Taguchi- grey relation based multi-response optimization of diesel engine operating parameters with water-in-diesel emulsion fuel

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Abstrak

The use of water-in-diesel (W/D) emulsion fuel has the potential to promote better performance with lower emissions in existing diesel engines. The present study aims to analyzes the influence of operating parameters on the overall engine performance and emission characteristics using W/D emulsion fuel and to obtain the optimum level for favorable performance and emission levels. The engine operating parameters were optimized using a Taguchi–grey relation based multi-response optimization tool. Two controlling parameters, namely compression ratio (CR) and percentage of W/D, were considered as input process parameters. An L16 orthogonal array was used to collect the output responses (performance and emissions) under varying engine load conditions. The signal-to-noise (S/N) ratio and grey relational analysis were used to analyze the performance and emission parameters. From the results obtained, it is noted that both controlling parameters have a significant effect on the performance and emission levels. The optimum level of performance and emission levels are obtained at a CR of 18 and water concentration of 10%. Moreover, under these optimum conditions, i.e. at 10% of water concentration, the fuel properties are at par with the standard diesel fuel properties requirement.