

Sheet No.

AQF-2100V PE-055E Energy

Analysis of Fluorine and Chlorine in Jet Fuel by Vertical Combustion Ion Chromatography

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Model: AQF-2100V system
Detection method: Ion chromatography
Applicable standards: ASTM D7566, ASTM D1655

Airlines are increasingly working to blend sustainable aviation fuel (SAF) into conventional jet fuel. The production process for SAF differs from that for conventional fuels, making halogen measurement important when monitoring manufacturing processes. The ASTM D7566 quality standard for synthetic fuels including SAF stipulates a maximum halogen concentration of 1 mg/kg. However, ASTM D1655, the existing jet fuel standard, does not include evaluation of halogen concentration. This sheet describes the fluorine and chlorine analyses performed for Jet A-1 fuel (with and without desulfurization) and Jet B fuel used in blended SAF, using a vertical combustion ion chromatography (C-IC) system that combines the AQF-2100V automatic sample combustion unit with a sensitive ion chromatograph. The vertical C-IC system is capable of rapidly and accurately measuring fluorine and chlorine concentrations in liquid samples, as well as concentrations of bromine, iodine, and sulfur. This study demonstrates that chlorine and fluorine can be measured with high sensitivity, unaffected by high sulfur concentrations.

Analysis Method

- Vertical combustion ion chromatography

The sample is thermally decomposed in argon (Ar) carrier gas before being combusted in oxygen (O₂) gas. The halogens in the sample are converted into hydrogen halides and halogen gases; sulfur is converted into SO_x. These components are collected in an absorption solution and converted into halide ions or sulfate ions. This absorption solution is automatically injected into the ion chromatograph for analysis. Since concentrations of fluorine and chlorine in jet fuel can be as low as parts per billion, analysis is performed using a multiple combustion method wherein the sample is injected five times.

Analysis flow

[Sample collection] → [Combustion] → [Combustion gas collection] → [Ion chromatography]

Sample

- Jet fuel (Jet A-1, Jet B)

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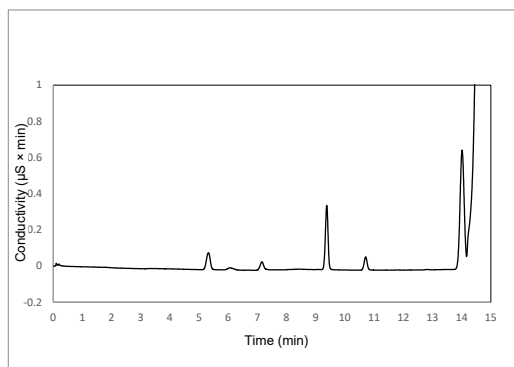
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Analysis Results

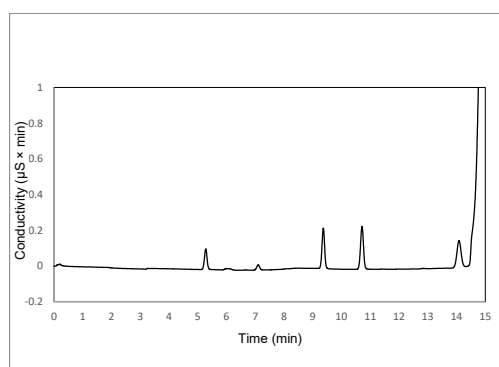
Sample	Measurement (n=3)	Concentration (mg/kg)	
		F	Cl
Jet A-1-1	Average	0.004	0.029
(without desulfurization)	RSD (%)	17.5	4.7
Jet A-1-2	Average	0.004	0.069
(with desulfurization)	RSD (%)	8.7	3.8
Jet A-1-3	Average	0.003	0.018
(with desulfurization)	RSD (%)	9.3	6.1
Jet B	Average	0.008	0.025
	RSD (%)	11.2	7.7

• Chromatograms

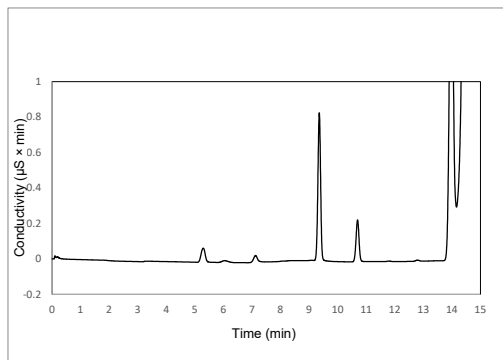
Jet A-1-1



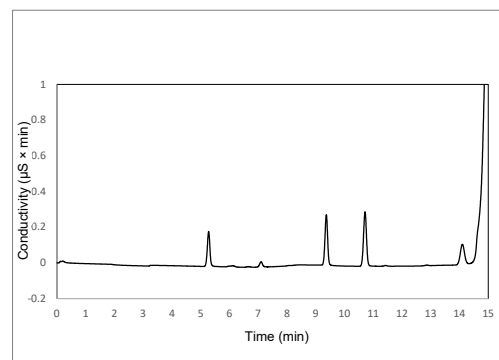
Jet A-1-3



Jet A-1-2



Jet B



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Apparatus and Analysis Conditions

- AQF-2100V automatic sample combustion unit
 - VF-210 vertical electric furnace
 - Decomposition temperature (Inlet) 900 °C
 - Decomposition temperature (Outlet) 1,000 °C
 - Ar flow rate 100 mL/min
 - O₂ flow rate 500 mL/min
 - ASC-250L liquid sample changer
 - Syringe size 250 µL
 - Vial tray 4 mL
 - Number of combustions 5 times
 - Total injection volume 1,250 µL
 - Sample aspiration speed 25 µL/s
 - Wait time after aspiration: 2 s
 - Combustion operation time Approx. 33 mins per cycle
 - Injection speed 1.2 µL/s
 - Wait time after injection 2 s
- GA-210 combustion gas absorption unit
 - Absorption tube size 10 mL
 - Absorption solution volume 5 mL
 - Absorption solution composition Ultrapure water
 - Measurement mode Constant volume method (fixed volume: 10.3 mL)
 - Liquid level sensor position Low
 - Sample loop 1,000 µL
- Thermo Fisher Scientific Inc. Dionex™ Integriion™ Ion Chromatograph

* This sheet is provided for reference purposes only and does not guarantee analysis values. Optimal conditions may vary depending on external factors such as the analytical environment and sample characteristics.

* Measured values may vary depending on the maintenance and condition of the combustion unit and ion chromatograph. Particularly for samples with concentrations below 1 ppm, blank control and chromatogram signal processing are extremely important.

* Handling of chemicals: Check chemical labels and safety data sheets, and take great care when handling chemicals.