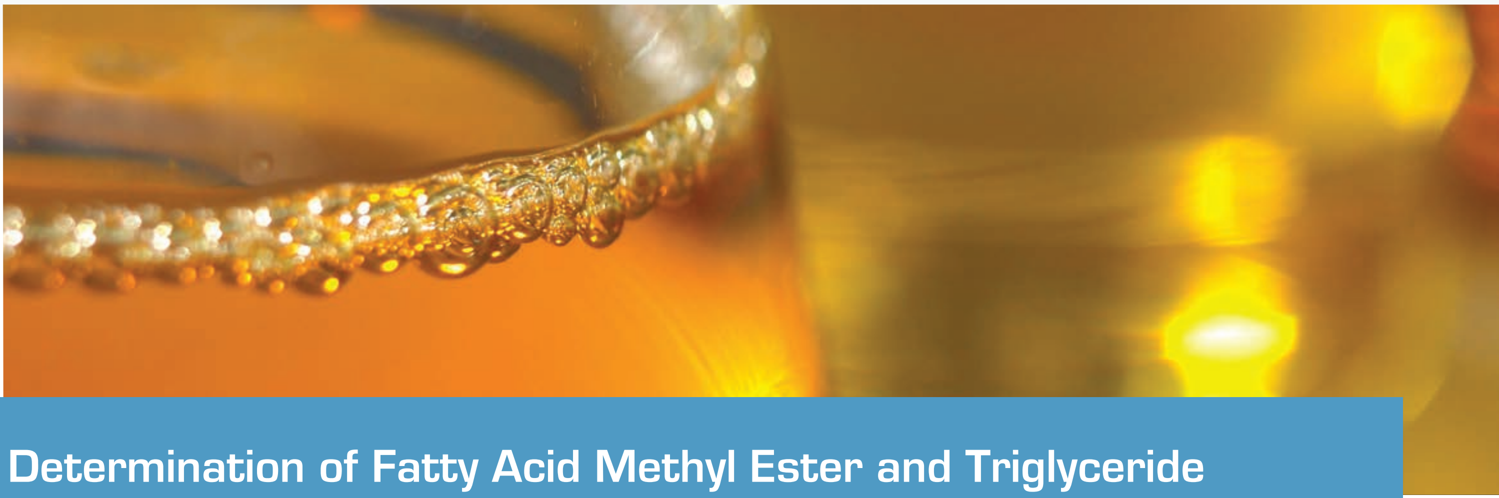
Application Note



Determination of Fatty Acid Methyl Ester and Triglyceride in Mixture of Biodiesel Fuel and Diesel Fuel

Introduction

Diesel fuel is made from petroleum, a natural resource. The combustion of diesel oil produces carbon dioxide which is considered to be one of the causes of global warming.

Plant oils, however, are produced by photosynthesis in which atmospheric carbon dioxide is consumed. Biodiesel is made from vegetable oil produced from various plant materials into fatty acid methyl esters (FAME) by trans-esterification of the triglycerides contained in the vegetable oils. Therefore, carbon dioxide exhausted from the combustion of biodiesel in a diesel engine is reabsorbed by plants through photosynthesis, offsetting the amount of carbon dioxide consumed by the plant material: this is called carbon neutrality. As a result, determination of fatty acid methyl esters and triglycerides in fuel is now of increased interest.

In Japan, the measurement method for determination of fatty acid methyl esters and triglycerides was promulgated in Official Gazette No.78 of the Ministry of Economy, Trade and Industry, issued on the 22nd of March, 2007. JASCO has determined the fatty acid methyl esters and triglycerides content in diesel fuel mixed with biodiesel in accordance with this standard method.

Jasco LC 2000 Plus Series

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Experimental

JASCO HPLC 2000 series modular components were used for this measurement. The system consists of a PU-2080 pump, a DG-2080-53 degasser, a CO-2060 column oven, an AS-2057 autosampler, a RI-2031 refractive index detector, and the ChromNAV chromatography data station software.

The stock solution was prepared by dissolving 5.0 g of methyl stearate and 0.05 g of trilinolein in diesel oil to make up a volume of 50 mL. The standard solutions were then prepared by diluting the stock solution with diesel fuel.

Results and Discussion

Figure 1 is a chromatogram obtained by injecting 5 µL of the 10X diluted stock solution. Resolution between the methyl stearate (peak 2) and trilinolein (peak 3) was calculated to be 5.7, whereas the Official Gazette's requirement for the resolution is 3.0, well exceeding the established criteria.

In order to examine the quantitative precision, 5 µL of the stock solution and the standard solutions with various concentrations were injected and the obtained peak areas were plotted against the concentrations of the standard solutions. Results showed that the coefficients of correlation for methyl stearate was r^2=1.0000 in the range of 1-100 mg/mL and for trilinolein was r^2=0.9999 in the range of 0.01-1 mg/mL, respectively.

Figure 2 demonstrates the chromatogram obtained by injecting 5 µL of a mixture of biodiesel and diesel fuel (5/95). Peak 2, corresponding to fatty acid methyl esters, was quantified to be 48.99 mg/mL in terms of methyl stearate. No peak corresponding to triglycerides was observed. These results meet the Official Gazette's requirements for the contents of fatty acid methyl esters and triglycerides: less than 5.0% (w/v) and less than 0.01% (w/v), respectively.

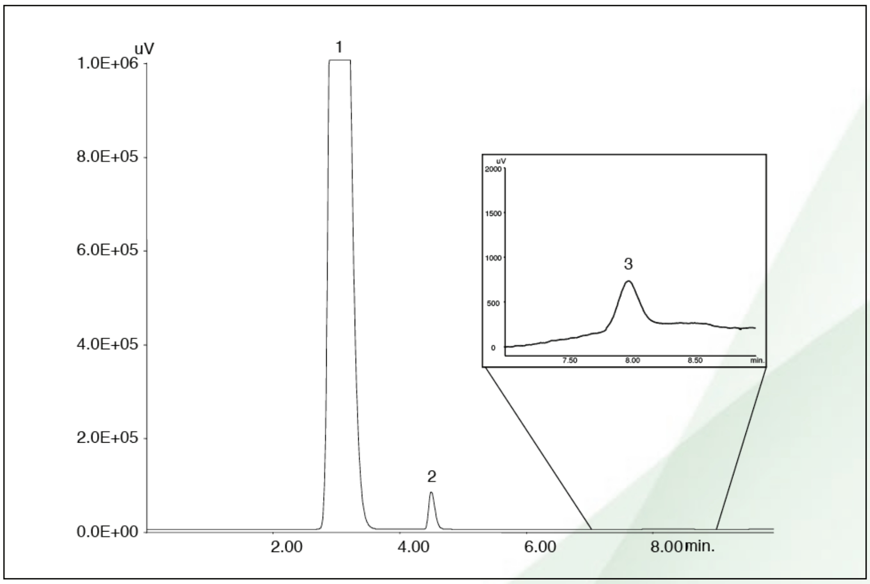

Figure 1: Chromatogram of standard mixture
Peaks: 1 = diesel oil; 2 = methyl stearate(10 mg/mL) ; 3 = trilinolein(0.1 mg/mL) Conditions: column = Finepak SIL-5 (4.6 mm x 250 mm); mobile phase = 2-propanol/n-hexane(0.4/99.6); flow rate = 1.0 mL/min; column temperature = 40°C; injection volume = 5 µL

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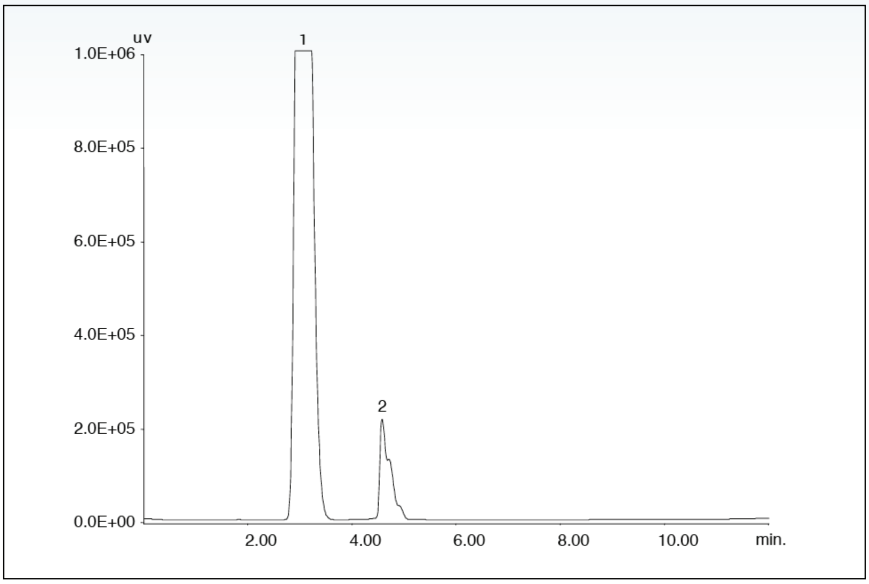

Figure 2: Chromatogram of a mixture of biodiesel and diesel fuel (5/95)
Peaks: 1 = diesel fuel; 2 = fatty acid methyl esters.
The chromatographic conditions are the same as in Figure 1.

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