

# Fan (Andy) Hu

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## Key Qualifications

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**Analytical Thinker:** Strong problem solving and analytical skills; conducting research projects independently; analyzing and interpreting results independently to solve problems; studying chemistry, mechanical engineering, chemical engineering, and management classes with the achievement of As

**Leadership:** leader of research team in the Ragauskas Group in collaboration with the Wyman Group; leader of TAPPI Graduate Chapter (President of TAPPI Graduate Chapter for 6 months so far), leading other TAPPI officers to organize various events; Teaching assistant of General Chemistry and Synthetic Lab for two semesters, advising and teaching approximately 80 students chemistry knowledge and experimental skills

**Interpersonal Skills:** Exceptional verbal and written communication skills leveraged to publish more than 6 papers including one review paper within 3 years; to give presentation in the BioEnergy Science Center (BESC) conference; and to organize various events for TAPPI Graduate Chapter

**Teamwork Skills:** Coordinated and collaborated with various researchers including biologists, chemists, material scientists, chemical and biological engineers to finish projects successfully; coordinated with other TAPPI officers to organize different events successfully

**Interest in Business:** Born in a family running real estate business; bathed in a business environment since childhood; went to Hong Kong for the college education and thus exposed to the financial world; investing in mutual funds, equity and index options

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## Education

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- **Georgia Institute of Technology (Gatech)**, Doctor of Philosophy (PhD) major in Chemistry, minor in Paper Science & Engineering, *Expected* 2014
  - **CGPA: 3.88/4.00**
  - **Supervisor: Arthur Ragauskas**, the Fulbright Distinguished Chair in Alternative Energy, Fellow of the American Association for the Advancement of Science, Fellow of the International Academy of Wood Science and TAPPI
  - **PhD Thesis:** Pseudo-lignin Chemistry in Pretreatment of Biomass for Cellulosic Ethanol Production
- **Hong Kong University of Science and Technology (HKUST)**, Bachelor of Science (BSc) in Chemistry, May 2009
  - **First Honor Graduate**
  - **4-time Dean's List:** Fall 2006, Spring 2007, Fall 2007 and Spring 2008
  - **School of Science Scholarship**
  - **HKTIIT Scholarship**

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## Research Experience

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### Optimization of Dilute Acid Pretreatment (DAP) by Dimethyl Sulfoxide (DMSO)

- The inhibition effects of pseudo-lignin formed from DAP in water/DMSO system will be evaluated and compared with pseudo-lignin produced from DAP in pure water system
- The study is still undergoing

### Pseudo-lignin Suppression

- The goal is to reduce pseudo-lignin formation while maintaining high dilute acid pretreatment severity
- The preliminary results showed that DMSO to the reaction system was effective in suppressing pseudo-lignin formation
- Even in the presence of water, DMSO preferentially solvate the carbonyl carbon atom of HMF that takes part in the pseudo-lignin formation reaction, thereby protecting HMF from pseudo-lignin formation
- Pseudo-lignin produced from dilute acid pretreatment in water/DMSO mixture will be characterized and compared with pseudo-lignin produced from dilute acid pretreatment in pure water system
- The study is still undergoing

### Pseudo-lignin vs. Dilute Acid Pretreated Lignin

- This study evaluated the inhibition effects of pseudo-lignin to enzymatic hydrolysis of cellulose in comparison to lignin
- The result suggests that pseudo-lignin formation needs to be avoided because it is more detrimental to enzymatic hydrolysis of cellulose than dilute acid-pretreated lignin.
- New experimental and laboratory skills including EMAL isolation and HSQC NMR characterization were developed
- Results were published in **ACS Sustainable Chemistry & Engineering** (one of ACS publications, focusing on sustainability in the chemical enterprise and the principles of green chemistry and green engineering)

### Pseudo-lignin Generation from Avicel (in collaboration with the Wyman Group in UC Riverside)

- Leader of the team in the Ragauskas Group in collaboration with **Charles Wyman**, distinguished professor and director of the biotechnology center for fuels and chemicals at NREL
- Exercised leadership and teamwork skills in coordinating results within the Ragauskas Group and communicating with the Wyman Group in UC Riverside

- The work done by Gatech was to characterize dilute acid pretreated or hydrothermal pretreated Avicel, Avicel/xylan mixture and Avicel/xylose mixture by FT-IR and Solid-state NMR, in order to determine if pseudo-lignin was formed during the pretreatments
- New experimental and laboratory skills such as CP/MAS NMR analysis were developed
- The work done by UC Riverside further supported that pseudo-lignin inhibits enzymatic hydrolysis of cellulose
- Results were published in **Biotechnology & Bioengineering** (IF: 3.95)

### Pseudo-lignin Isolation and Characterization

- Pseudo-lignin was isolated from dilute acid pretreated holocellulose, and was characterized by GPC, FT-IR and <sup>13</sup>C NMR
- The interactions between pseudo-lignin and cellulases were investigated, and pseudo-lignin was shown to be detrimental to enzymatic hydrolysis of pretreated biomass
- Experimental skills including molecular weight analysis, FT-IR and NMR characterization, enzymatic hydrolysis, carbohydrate and lignin analysis were developed
- Laboratory skills including GPC, FT-IR, NMR, HPLC, IC and autoclave were developed
- Results were published in **Bioresource Technology** (IF: 4.98 – prestigious journal on biofuel and biorefinary)

## Leadership Experience

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<b>TAPPI Graduate Student Chapter</b>	<b>President</b>	<b>May 2012 – Present</b>
<ul style="list-style-type: none"> <li>- Lead team to organize various successful events including factory visit, seminar series, movie nights, etc</li> <li>- Exercised management skills in organizing these events</li> </ul>		
<b>TAPPI Graduate Student Chapter</b>	<b>Treasurer</b>	<b>July 2011 – May 2012</b>
<ul style="list-style-type: none"> <li>- Exercised teamwork skills in organizing various events</li> <li>- Experienced some basic accounting principles and financial knowledge</li> </ul>		
<b>Georgia Institute of Technology</b>	<b>Teaching Assistant</b>	<b>August 2009 – May 2010</b>
<ul style="list-style-type: none"> <li>- Managed approximately 80 students to finish experiments successfully and safely</li> <li>- Led and instructed recitation to approximately 40 students, successfully growing their chemistry knowledge</li> </ul>		

## Selected Publications

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- **Hu F**, Jung S, Ragauskas AJ. Impact of Pseudolignin versus Dilute Acid-Pretreated Lignin on Enzymatic Hydrolysis of Cellulose. *ACS Sustainable Chem. Eng.* 2012; DOI: 10.1021/sc300032j.
- **Hu F**, Jung S, Ragauskas AJ. Pseudo-lignin Formation and Its Impact on Enzymatic Hydrolysis. *Bioresource Technol.* 2012; 117:7-12.
- **Hu F** and Ragauskas AJ. Pretreatment and Lignocellulosic Chemistry. *Bioeng. Res.* 2012; 5(4):1043-1066.
- Kumar R, **Hu F**, Sannigrahi P, Jung S, Ragauskas AJ, Wyman CE. Carbohydrate Derived Pseudo-lignin Can retard Cellulose Biological Conversion. *Biotechnol. Bioeng.* 2012; DOI: 10.1002/bit.24744.
- Sannigrahi P, **Hu F**, Pu YQ, Ragauskas AJ. A Novel Oxidative Pretreatment of Loblolly Pine, Sweetgum and Miscanthus by Ozone. *J. Wood Chem. Technol.* 2012; 32:361-375.
- Foston M, Hubbell CA, Samuel R, Jung S, **Hu F**, Ding SY, et al. Chemical, Ultrastructural and Supramolecular Analysis of Tension Wood in Populus tremula x alba as A Model Substrate for Reduced Recalcitrance. *Energy Environ. Sci.* 2011; 4:4962-4971.

## Other Involvements and Interests

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- **Competitive Bodybuilder** (workout at least 3 times per week, 2 hours per time; 5'10", 138 lb, body fat%: 12%; maximum bench press: 187 lb; maximum deadlift: 253 lb; maximum squat: 267 lb)
- **Avid Basketball Player** (attended Mainland Students Basketball Competition in HKUST)
- **Amateur Mixed Martial Arts Fighter** (interested at Muay Thai, Sanshou and Jiu-Jitsu)