상용IDI디젤엔진에서 디젤과 바이오디젤 혼합연료의 기관성능특성에 관한 연구

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Study of Engine Performance Characteristics of Diesel-Biodiesel Blends in a Natural-Aspirated IDI Diesel Engine

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1. Introduction

In the present work, the blend of biodiesel derived from soybean and waste edible oil would be tested in an IDI diesel engine. The objective of this work is to investigate the engine performance and its combustion characteristics compared to standard diesel fuel. The data resulted from this work would be provided with some theoretical aspects to explain the engine characteristics and also compared to other reports with similar experiment condition.

2. Experimental set up

The experiments were conducted on a three cylinders, four-stroke, natural aspirated indirect injection diesel engine. The engine was connected to an engine dynamometer providing maximum engine power of 74 kW. The engine was tested at full-load, fuelled with diesel and diesel-biodiesel blends (BD25, BD45, BD65) at constant engine speed ranging from 1000 to 2600 rpm with interval 200 rpm.

3. Results and Discussion

3.1 Engine performance

Fig. 1 and 2 show the engine power and brake specific fuel consumption at full-load for different fuels. Fig. 3 shows the variation of the indicated horse power of the engine at full-load for different fuel types. Generally we can say there is no big different in the power resulted from all tested-fuels. However, the indicated horse power reached by neat diesel fuel was still higher than the blends of diesel and biodiesel. This is understandable since the lower heating value of biodiesel is suggested to be responsible for the torque and engine power decrease.

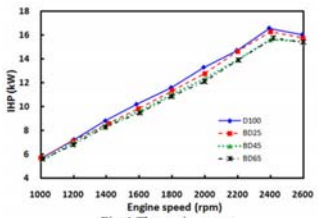

Fig. 1 The engine power

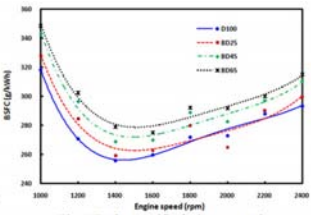

Fig. 2 Brake specific fuel consumption

Fig. 2 The torque with engine speed at full-load

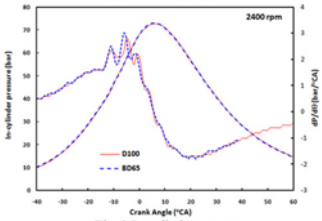

Fig. 3 In-cylinder pressure

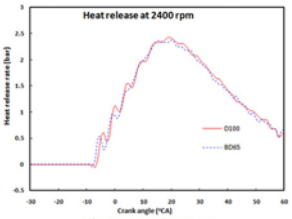

Fig. 4 Heat release rate

Fig. 3 IHP with the engine speed at full-load

3.2 Combustion characteristics

Fig. 3 shows the variations of cylinder pressure with crank angle for diesel fuel and BD65 at 2400 rpm. The pressure change rate in bar/°CA is also presented in the same graph. From this graph it is shown that the maximum pressure inside cylinder of BD65 is slightly higher than that of D100. This could be down to the role of the higher oxygen content in the biodiesel at the main combustion period. The heat release rate presented in Fig. 4 showed that BD65 started the combustion earlier than that of D100. From Fig. 4 it is also clearly observed that the heat release rate of D100 is higher than that of BD65.

4. Conclusion

The performance of an IDI diesel engine fuelled with diesel and diesel-biodiesel blends was experimentally conducted. The results showed that engine power decreased with increase of biodiesel content as the consequence of lower heating value of biodiesel compared to diesel fuel. The brake specific fuel consumption increased also due to this reason. From the combustion analysis, it was observed that biodiesel content resulted in slightly higher in-cylinder pressure and pressure-rise rate in the cylinder process; and that biodiesel blends have shorter ignition delay than the diesel fuel.

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