

**Research Topic for the ParisTech/CSC PhD Program**  
(one page maximum)

**Subfield:** Physical Chemistry, Renewable Energy

**ParisTech School:** ENSTA ParisTech

**Title:** Experimental and modeling study of thermal decomposition of Biomass

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**Short description of possible research topics for a PhD:**

Growing concerns about Green House Gas emissions and depleting of fossil fuel sources have promoted great interest in the use of renewable resources for fuels and chemicals. The decomposition of lignocellulosic biomass which is a complex material made of cellulose, lignin, and hemicelluloses, is a potential source of energy through different upgrading processes. The variety of products that can be obtained (e.g. syngas, biofuel, biogas...) makes this option interesting but for targeting a profitable solution, a better understanding of the chemistry is necessary to optimize and to characterize the use of biomass. The main goal of the Ph.D project proposed here is the experimental and modeling study of thermal decomposition of Biomass. The experimental part will be focused on the pyrolysis of the lignocellulosic biomass, and its principal constituents. The measurements will be performed by using a pyrolyser and a thermogravimetric analyzer (TGA) coupled to gas chromatograph and mass spectrometer (GC-MS), and a gas chromatograph (GC) equipped with a thermal conductivity detector (TCD). The solid residues will be characterized by using different methods of analysis such as surface area measurements (BET), elemental analysis, and microscopy (SEM, TEM). The identification of the decomposition products including permanent gases exhausted will then allow the understanding of the phenomena, and the proposal of a detailed chemical kinetic model of the biomass compounds decomposition, and the development of 2nd generation biofuels. This modeling part will be performed by using specific softwares specifically adapted to this purpose

This PhD project can lead to an academic career in physical chemistry or to positions as engineers in international industries related to energy and renewable energy.

**Required background of the student:** Energy, solid background in Physical Chemistry.

**A list of 5(max.) representative publications of the group:** (Related to the research topic)

J. Liang, C. Deng, K. Chatelain, M. Matrat, J. Deschamps, L. Catoire, " Pyrolysis of selected molecules for second generation biofuels production", *Energy and fuel*, to be submitted 2018.

A. Osmont, L. Catoire, P. E. Bocanegra, I. Gökalp, B. Thollas, J. A. Kozinski, "Second generation biofuels: Thermochemistry of glucose and fructose", *Combustion and Flame*, 157, 2010, 1230-1234.

L. Catoire, M. Yahyaoui, A. Osmont, I. Gökalp, M. Brothier, H. Lorcet, D. Guénadou, "Thermochemistry of compounds formed during fast pyrolysis of lignocellulosic biomass", *Energy & Fuels*, 22, 2008, 4265-4273.

A. Osmont, L. Catoire, I. Gökalp, "Thermochemistry of methyl and ethyl esters from vegetable oils", *International Journal of Chemical Kinetics*, 39, 2007, 481-491.