DETERMINATION OF THE QUALITY PARAMETERS OF BIODIESEL

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400

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TS No.: 25 – DETERMINATION OF FREE AND TOTAL GLYCEROL AND MONO-, DI-, TRIGLYCERIDE CONTENTS IN BIODIESEL [1,3,4]

TS No.: 26 – DETERMINATION OF ESTER AND LINOLENIC ACID METHYL ESTER CONTENTS IN BIODIESEL [3,1,4]

TS No.: 27 – DETERMINATION OF ACID VALUE OF BIODIESEL [3,1,4]

TS No.: 28 – DETERMINATION OF COLD FILTER PLUGGING POINT OF BIODIESEL [2,4]

TS No.: 29 – DETERMINATION OF POUR POINT OF BIODIESEL [2,4]

TS No.: 30 – DETERMINATION OF CLOUD POINT OF BIODIESEL [2,4]

TS No.: 31 – DETERMINATION OF MOISTURE CONTENT IN BIODIESEL [1,3,4]

TS No.: 32 – DETERMINATION OF WATER AND SEDIMENT IN BIODIESEL [1,3,4]

TS No.: 33 – DETERMINATION OF OXIDATIVE STABILITY OF BIODIESEL [2,4]

TS No.: 34 – DETERMINATION OF CARBON RESIDUE IN BIODIESEL [1,3,4]

TS No.: 35 – DETERMINATION OF FLASH POINT OF BIODIESEL [2,4]

TS No.: 36 – DETERMINATION OF KINEMATIC VISCOSITY OF BIODIESEL [2,4]

TS No.: 37 – DETERMINATION OF DENSITY OF BIODIESEL [2,4]

The quality of biodiesel is important for end-users, engine manufacturers and petroleum companies to ensure that it can be used directly or blended with petroleum diesel. Thus, the ability to analyse is an important capability to have. The major difference between biodiesel from different vegetable oils is their inherent characteristics and properties. Therefore, analyses of biodiesel first requires fundamental understanding of the vegetable oils for sound procedures to be adopted. The Malaysian Palm Oil Board (MPOB) has been the pioneer in palm biodiesel research and development since the 1980s. The MPOB technical team is experienced in the analyses of biodiesel, especially biodiesel from palm oil. Industry members will benefit from reliable results using international biodiesel testing methods specified in the EN 14214 and ASTM D 6751 regulations.

SERVICES OFFERED BY MPOB

1. **TS No.: 25 – Determination of Free and Total Glycerol and Mono-, Di-, Triglyceride Contents in Biodiesel**
   Based on EN 14105. The determination is by gas chromatography with internal calibration. The contents are expressed in percentages (w/w), to the nearest 0.01%.

2. **TS No.: 26 – Determination of Ester and Linolenic Acid Methyl Ester Contents in Biodiesel**
   Based on EN 14103, and carried out using gas chromatography with internal calibration (methyl heptadecanoate). The methyl ester peaks in the analysis range from myristic acid (C14:0) to nervonic acid (C24:1). The result is expressed as the mass fraction in percent.

3. **TS No.: 27 – Determination of Acid Value of Biodiesel**
   The determination is by titrimetry based on EN 14104. The acid value is expressed as the amount (in milligrammes) of potassium hydroxide required to neutralize one gramme of the biodiesel (mg KOH g^{-1}).

4. **TS No.: 28 – Determination of Cold Filter Plugging Point of Biodiesel**
   Based on EN 116. The CFPP is the highest temperature at which a given volume of fuel

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fails to pass through a standard filtration device in a specific time, when cooled under standard conditions.

5. **TS No.: 29 – Determination of Pour Point of Biodiesel**
   Based on ASTM D 97. The pour point is the lowest temperature at which movement of the test specimen is observed under the prescribed conditions of the test.

6. **TS No.: 30 – Determination of Cloud Point of Biodiesel**
   Based on ASTM D 2500. The cloud point is the temperature of a liquid specimen at which the smallest observable cluster of wax crystals first appears upon cooling under prescribed conditions.

7. **TS No.: 31 – Determination of Moisture Content in Biodiesel**
   Based on ASTM E 203. The determination is carried out using the Karl-Fischer Titrator. The result is important as biodiesel is hygroscopic.

8. **TS No.: 32 – Determination of Water and Sediment in Biodiesel**
   Based on ASTM D 1796 (1997) and using a centrifuge. This result is important because high water and sediment contents can corrode and block the fuel filters and injectors.

9. **TS No.: 33 – Determination of Oxidative Stability of Biodiesel**
   Based on EN 14112 and using a 743 Rancimat instrument. It is an accelerated oxidation test with the oxidative stability expressed in hours.

10. **TS No.: 34 – Determination of Carbon Residue in Biodiesel**
    Based on ISO 10370. EN 14214 requires the test to be carried out on a 10% distillation residue of the sample while ASTM D 6751 requires 100% sample without prior distillation. The carbon residue value approximates the tendency of biodiesel to form deposits. The carbon residue is the residual material after evaporation and pyrolysis of a sample. The test indicates the amount of glycerides, free fatty acid, soaps and catalyst residues in the sample.

11. **TT No.: 35 – Determination of Flash Point of Biodiesel**
    Based on ASTM D 93 and using a Pensky-Martens closed cup tester. The flash point is the lowest temperature at which an ignition source ignites the vapours from the sample under the specified conditions of the test.

12. **TS No.: 36 – Determination of Kinematic Viscosity of Biodiesel**
    Based on ASTM D 445. The kinematic viscosity is the time taken by a volume of sample (liquid form) to flow under gravity through a calibrated glass capillary viscometer. The unit is in $mm^2 s^{-1}$.

13. **TS No.: 37 – Determination of Density of Biodiesel**
    Based on ASTM D 4052. A small volume of the biodiesel sample is introduced into an oscillating sample tube and the change in oscillating frequency caused by the change in the mass of the tube is used in conjunction with the calibration data to determine the density of the sample.

TABLE 1. COSTS OF ANALYSES

TS No.	Analysis	RM / sample*
25	Free and Total Glycerol and Mono-, Di-, Triglyceride Contents	400
26	Ester and Linolenic Acid Methyl Ester Contents	200
27	Acid Value	40
28	Cold Filter Plugging Point	70
29	Pour Point	70
30	Cloud Point	70
31	Moisture Content	60
32	Water and Sediment	60
33	Oxidative Stability	100
34	Carbon Residue	400
35	Flash Point	70
36	Viscosity	70
37	Density	70

Note: * The costs may be revised from time to time.

Figure 1. Gas chromatography for determination of glycerides, free and total glycerol, methanol and esters contents.

Figure 2. Karl Fischer titrator for determination of moisture content.

Figure 3. Carbon residue tester.

Figure 4. Centrifuge for determination of water and sediment.

Figure 5. Cloud point, pour point and CFPP tester.

Figure 6. The 743 Rancimat for determination of oxidative stability.

Figure 7. Multi range viscometer.

Figure 8. Digital density meter.

Figure 9. Flash point tester.

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