational Fluid Dynamics, 2007 AIChE Spring National Meeting, Houston, Texas, April 22-26, 2007. **Oral Presentation.**
- Thomas. R. Hanley, and **Byung-Hwan Um**: Broth Rheology and Ethanol Yield for a *Zymomonas mobilis* Fermentation with High Substrate Loading, 2007 AIChE Spring National Meeting, Houston, Texas, April 22-26, 2007. **Oral Presentation.**

- **Byung-Hwan Um**, and Thomas. R. Hanley: Solidification Mechanism and Solidifier Effectiveness for Fuels and Oils, 2007 AIChE Spring National Meeting, Houston, Texas, April 22-26, 2007. **Oral Presentation.**
- **Byung-Hwan Um**, and Thomas. R. Hanley: Rheological Properties and Glucose Yield from High Solid Enzymatic Suspensions as a Function of Enzyme Loading and Temperature, 233nd ACS National Meeting & Exposition, Chicago, IL, March 25 - 29, 2007.
- **Byung-Hwan Um**, and Thomas. R. Hanley: Optimization of Ethanol Production from Concentrated Substrate, *Alternative Energy Solutions from Alabama's Natural Resource*, Auburn, Alabama, October 23-24, 2006.
- **Byung-Hwan Um**, and Thomas. R. Hanley: The Effect of Temperature on Ethanol Production from Concentrated Solka-Floc in a Three-Liter Bench Scale Bioreactor, 28th *Symposium on Biotechnology for Fuels and Chemicals*, Nashville, Tennessee, May 7-11, 2006.
- **Byung-Hwan Um**, and Thomas. R. Hanley: The Effect of Toxic Products on Ethanol Production from Concentrated Corn Stover Hydrolyzates in a Three-Liter Bench Scale Bioreactor, 25th *Symposium on Biotechnology for Fuels and Chemicals*, Breckenridge, Colorado, May 4-8, 2003.
- Natalia V. Pimenova, **Byung-Hwan Um**, and Thomas. R. Hanley: The Effect of Viscosity Change on The Rate and Extent of *Zymomonas mobilis* Cellulose Fermentation, 25th *Symposium on Biotechnology for Fuels and Chemicals*, Breckenridge, Colorado, May 4-8, 2003.
- **Byung-Hwan Um**, and M. Nazmul Karim: Effect of Sulfuric and Phosphoric Acid Pretreatments on Enzymatic Hydrolysis of Corn Stover, 24th *Symposium on Biotechnology for Fuels and Chemicals*, Gatlinburg, Tennessee, April 27-May 4, 2002.
- **Byung-Hwan Um**, and M. Nazmul Karim: Modeling of Surfactant and Solid Concentration Effectiveness on Enzymatic Hydrolysis of Corn Stover, 94th *Annual AIChE Meeting*, Reno, Nevada, November 4-9, 2001.
- Sung-Bae Kim and **Byung-Hwan Um**: Effect of Pretreatment Reagent and Hydrogen Peroxide on Enzymatic Hydrolysis of Oakwood in Percolation Process, 22th *Symposium on Biotechnology for Fuels and Chemicals*, Gatlinburg, Tennessee, May 7-11, 2000.
- Sug-Jung Huh, **Byung-Hwan Um**, Nam-Kyoo Moon, Sung-Bae Kim, Soon-Chul Park: Pretreatment of Lignocellulosic Biomass by Alkaline Hydrogen Peroxide under Percolation Process, *KICChE (Korean Institute of Chemical Engineering)*, Suwon, Korea, April 23-24, 1999.

- Sug-Jung Huh, **Byung- Hwan Um**, Sung-Bae Kim, Soon-Chul Park: Pretreatment of Woody Biomass by Ammonia-Hydrogen Peroxide Percolation Process, *KIChE (Korean Institute of Chemical Engineering, Kwangju, Korea, October 23, 1998*

PUBLICATIONS

- **Byung-Hwan Um**, and Thomas R. Hanley. 2008: A Comparison of Simple Rheological Parameter and Simulation Data for *Zymomonas mobilis* Fermentation Broths with High Substrate Loading in 3 L Bioreactor, *Appl. Biochem. & Biotech.* Accepted.
- **Byung-Hwan Um**, and Thomas R. Hanley. 2007: Rheological Properties and Ethanol Yield for *Zymomonas mobilis* Fermentation Broths with High Substrate Loading, *J. BioResource.* Accepted.
- **Byung-Hwan Um**, M. Nazmul Karim, and Linda L. Henk: Effect of Sulfuric and Phosphoric Acid Pretreatments on Enzymatic Hydrolysis of Corn Stover, *Appl. Biochem. & Biotech.*, **105/108**, 115-126(2003).
- Sung-Bae Kim, **Byung-Hwan Um**, and Soon-Chul Park: Effect of Pretreatment Reagent and Hydrogen Peroxide on Enzymatic Hydrolysis of Oakwood in Percolation Process, *Appl. Biochem. & Biotech.*, **91/93**, 81-84(2001).
- Sug-Jung Huh, **Byung-Hwan Um**, Nam-Kyoo Moon, Sung-Bae Kim, Soon-Chul Park: Pretreatment of Lignocellulosic Biomass by Alkaline Hydrogen Peroxide under Percolation Process, *Korea J. Theories and Application of Chemical Engineering*, **5(1)**, 1121- 1124 (1999).
- Sug-Jung Huh, **Byung- Hwan Um**, Sung-Bae Kim, Soon-Chul Park: Pretreatment of Woody Biomass by Ammonia-Hydrogen Peroxide Percolation Process, *Korea J. Theories and Application of Chemical Engineering*, **4 (2)**, 3013-3016 (1998).

MANUSCRIPTS UNDER REVIEW

- **Byung-Hwan Um**, and Thomas R. Hanley. 2007: Flow Pattern Simulation in a High Solids Cellulose to Ethanol Bioreactor using Computational Fluid Dynamics, *J. BioResource.* Manuscript under Revision.
- **Byung-Hwan Um**, and Thomas R. Hanley. 2008: High Solid Enzymatic Hydrolysis and Fermentation of Solka Floc to Ethanol, *J. Microbiology and Biotechnology.* Manuscript under Review.

MANUSCRIPTS IN PREPARATION

- **Byung-Hwan Um**, and Peter van Walsum. 2009: Evaluation of Acid and Enzymatic Hydrolysis from Hemicellulose Hydrolyzates on Mixed Pulping Wood for Ethanol Production. Manuscript was submitted to *Appl. Biochem. & Biotech.*
- **Byung-Hwan Um**, and Peter van Walsum. 2009: Comparison of Different Detoxification Process of Hemicellulose Extracts for use in Ethanol Fermentation. Manuscript in preparation for the Journal of *Appl. Biochem. & Biotech.*
- **Byung-Hwan Um**, and Thomas R. Hanley. 2009: Computational Fluid Dynamics Simulation for Predicting Flow Pattern of Viscous Fluids in a Bioreactor with Various Operating Conditions. Manuscript in preparation for the Journal of *Appl. Biochem. & Biotech.*

SOCIAL ACTIVITIES AND AWARDS

- Winner (Golf Tournament, Division "A"), Olympics of the Korean Community at the Southern East Conference, Montgomery, AL, June 3, 2006-June 4, 2006.
- Winner (Mixed Doubles), Korean Community Tennis Open, Auburn-Opelika, AL, March 18, 2006.
- President of Korean Student Association, Auburn University, AL, January, 2005~December 2005.
- Runner-up (Mens' Singles), Korean Community Tennis Open, Auburn-Opelika, AL, March 22, 2004.
- Volunteered as an Interpreter, "International Science Engineering Fair", Intel, Louisville, KY, May 12-18, 2002.
- Served the army, Wonju, Gangwondo, Korea (ROK), August 1992-October 1994.

ACADEMIC ACTIVITIES AND FELLOWSHIPS

- Research Member, Immediate Response Spill Technologies, Louisville, KY, December, 2006-July, 2007.
- Research Assistantship, Auburn University, AL, December, 2006-August, 2007.
- Provost Fellowship, Auburn University, AL, July, 2004-December, 2006.
- Research Assistantship, University of Louisville, KY, January, 2002-June 2004.
- Teaching Assistantship, "Process Simulation", Colorado State University, CO, August 20, 2001-December 12, 2001.
- Research Assistantship, Colorado State University, CO, May 2001-August 2001.
- Teaching Assistantship, "Reactor Design", Colorado State University, CO, January 16, 2001-May 12, 2001.
- Research Member, Agricultural Research Development and Education Center, CO, September 2000-December 2000.
- Research Assistantship, Ministry of Education, Korean Government, Korea (ROK), May 1998-May 2000.

- Research Assistantship, Gyeongsang National University, Chinju, Korea (ROK), 1995-1997.
- Gaechuck Scholarship, Gyeongsang National University, Chinju, Korea (ROK), 1995-1997.
- Outstanding Senior in Biochemical Engineering, Gyeongsang National University, Chinju, Korea (ROK), March 1997.

TECHNICAL SKILL

- Glucose analyzer (YSI).
- DNSA sugar analysis.
- High Performance Liquid Chromatography (HPLC).
- Cell culture (Lab. ~ Pilot Scale).
- Pretreatment of lignocellulosic biomass.
- Enzyme hydrolysis of cellulose fiber.
- Bacterial ethanol fermentation (3L and 120 L).

COMPUTER SKILL

- Language: **Matlab.**
- Simulation: **FLUENT (MixSim), ASPEN-PLUS.**
- Operating system: Window XP, Linux.
- Software: MS office.

MEMBERSHIPS

- Research member, IRST (Immediate Response Spill Technologies).
- Student member, SBFC (Symposium on Biotechnology for Fuels and Chemicals).
- Student member, ACS (America Chemical Society)
- Student member, AIChE (American Institute of Chemical Engineering).
- Student member, Colorado Biotechnology.
- Student member, Korean Society for Biotechnology and Bioengineering.
- Student member, KIChE (Korean Institute of Chemical Engineering).

RELEVANT COURSE WORK

Bioinformatics
 Biological Principles of Environmental Engineering
 Biomedical Engineering
 Chemical Engineering Thermodynamics
 Chemical Reactor Design
 Chemical Process Calculations
 Chemical Plant Design
 Computer-Aided Process Simulation
 Environmental Chemical Engineering
 General Microbiology

General Microbiology Lab.
Introduction to Computational Fluid Dynamics
Mathematics for Chemical Engineers
Material Principles Micro/Nano Systems
Physical Chemistry
Process Control
Pulp and Paper Engineering
Separation Processes
Transport Phenomena
Unit Operations

REFERENCES

Professional References:

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