

Experimental investigation of engine performance for 2nd generation biodiesel derived from Mg₂Zr₅O₁₂ catalyst

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Supplementary Material

Table S1. Technical specifications of diesel engine, dynamometer, and engine loads.

Model	Kirloskar TV1
Engine	IC
Type	Water cooled, diesel
No. of cylinders	1
No. of strokes	4
Stroke length	110 mm
Cylinder diameter	87.5 mm
Connecting rod length	234 mm
Orifice diameter	20 mm
Dynamometer	Type eddy current, water cooled, with loading unit
Dynamometer model	AG-10, SAJ Test Plant Pvt. Ltd
Water inlet	1.6 bar
Dynamometer arm length	185 mm
Peak cylinder pressure	77.5 kg/cm ²
Fuel injection pump	PCB Piezotronics, Model HSM111A22
Fuel injection standard time	23°bTDC
Fuel injection pressure	210 bar
Fuel flow transmitter	DP transmitter, Range 0-500 mm WC
Air flow transmitter	Pressure transmitter, Range (-) 250 mm WC
Power	3.5 kW
Speed	1500 rpm
Brake mean effective pressure at 1500 rpm	6.35 kg/cm ²
Power rating:	
Continuous	7/1500 hp/rpm
Intermittent	7.7/1500 hp/rpm
CR ratio	18:1

Overall dimension	617L × 504W × 877H
Weight	160 kg
Load cell model	Apex, Model AX-155 and constant speed
Capacity	0 – 50 kg
Operating temperature range	-20 °C to +70 °C
Data acquisition device	NI USB-6210, 16 bit
Software	'EnginesoftLV' Engine performance analysers software

Table S2. Technical specifications of exhaust gas analyser.

Gases Measured	CO, CO ₂ , NO _x , UHC
Exhaust gas analyser	PEA205, INDUS <i>Scientific</i>
Smoke meter	Indus Scientific, Range – 0 to 100% HSU
Principle	Non-Dispersive Infrared Sensors for CO, CO ₂ , HC and Electrochemical sensors for NO _x
Gas Flow Rate	500 – 1000 ml per minute
Operating temperature	5 to 45 °C
Pressure	813 to 1060 mbar
Humidity	0-90%
CO emission range	0-15.00% 0-4000ppm
CO ₂ emission range	0-20.00%
NO _x range	0-5000 ppm
UHC range	0-30000 ppm