

PARTICULATE REDUCTION IN GDI ENGINES USING MANNICH DETERGENTS

ABSTRACT

The present disclosure relates to fuel additive packages, fuels, and methods of achieving emission particulate reductions in gasoline direct injection (GDI) engines using select Mannich detergents (e.g., reaction products of a hydrocarbyl-substituted hydroxyaromatic compound, an aldehyde, and an amine). In one approach or embodiment, the select Mannich detergents herein for emissions particulate reductions include one or more of the following characteristics: (i) certain molar ratios of the hydroxyaromatic compound, the amine, and the aldehyde; (ii) select oligomer structures; and/or (iii) certain isomeric forms of polyisobutylene substituents on the hydroxyaromatic compound.

[No Available Figure]