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Formulation optimization and physicochemical properties prediction of E10 fuel

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ABSTRACT/RESUME

Abstract: *Nowadays, large range of fuels supplied has diverse composition. To optimize the combustion process, engine performance and to meet EPA emissions standards, the knowledge of gasoline properties should be obtained in real time. Evaluation and prediction of physicochemical parameters such as octane numbers and densities still play an essential role in the quality control of gasoline and similar fuels. Their measurements, according to standard ASTM procedures are time and work consuming and demand specific equipment's. This study presents an alternative approach based on the use of Design of Experiments (DOE) method and its application for E10 fuel formulation optimization and then the prediction of the principal gasoline properties such as octane number and density using mathematical models. The optimization of gasoline composition is performed by the implementation of a mixing plan with different gasoline refinery blending stocks (toluene, reformate, naphtha, heavy reformate, pentane) and ethanol, with 10% in volume. The variation influence of each component proportion in the mixture, on the two essential properties of gasoline as indicated above, has been studied with comparison to the commercial gasoline, considered as a base line. We reveal a strong correlation between these properties and the gasoline blend composition. Blend stocks and formulated E10 fuel samples, previously tested according to standard methods, were used to build mathematical models, which were evaluated by experimental validation. The obtained root mean square prediction differences (RMSPD) are respectively 0.64% and 0.33% for RON and density. These results suggest that our models can be used to predict different physicochemical properties, furthermore, the obtained E10 fuels found to have the same properties as commercials gasoline.*