SetaAnalytics Technical Applications Note For IP 436 & ASTM 6379 Test Method for Aromatic Content of Jet Fuel

Background and Need

In the early 1990's the international aviation community via the UK Aviation Fuels Committee requested the Energy Institute to look into an improved more precise and less subjective test measurement technology to replace the "FIA" to give volume percent limit on the aromatics content (mono/di and total aromatics). Following Oil industry discussion, it was agreed to review the use of the HPLC IP 391 method for diesel as a potentially robust analytical method that could cover the range of aromatics found in jet fuel, and not suffer from interferences from jet fuel additives. Another major factor was that the test method would be suitable to run in test house laboratories but also in refinery laboratories.

Implementation of these volume percent aromatic limits, which is currently set at a level 11% max by wt and is referenced as a note to the main specification for Jet A-1 in the UK DEF STAN 91-91. It is expected that over the coming years the FIA method in the spec for Jet A-1 will be totally replaced by the more convenient and more accurate HPLC IP 436 method.

Note: The amount of Total aromatics is sometimes referred to as PAH (**P**oly **A**romatics **H**ydrocarbon).

The measurement of mono and di aromatics is mandated on all jet fuels refined or traded as Jet A-1. The Jet A-1 specification is generally the recognised as the International Jet spec for must countries other than N America.

The Fuels

There are a number of different Jet distillate fuels, that contain poly aromatic components, and these fuels for military use, of which there are, as well as Jet A-1.

In the case of Jet A and Jet B the wide cut fuel, the current US spec ASTM D1655 does not specify the HPLC method but the ASTM do recognise the method for Jet fuel and it is cited as ASTM 6379.

In the case where the Jet fuel is from an unknown supply source, it should still be accompanied by a certificate of quality by a lab which is certified to test and release Jet fuel to DEF STAN 91-91 or ASTM D1665 or both. If the HPLC test method has been used to release the Jet fuel, a note must be written to indicate that the HPLC method IP 436 has been run instead of the historic IP or ASTM FIA method.

The Separation & Measurement Instrumentation

The HPLC system comprises of 5 critical parts to enable quality values to be obtained.

1. ***Mobile Phase Degasser system***
2. ***Injection Valve***
3. ***Separation Column***
4. ***RI Detector***
5. ***Integrator***

1. Degasser System

The mobile phase degasser is a very useful tool to ensure the mobile phase system is free of any dissolved air, which can lead to operability problems when the mobile phase pumped on pressure through the pre-packed column system. This can lead to poor separation and may also affect the detection of the aromatic components.

2. Injection Valve
This highly engineered unit allows via the sample loop the delivery and insertion of the sample dissolved in a diluent, to be carried on down into the separation column as one discrete aliquot.

3. Separation Column
This is the most crucial part of the separation system, and the quality of the absorbent material, in terms of chemical derivatisation, particle size and distribution have a major impact on the separation efficiency, the component resolution and the repeatability of the separation. As well as the reproducibility of the column performance for inter lab comparisons. Besides these critical areas, the longevity of the column is also determined by the quality of the packing material and the mechanical functionality of the columns construction.

4. RI Detector
The sensitivity and base line stability of both the measurement source and the detector are very important to ensure good repeatable measurements at the lower levels that are to be determined.

5. Integrator
This is the final component of the system that enables the analyst to use either automatic or manual chromatographic determinations of the component peaks are they exit the column and are detected via the Refractive Index measurement. Not only does this system if set up correctly allow effective, repeatable measurements to be made, but will all automatic concentrations to be determined, if programmed with a suitable calibration data set for the components under evaluation. Also the system will provide an archiving capability to allow traceability (required to meet Jet A-1 release requirements) plus can be connected to a Laboratory Information Management System (LIMS).

An example of typical separations is shown in the following example for a Jet A-1 meeting UK MOD/CAA DEF STAN 91-91 specification.