Under Pressure and in Hot Water – Algae Conversion to Fuels and Chemicals

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There is much interest in using renewable biomass resources to meet demand for fuels and chemicals. Algal biomass is an attractive biomass feedstock because it requires less land area and has a higher photosynthetic efficiency than terrestrial biomass and it does not involve a food/feed vs. fuel competition as does corn ethanol or soy biodiesel. Microalgae grow to biomass densities of around 1 g/L in nature, so a tremendous amount of water accompanies the biomass feedstock. Conventional algal bioenergy processes (e.g., lipid extraction for biodiesel production) first remove the water and then process the dried biomass. These dewatering and drying steps are costly and energy intensive. Thus, there is a need for algal biomass conversion processes that operate in the aqueous phase. We are helping to develop the chemical kinetics and reaction engineering foundations for hydrothermal processes that can convert wet algal biomass to biofuels directly (no drying) and thereby reduce process energy demands for biofuel production. This talk will outline recent progress made in understanding and optimizing the use of hydrothermal carbonization and hydrothermal liquefaction for converting wet algal biomass into liquid fuels or to chemicals. Advancements made in the liquefaction process, the reaction pathways and kinetics, and new insights arising from reaction modeling and model compound experiments will be highlighted.