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Influence of Methyl Linolenate and Methyl Palmitate on Soot nucleation rates in Biodiesel Flames

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Abstract

Currently, there is a growing focus on extremely tiny soot particles because of their extensively documented negative impacts on both human health and the environment. More specifically, understanding the nucleation of soot particles is one of the most important aspect in achieving more regulated and environmentally friendly combustion. This study focused on establishing the influence of methyl esters on the overall nucleation rates and soot volume fraction of biodiesel flame by simulating and comparing the nucleation rates of Methyl Linolenate (MLe) and Methyl Palmitate (MP) flames. The study was based on Moss-Brooke's soot model using biodiesel surrogates (FAME) reduced mechanism with 177 chemical species and 2904 chemical reaction. Fuel and air inlet conditions were set at normal room conditions (101325 Pa and 300 K).

Stationary walls were applied to the left and right plane of computational domain while zero gradient conditions at the outlet. Specified velocities for the fuel and air were 0.4 m/s. According to the computation, MLe has a greater influence in nucleation and soot volume fraction as compared to MP due to higher aromatic content and higher production of soot precursors with carbon rings in the flame.

Keywords: Soot Nucleation; Biodiesel; Methyl Linolenate; Methyl Palmitate; Precursor.

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