**The Comparison of Combustion and Spray Parameters between Two Heavy-duty Marine Injectors: One Cavitating Cylindrical Nozzle and One Conical Nozzle**

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In the transition to sustainable mobility, drop-in biofuels are important both in the short- and medium-term transfer process and as a sustainable energy route in the long term. The current research studies Rapeseed Oil Methyl Ester (RME), which is produced by esterification of rapeseed oil, and Hydrotreated Vegetable Oil (HVO), which is produced by hydro-treatment of vegetable oils and/or animal fats, along with reference diesel fuel in a constant volume and constant pressure combustion chamber and determines the relationship between cetane number, oxygen concentration, and nozzle geometry to ignition initiation and flame and soot lift-off lengths. This analysis is carried out by utilizing two optical methodologies, OH\* chemiluminescence and natural flame luminosity (soot). The spray and combustion characteristics of these fuels are measured with two large-scale, heavy-duty maritime injectors with outlet diameters of 300 μm. These two injectors, which have conicity factors of 0 and 4, display geometry-related and cavitation effects, show discernible variation in flame initiation and propagation, and link the spray cone angle and penetration to soot production and the positioning of OH\* signals. Easier oxygen-carbon bond breakdown of RME fuel, less volatility, and 10% oxygen content illustrate higher liquid penetration and a perceptible delay in the liquid/vapour phase change, which leads to a quicker igniting, shorter lift-off length but less soot formation in both nozzles. The findings, on the other hand, reveal that a wider cone angle and a higher rate of cavitation of the cylindrical nozzle have a direct impact on faster ignition initiation and less soot formation by entraining more air into the spray. The ambient conditions in the CVC chamber have been adjusted to 6 MPa pressure and 973 K temperature and fuel conditions have been set to 150 MPa pressure and 363 K temperature.

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