



Supercritical water gasification and hydrothermal carbonization of biomass

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Hydrothermal processes represent an interesting option to treat high moisture residual biomass (agro-industrial residues, organic fraction of municipal solid waste, sewage sludge, and others) which, presently, are disposed of by anaerobic digestion, composting, or land filling, or converted by dry thermo-chemical processes (combustion, gasification) after an energy-intensive drying pretreatment.

Hydrothermal processes utilize as reaction medium and as reactant the water content of the moist substrate. SuperCritical Water Gasification (SCWG) occurs at severe process conditions –pressure of about 250 bar, temperature greater than 400 °C– and produces a syngas rich in CO, H₂, and CH₄. HydroThermal Gasification (HTC) occurs at much milder process conditions –temperature in the range 180-250 °C, pressure of 10-50 bar, water in the liquid phase– and converts the feedstock into a solid product enriched in carbon: hydrochar or biochar. Syngas can be utilized as energy vector to feed internal combustion engine, gas turbine, fuel cells, or to produce chemicals and liquid biofuels. Hydrochar, on the other hand, can be utilized as solid biofuel, soil amendment, catalyst, adsorbent, or raw material for activated carbon production.

The seminar will provide an overview on hydrothermal processes and will focus on SCWG and HTC, highlighting strengths and weaknesses of these processes in view of their practical application at industrial scale.



Luca Fiori is associate professor of Chemical Engineering Fundamentals at the Department of Civil, Environmental, and Mechanical Engineering of the University of Trento, Italy. He is a chemical engineer with a PhD in chemical and process engineering. He is lecturer of the academic courses Bioenergy, Thermo-chemical Energy Processes, and Food Engineering. He leads the Green Process Engineering research group. The research focus is residual biomass valorization through high-pressure fluids techniques: biomass and waste to added-value products and energy. His research covers Supercritical Fluid Extraction (SFE) and Fractionation (SFF), Supercritical Water Gasification (SCWG), and HydroThermal Carbonization (HTC).