



Experimental study on direct injection diesel engine fuelled with ferric chloride nanoparticle dispersed *Cassia Fistula* biodiesel blend

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Abstract

The present work investigates the influence of surface-modified ferric chloride (FeCl_3) nanoparticles mixed *Cassia Fistula* oil biodiesel blend (B20) for assessing combustion, performance, and emission parameters of diesel engine. FeCl_3 nanoparticles were dispersed in three different concentrations as 50 ppm, 75 ppm, and 100 ppm. QPAN 80 dispersant was used as a dispersant to modify the surface of FeCl_3 nanoparticles. The stability study of the prepared fuel dispersions was carried out for a period of one month using UV spectroscopy. B20 blend dispersed with FeCl_3 nanoparticles has shown good stability. A tremendous improvement in engine operating parameters was seen with nanofuel and the injection pressure (IP) together. At higher IP of 220 bar, the brake thermal efficiency (BTE), cylinder pressure (CP), and net heat release rate (NHRR) were found to have improved by 3.14%, 5.81%, and 22.92% whereas the brake-specific fuel consumption (BSFC) was lowered by 3.89%. The emissions in terms of carbon monoxide (CO), unburnt hydrocarbons (UHC), nitrogen oxide (NO_x), and smoke were noticed to have lowered by 42.68%, 9.73%, 14.68%, and 23.02%, respectively, for B20 + 75 ppm FeCl_3 + 75 ppm dispersant as compared to regular diesel.

Keywords Dispersant · *Cassia Fistula* · Cylinder pressure · Emission · Cetane number

Abbreviations

B100	100% <i>Cassia Fistula</i> Biodiesel	B20 + 100 ppm FeCl_3 + 100 ppm dispersant	20% <i>Cassia Fistula</i> In diesel + 100 ppm Ferric Chloride nanoparticles + 100 ppm dispersant
B20	20% <i>Cassia Fistula</i> In diesel		
B20 + 50 ppm FeCl_3 + 50 ppm dispersant	20% <i>Cassia Fistula</i> In diesel + 50 ppm Ferric Chloride nanoparticles + 50 ppm dispersant	ppm ASTM NaOH SEM	Part per million American standards for testing materials Sodium hydroxide Scanning electron microscope
B20 + 75 ppm FeCl_3 + 75 ppm dispersant	20% <i>Cassia Fistula</i> In diesel + 75 ppm Ferric Chloride nanoparticles + 75 ppm dispersant	DSC FTIR BTE BSFC	Differential scanning calorimetry Fourier-transform infrared spectroscopy Brake thermal efficiency (%) Brake-specific fuel consumption (kg/kWh)
		CP NHRR	Cylinder pressure (bar) Net heat release rate (J/degree CA)
		ADC IP CO	Analogue to digital converter Injection pressure Carbon dioxide (%)

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