



Education

- **École Polytechnique de Montréal, University of Montreal, QC, Canada** (2013)
Ph.D. Degree, Department of Chemical Engineering
Thesis: “Production of Chemicals by Microwave Thermal Treatment of Lignin”

- **University of Ain Shams, Cairo, Egypt** (2008)
M.Sc. Degree, Department of Physics Engineering
Thesis: “Measurements of the Specific Heat at Constant Volume for Jojoba Bio-Gasoline Fuel”

- **University of Ain Shams, Cairo, Egypt** (2005)
Qualification of the Department of Physics and Mathematics Engineering
A program of 54 credits, 16 courses, in the field of Physics Engineering.

- **University of Helwan, Cairo, Egypt** (2002)
B.Sc. Degree, Department of Mechanical Power Engineering
Grade: Very Good, with honours (The sixth of 700 students).
Graduate project title: “Hydraulic Control.” Graduate Project Grade: Distinction.

Research Interests

- Biomass/wastes processing and valorization
- Pyrolysis, gasification, and combustion
- Chemical reaction engineering
- Process design, development and optimization
- Energy management systems
- Process integration
- Renewable energy
- Bio-oil production and upgrading
- Extraction processes
- Modeling and simulation
- Pulp and paper
- Techno-economic analysis
- Microwave heating

Work Experience

- **Research Center in Process Engineer – Biorefinery (CRIP),** **Postdoctoral** **2014–**
École Polytechnique, University of Montreal, QC, Canada **Researcher**

- **Research Center in Process Engineer – Biorefinery (CRIP),** **Doctorate** **2010 - 2013**
École Polytechnique, University of Montreal, QC, Canada **Researcher**

- **Faculty of Engineering, University of Helwan, Cairo, Egypt** **Lecturer** **2002 - 2009**

- **Arab Academy for Science, Technology and Maritime** **Lecturer** **2007 - 2009**
Transport, Cairo, Egypt **(Part-Time)**

- **Egyptian Company for Air Conditioning and Refrigeration** **General Manager** **2004 - 2009**
Services, Cairo, Egypt **and Owner**

Expertise

- Multidisciplinary research & development experience in the fields of renewable energy, biomass processing, waste management and valorization, thermal and catalytic chemical reactions, pulp and paper, techno-economic analysis, and the design, development and optimization of multiphase processes under extreme conditions.
- Process simulation
- Characterization and measurement techniques such as GC-MS, GC-FID, GC-TCD, FTIR, ^{13}C NMR, ^{31}P NMR, TGA, pressure transducers, piezoelectric transducer, Karl Fischer analyzer, Bomb Calorimeter, C-H-O-N-S elemental analyzer, and others
- Utilization of electromagnetic radiation in high temperature reactors
- Project management with positive atmosphere promotion
- Writing technical reports, scientific communications and proposals
- Motivated teacher with +8 years of experience in the university education system and educational testing standards.
- Managed classes of up to 500 students
- Exceptional communicator with advanced problem-solving skills
- Ability to excel quickly at new tasks, regardless of prior familiarity with specialized knowledge

Research Background

Work with TOTAL American Services, Inc. (Industrial Chair) to investigate and model the hydrodynamics and catalytic reactions of multiphase processes, under high pressure and high temperature, towards the design, scale-up, and optimization of different chemical processes (Collaboration between École Polytechnique de Montréal, University of Montreal and TOTAL American Services, Inc. from 2011 to 2020). The tasks include:

- Developing a novel process for hydroconversion of oil derived wastes
- Conducting pilot plant experiments for investigating the hydrodynamics and catalytic reactions of multiphase processes at extreme conditions
- Analyzing, processing, and interpreting pilot scale data
- Modifying the design of pilot-scale fluidized bed (works at 30 bar & 1100 C) and slurry bubble column (works at 30 bar & 220 C) reactors
- Designing, selecting and purchasing equipment/instrumentation
- Installing new equipment and piping
- Troubleshooting and technical support
- Operation oversight and continual improvements of the system safety
- Supervising intern students' projects
- Producing technical reports, memos and project proposals

Work with Lignoworks Natural Sciences and the Engineering Research Council of Canada (NSERC) Strategic Network to create technology platforms for novel materials and chemicals based on lignin, which benefits traditional paper mills by diversifying their product lines and also addresses the serious challenges faced by the Canadian forest industry (More than 70 researchers from Canada have been involved in this project). The tasks include:

- Developing a commercial process for the thermal decomposition of lignin
- Developing a novel process for extraction high-value solvents from pyrolysis oil
- Conducting process design, simulation, and data analysis
- Completing a techno-economic evaluation for the designed process
- Developing approaches for presenting the product at a competitive selling price

- Building an experimental setup for the thermal decomposition of complex feedstocks
- Building an original microwave-TGA for kinetic purposes
- Developing a novel process for extraction high-value aromatics from pyrolysis oil
- Investigating impact of reaction conditions on the composition and structure of bio-oil
- Examining reaction kinetics
- Simulating the composition and the yield of pyrolysis products to optimize the process parameters
- Producing technical reports, memos and project proposals

Work with KENGTEK Engineering Services and Pyrowave Inc., Canada, to develop a novel process for the distributed microwave pyrolysis of domestic waste (Collaboration between École Polytechnique de Montréal, University of Montreal and KENGTEK Engineering Services and Pyrowave Inc.). The tasks include:

- Simulating the conversion of microwave energy to heat
- Conducting bench/pilot scale experiments
- Optimizing reaction conditions
- Maximizing yield and quality of the products
- Producing technical reports and memos

Work with FPInnovations to use the kraft lignin microwave-pyrolysis oil as a substitute in phenol formaldehyde resins and adhesives. (Collaboration between École Polytechnique de Montréal, University of Montreal and FPInnovations, Montreal, QC, Canada).

Collaborate with several academic institutions, e.g., Queen's University, University of Western Ontario, and University of Ottawa in the fields of biomass and waste valorization, and using bio-oil to synthesize commercially viable products.

Teaching Experience

- **Faculty of Engineering, University of Helwan, Cairo, Egypt** **Lecturer** **2002, 2009**
Heat transfer, Thermodynamics, Fluid Mechanics, Engineering Drawing, Properties of Matter, Magnetism, Electricity, and Optics
1500 students per semester
- **Arab Academy for Science, Technology and Maritime Transport** **Lecturer** **2007, 2009**
Heat Transfer, Thermodynamics, Physics I, and Physics II
100 students per semester

Journal Publications

Farag, S., B. Mudraboyina, P. G. Jossop, and J. Chaouki (2016). "Impact of the pyrolysis technique on the yield and composition of a bio-oil from kraft lignin." Submitted for publication.

Mudraboyina, B., **S. Farag**, A. Banerjee, J. Chaouki, and P. G. Jessop (2016). Supercritical fluid rectification of lignin pyrolysis oil methyl ether (LOME) and its use as a bio-derived aprotic solvent. *Green Chemistry*. DOI:10.1039/C5GC02233A. (Impact Factor 8.02)

Esmaili, A., **S. Farag**, C. Guy, and J. Chaouki (2015). "Effect of Elevated Pressure on the Hydrodynamic Aspects of a Pilot-Scale Bubble Column Reactor Operating with Non-Newtonian Liquids." *Chemical Engineering Journal*. DOI:10.1016/j.cej.2015.12.017. (Impact Factor: 4.62)

Farag, S. and J. Chaouki (2015). "Economics evaluation for on-site pyrolysis of kraft lignin to value-added chemicals." *Bioresource Technology*, DOI: 10.1016/j.biortech.2014.10.096. (Impact Factor: 5.33)

Farag, S. and J. Chaouki (2015). "A modified microwave thermogravimetric-analyzer for kinetic purposes." *Applied Thermal Engineering*, DOI: 10.1016/j.applthermaleng.2014.09.038. (Impact Factor: 3.03)

Farag, S., D. Fu, P. G. Jessop and J. Chaouki (2014). "Detailed compositional analysis and structural investigation of a bio-oil from microwave pyrolysis of kraft lignin." *Journal of Analytical and Applied Pyrolysis*. DOI:10.1016/j.jaap.2014.06.005 (Impact Factor: 3.89)

Farag, S., L. Kouisni and J. Chaouki (2014). "Lumped approach in kinetic modeling of microwave pyrolysis of kraft lignin." *Energy & Fuels*. DOI: 10.1021/ef4023493. (Impact Factor: 2.79)

Fu, D., **S. Farag,** J. Chaouki and P. G. Jessop (2014). "Extraction of phenols from lignin microwave-pyrolysis oil using a switchable hydrophilicity solvent." *Bioresource Technology*. DOI:10.1016/j.biortech.2013.11.091 (Impact Factor: 5.6)

Doucet, J., J.-P. Lavolette, **S. Farag** and J. Chaouki (2014). "Distributed microwave pyrolysis of domestic waste." *Waste and Biomass Valorization* 5(1): 1-10.

Farag, S., A. Sobhy, C. Akyel, J. Doucet and J. Chaouki (2012). "Temperature profile prediction within selected materials heated by microwaves at 2.45 GHz." *Applied Thermal Engineering*. DOI:10.1016/j.applthermaleng.2011.10.049. (Impact Factor: 3.03)

Dissertations and Book Chapters

Farag, S. and J. Chaouki (2015). "Innovative solutions in fluid-particle systems and renewable energy management." Hershey, PA, USA, IGI Global: 1-316.

Farag, S. (2013) "Production of chemicals by microwave thermal treatment of lignin." Department of Chemical Engineering, École Polytechnique de Montréal, University of Montreal, Canada. Philosophiae Doctor.

Farag, S. (2008). "Measurements of specific heat at constant volume for jojoba bio-gasoline fuel." Department of Physics and Mathematics Engineering, Faculty of Engineering, University of Ain Shams, Cairo, Egypt. Master of Science.

Conference Publications/Presentations

Farag, S. and J. Chaouki (2015). "Technical and economical Feasibility of Pyrolysis of Kraft Lignin." *Materials for Oil, Gas & Biofuels Chapter 4, Materials for Energy, Efficiency and Sustainability, TechConnect Briefs*.

Farag, S. and J. Chaouki. "Technical and economical feasibility of pyrolysis of kraft lignin." *TechConnect World Innovation Conference, Gaylord National Hotel & Convention Center, Washington, DC, USA, June 14-17, 2015*.

Chaouki, J. and **S. Farag.** "Energy and chemicals from biomass & waste: the state of the art." *SYMPHOS 2015, Marrakesh, Morocco, May 18-20, 2015*.

Farag, S. and J. Chaouki. "Preliminary economic assessment for the production of lignin-based chemicals." *3rd Annual FIBRE (Forest Innovations by Research and Education) CONFERENCE "The Path Forward", École Polytechnique, Montreal, Quebec, Canada, May 11-13, 2015*.

Farag, S. and J. Chaouki. "Microwave-assisted pyrolysis of kraft lignin for value-added chemicals." *Industry Connect – FIBRE Regional Workshop, Ivey Spencer Leadership Centre, London, Ontario, March 30, 2015*.

Farag, S. and J. Chaouki. "Microwave-assisted pyrolysis of kraft lignin for value-added bio-products." *Fourth International Forest Biorefinery Symposium PaperWeek Canada, Fairmont Queen Elizabeth Hotel, Montreal, Quebec, Canada, February 3-4, 2014*.

Farag, S. and J. Chaouki. "Microwave-assisted pyrolysis of kraft lignin for bio-chemicals production." *FIBRE Cross-Country/Cross-Linking Workshops, Eastern Canada Workshop, University of McGill, Montreal, Quebec, Canada, November 19, 2013*.

Farag, S. and J. Chaouki. "Microwave pyrolysis of lignin." *1st FIBER (Forest Innovations by Research and Education) Network conference, NAV Centre, Cornwall, Ontario, Canada, May 14-16, 2013*.

Chaouki, J. S. Farag. “Upgrading pyrolysis products with assistance of microwave heating.” The 62nd Canadian Chemical Engineering Conference, Vancouver, British Columbia, Canada, October 14-17, 2012. (Keynote Presentation)

Doucet, J., J.-P. Lavolette, S. Farag and J. Chaouki. “Distributed microwave pyrolysis of domestic waste.” The 4th International Conference on Engineering for Waste and Biomass Valorization, Porto, Portugal, September 10-13, 2012.

Farag, S., A. Sobhy, C. Akyel, and J. Chaouki. “Production of aromatics using microwave pyrolysis of lignin.” The 61st Canadian Chemical Engineering Conference, London, Ontario, Canada, October 23-26, 2011.

Sobhy, A., S. Farag, and J. Chaouki. “Energy consumption in microwave pyrolysis of biomass.” The 61st Canadian Chemical Engineering Conference, London, Ontario, Canada, October 23-26, 2011.

Farag, S., A. Sobhy, C. Akyel and J. Chaouki. “Production de produits chimiques à partir du traitement thermique aux micro-ondes de lignine.” Colloque étudiant sur le développement de produits biosourcés, ACFAS-COLLOQUE 118, University of Sherbrooke, Quebec, Canada, May 9-10, 2011.

Farag, S., A. Sobhy and J. Chaouki. “Comparison between microwave and conventional heating for high temperature biorefinery of waste biomass.” International Forest Biorefinery Symposium, Fairmont Queen Elizabeth Hotel Montreal, Quebec, Canada, February 1-2, 2011.

Sobhy, A., S. Farag, and J. Chaouki. “Microwave-assisted pyrolysis and gasification of waste biomass.” International Forest Biorefinery Symposium, Fairmont Queen Elizabeth Hotel Montreal, Quebec, Canada, February 1-2, 2011.

Farag, S., M. Radwan, S. Eid, and I. El-Gizawy. “Calculation of some thermodynamic properties based on isochoric specific heat and $PvTx$ relationship for jojoba bio-gasoline as a renewable fuel.” Accepted at the 17th Symposium on Thermophysical Properties, Boulder, Colorado, U.S.A, June 21-26, 2009.

Farag, S., M. Radwan, S. Eid, and I. El-Gizawy. “Measurements of specific heat at constant volume and $PvTx$ relationship for jojoba bio-gasoline as a renewable fuel.” 18th European Conference on Thermophysical Properties, Pau, France, August 31 – September 4, 2008.

Farag, S. and J. Chaouki. “Microwave Pyrolysis of Lignin.” NSERC Biomaterials and Chemicals Network (LIGNOWORKS), Annual General Meeting, Hilton Lac-Leamy, Gatineau, Quebec, Canada, November 23-24, 2015.

Farag, S. and J. Chaouki. “Hydrodynamics Aspects of Multiphase Reactors at Extreme Conditions.” TOTAL American Services Inc., TOTAL Students Sponsored Meeting, Marriott Hotels and Resorts, Santa Clara, California, USA, February 3-4, 2015.

Farag, S. and J. Chaouki. “Microwave Pyrolysis of Lignin.” NSERC Biomaterials and Chemicals Network (LIGNOWORKS), Annual General Meeting, The Listel Hotel, Vancouver, Canada, June 5-7, 2014.

Farag, S. and J. Chaouki. “Microwave Pyrolysis of Lignin.” NSERC Biomaterials and Chemicals Network (LIGNOWORKS), Principle investigators meeting, Holiday Inn. Ottawa, Canada, January 27-28, 2014.

Farag, S. and J. Chaouki. “Microwave Pyrolysis of Lignin.” NSERC Biomaterials and Chemicals Network (LIGNOWORKS) Annual General Meeting, NAV Centre, Cornwall, Ontario, Canada, May 12-14, 2013.

Farag, S., A. Sobhy, and J. Chaouki. “Microwave Pyrolysis of Lignin.” NSERC Biomaterials and Chemicals Network (LIGNOWORKS), Annual General Meeting, Hilton Whistler Resort, Vancouver, British Columbia, Canada, May 1-4, 2012.

Farag, S., A. Sobhy, and J. Chaouki. “Microwave Pyrolysis of Lignin.” NSERC Biomaterials and Chemicals Network (LIGNOWORKS), Annual General Meeting, Hockley Valley Resort, Orangeville, Ontario, Canada, May 11-13, 2011.