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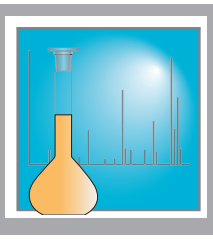

Highlights of Analytical Chemistry in Switzerland

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What Damage Can Biodiesel Cause in Jet Fuel?

Vladimir Purghart* and Hans Jäckle

*Correspondence: Dr. V. Purghart, Intertek Caleb Brett (Schweiz) AG, Wagistrasse 2, CH-8952 Schlieren, Tel.: +41 43 433 78 10, Fax: +41 43 433 78 19, E-mail: schlieren@intertek.com

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The term 'bio' has became very popular in the past years. It is often associated with ecological and environmental benefits. There is not only 'bio'-food but also 'bio'-fuel. A lot of car drivers think they are doing something good for the environment by using 'bio'-diesel fuel. Biodiesel in Europe is mostly prepared from rape, palm or soy oil. In the process of biodiesel production, the glyceride bonds are broken and methyl esters of the long chain fatty acids are formed (known as FAME = fatty acid methyl ester). Of course, FAME can be used instead of conventional diesel in diesel engines, but it has some different physical properties. The major differences are storage stability and cloudiness at lower temperatures. The latter phenomenon causes problems if jet fuel (Jet A-1) is contaminated by FAME. Even minor contamination at ppm levels could cause a jet turbine to fail. Therefore, the FAME content in jet fuel must not exceed 5 ppm. Such contaminations can be caused *e.g.* by transportation.

Air plane taking off (Copyright Roland Graf, cloning.ch)

Table 1. Selected fatty acid methyl esters for the quantification in Jet A-1

Species to be detected	Significant SIM masses [Da]	Expected retention time [min]
Methyl-palmitate C16:0	227, 239, 270, 271	24.9–26.4
Methyl-margarate C17:0	241, 253, 284	30.1–31.4
Methyl-stearate C18:0	255, 267, 298	34.7–35.5
Methyl-oleate C18:1	264, 265, 296	35.5–36.5
Methyl-linoleate C18:2	262, 263, 264, 294, 295	37.7–38.6
Methyl-linolenate C18:3	236, 263, 292, 293	40.3–41.1

A GC-MS test method was developed by the Institute of Petroleum (IP PM-DY/09) to monitor methyl esters of the most representative fatty acids present in biodiesel derived from the above-mentioned oils (a summary is given in Table 1). To obtain a sensitive GC-MS method, the SIM-mode (selected ion monitoring) was used (see 'Significant SIM masses' in the Table). The advantage of measurement in SIM mode is that the signals of any other non-relevant compounds in the chromatogram are suppressed or even eliminated. The Figures show a chromatogram of a standard solution containing 2 ppm of each fatty acid as well as a chromatogram of a real jet fuel. This sample contains a total amount of 5 ppm FAME.

This quality control process of jet fuel is important for air traffic security.

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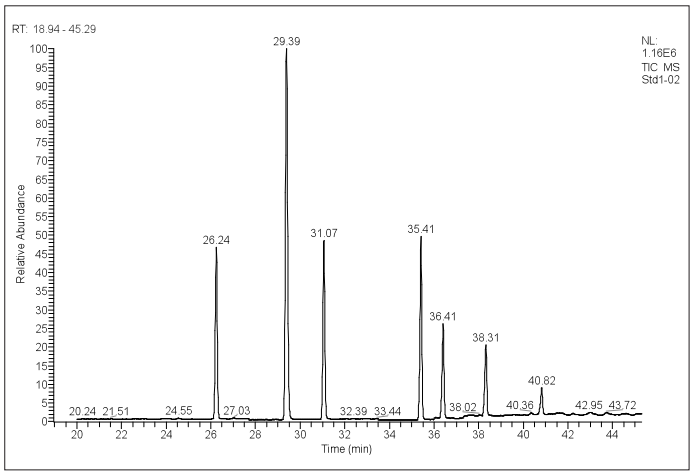
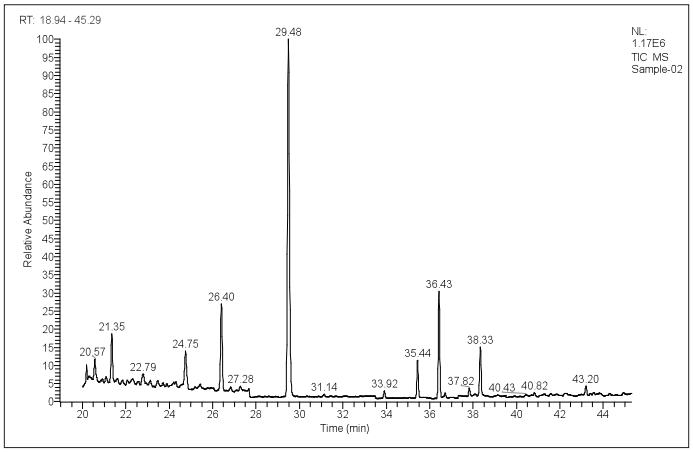


Standard solution containing 2 ppm of each fatty acid methyl ester (compare with the data given in the Table). The signal at 29.39 minutes is the internal standard (d33 - methyl-margarate)



Real Jet A-1 sample showing a total amount of 5 ppm FAME. The signal at 29.48 minutes is the internal standard (d33 - methyl-margarate)

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Please contact: Dr. Veronika R. Meyer, EMPA St.Gallen, Lerchenfeldstrasse 5, 9014 St.Gallen
Phone: 071 274 77 87, Fax: 071 274 77 88, Mail to: veronika.meyer@empa.ch