Combustion of Bio- and Biomass-Derived-Fuels to Address Security of Supply and Efficiency Challenges: A Chemical Kinetic Prospective

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Gaseous fuels derived from biomass can be used in conventional and new combustion devices (flameless combustors …). Among these fuels, hydrogen and syngas (CO/H_2) can be used in various amounts with natural gas. Furthermore, 'flameless combustion' is an interesting emerging combustion concept that can be used for reducing pollutant emissions, particularly NO_X, and improving combustion efficiency. Its application to gas turbine is currently studied. In flameless combustor, the reactants are preheated and diluted by exhaust gases, mainly H_2O, CO_2, CO, and traces of NO_X. In gas turbines, water vapor is also injected to limit NOx formation. Therefore, it is important to study the effect of such compounds on the kinetics of oxidation of conventional fuels (NG) or non-conventional fuels (CO/H_2/…). The effect of NO_X recirculation has been addressed previously whereas that of water vapor and CO_2 was not until recently.

Liquid fuels derived from biomass such as alcohols obtained from biomass fermentation can be used for ground transportation, and probably more. Among them, ethanol and n-butanol represent interesting alternatives to petrol-derived liquid fuels, although several environmental issues still need to be addressed. Methyl esters (FAME) derived from vegetable oil or animal fat are already used in 'Bio-Diesel'. Nevertheless, more about their combustion chemistry needs to be known.

Recent results obtained for the kinetics of combustion of these bio- and biomass-derived-fuels will be presented.