

Standardization and Upgrading of Biodiesel Fuel Quality

Shinichi Goto, Hitoshi Shiotani, Yuji Yoshimura, Hideaki Hamada

National Institute of Advanced Industrial Science and Technology (AIST)

JAPAN

Biodiesel fuel has been much attracted as a carbon neutral fuel because it is made from vegetable oil. Especially in Southeast Asia, there is much amount of biofuel resources such as palm oil and coconut oil, and it is desirable to use them for CO₂ reduction. In Japan, the program to revise Law on the Quality Control of Diesel Fuel is proceeding for biodiesel blended fuels. Verification tests are executing in AIST, and it is scheduled to fix the Japanese standard of biodiesel blended fuel in the spring of 2006.

The authors show the properties of biodiesel fuel and the potential applying to diesel engine. Palm oil methyl ester (PME) mainly contains saturated fatty acid methyl ester, so oxidation stability is better than other vegetable oil. It is suitable for blending biodiesel fuel. On the other hand, the low temperature performance of PME is not better than other vegetable oil methyl ester. Low temperature performance is one of the important problems in Japan, but it is not a problem in Southeast Asia. In addition, we comment on the effects of biodiesel fuel on engine performance and emission characteristics.

Properties of major biodiesel fuel

Property	Unit	Limits		Palm oil methyl ester (PME)	Rapeseed oil methyl ester (RME)	Soybean oil methyl ester (SME)
		Minimum	Maximum			
Ester content	%(m/m)	96.5		100.0	99.7	99.3
Density at 15	kg/m ³	860	900	874.3	884.9	884.1
Viscosity at 40	mm ² /s	3.50	5.00	4.404	5.068	4.028
Flash point		120	-	162	174	170
Sulfur content	mg/kg	-	10.0	< 3	< 3	4
Carbon residue	%(m/m)	-	0.3	0.04	0.32	0.15
Cetane number		51.0	-	66.5	52.2	52.7
Sulfated ash content	%(m/m)	-	0.02	<0.001	<0.001	<0.001
Water content	mg/kg	-	500	649	286	249
Total contamination	mg/kg	-	24	1.7	2.6	5.4
Copper strip corrosion	Rating	class1		1a	1a	1a
Oxidation stability	Hours	6.0	-	7.02	4.51	1.28
Acid value	mgKOH/g		0.5	0.10	0.17	0.08
Iodine value			120	50.2	110	128
Linolenic acid methyl ester	%(m/m)		12.0	0.3	7.7	7.2
Methanol content	%(m/m)		0.2	< 0.01	0.07	< 0.01
Monohlyceride content	%(m/m)		0.8	0.024	0.27	0.012
Diglyceride content	%(m/m)		0.2	< 0.001	0.12	< 0.001
Triglyceride content	%(m/m)		0.2	< 0.001	0.19	< 0.001
Free glycerol	%(m/m)		0.02	0.006	0.006	0.008
Total glycerol	%(m/m)		0.25	0.012	0.112	0.011
Sodium(Na)	mg/kg		5.0	< 1	< 1	< 1
Potassium(K)	mg/kg		(Na+K)	< 1	< 1	< 1
Calcium(Ca)	mg/kg		5.0	< 1	< 1	< 1
Magnesium(Mg)	mg/kg		(Ca+Mg)	< 1	< 1	< 1
Phosphorus content	mg/kg		10.0	< 1	< 1	< 1
CFPP				12	-11	-3