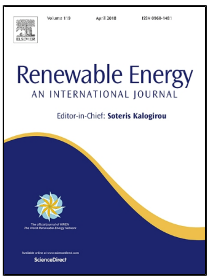
Accepted Manuscript



Experimental investigation of physicochemical properties of diesel, biodiesel and TBK-biodiesel fuels and combustion and emission analysis in CI internal combustion engine

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PII:	S0960-1481(18)30048-X
DOI:	10.1016/j.renene.2018.01.048
Reference:	RENE 9653
To appear in:	*Renewable Energy*
Received Date:	20 August 2016
Revised Date:	23 July 2017
Accepted Date:	14 January 2018

Please cite this article as: György Szabados, Ákos Bereczky, Experimental investigation of physicochemical properties of diesel, biodiesel and TBK-biodiesel fuels and combustion and emission analysis in CI internal combustion engine, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.01.048

Experimental investigation of physicochemical properties of diesel, biodiesel and TBK-biodiesel fuels and combustion and emission analysis in CI internal combustion engine

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HIGHLIGHTS

- TBK-Biodiesel or called TOMS is a new type of biodiesel
- Comparison tests have been conducted with three different fuels and with its blends
- Physicochemical properties, combustion process and emission have been investigated
- Bio fuels have a moderate improving effect on combustion and gas phase emission
- FSN and k decrease significantly with bio fuels

ABSTRACT

Nowadays, there is a lot of research done with renewable diesel fuels. The number of parent materials (especially sludge oil, used oil, edible and non-edible oils), production technologies, and additives of biodiesel is increasing. In our work a comprehensive comparison test series of three fuels (fossil diesel, conventional biodiesel (rapeseed oil methyl ester), and a new type of biodiesel (which is called Triglycerides of Modified Structure)) have been performed. Comparison tests have been conducted with respect to their physicochemical properties and their effect on the combustion and emission of a bus engine. Referring to the physicochemical properties, the tested biodiesel fulfil all the requirements of the EN (European Norm) 14214 standard, but the tested TBK (Thész-Boros-Király) doesn't fit some of the requirements of the EN standard. Based on the indicator and heat release results it can be established, that there is no significant, but a moderate improvement of the combustion process with bio fuels. As for the emission it can be stated, that bio fuels are advantageous as well, but the results are near to measurement accuracy, except smoke and opacity, which decreased in a high degree in case of the two tested bio fuel compared to the fossil one.

Keywords: Triglycerides of Modified Structures, TBK-Biodiesel, physicochemical properties, combustion analysis, emission analysis

ABBREVIATIONS

CI engine – Compression Ignition engine; TBK – the first character of the surnames of the three inventors (Thész, Boros, Király) of the new biofuel production technology; TOMS – Triglycerides Of Modified Structures (the English name of TBK-Biodiesel); PB – Palm Biodiesel; EN – European Norm; ASTM – American Society for Testing and Materials; PAH – Poly-Aromatic Hydrocarbons; HRD – Hydro-processed Renewable Diesel; HVO – Hydro-treated Vegetable Oil; EPS – Expanded Poly-Styrene; ICE – Internal Combustion Engine; FSN – Filter Smoke Number; RME – Rapeseed Methyl Ester; PM – Particulate Matter; LHV – Lower Heating Value; TG – ThermoGravimetry; DTG – Differential Thermogravimetry; k value – coefficient of opacity; CA – Crankshaft Angle; BTDC – Before Top Dead Centre; ATDC – After Top Dead Centre; HRR – Heat Release Rate; CFPP – Cold Filter Plugging Point; ULSD – Ultra Low Sulfur Diesel; FSO – Full Scale Output; TDC – Top Dead Centre; FAME – Fatty Acid Methyl Ester; NO_x – Nitrogen Oxides; CO – Carbon Monoxide; HC – Hydrogen Carbon