Determination of Aromatic Hydrocarbon Types in Middle Distillates

- Time-tested, dependable, and robust workhorse for your HPLC separations
- Integrated solvent and sample management with consistent system-to-system performance and high reproducibility
- Support for highly accurate analysis of middle distillates and other matrices
- ASTM D6379 and ASTM D6591

The definition of aromatics within the context of diesel fuel has caused problems, both within the oil industry, for the analysts who test and quantify them, and outside the industry, for those who need to interpret the data. Aromatics are chemically defined as the class of compounds derived from benzene (C6H6) which contain a closed ring of six carbon atoms. The term aromatic also applies to other ring compounds, often containing heteroatoms, which have a fully-conjugated double bond system. Aromatic compounds may also have more than one ring in their structure and may have aliphatic chains or rings attached to one or more of the basic rings[1].

Quantification of the aromatic content of hydrocarbon fuels is crucial to assess their combustion characteristics, compliance with environmental regulations and to ensure that the finished fuel products are safe. Fuel properties influence equipment performance and pollutant emissions characteristics in a combustion process. It has been well recognized that some of the structural characteristics of fuel components such as aromatic hydrocarbons in the petroleum fractions significantly affect the combustion process in different engines. The aromatics tend to create a smoky flame and they will also release a greater proportion of undesired thermal radiation. Most of the aromatic hydrocarbons especially polycyclic aromatic hydrocarbons are toxic, carcinogenic, and mutagenic compounds that disrupt the endocrine system. They can cause damage to humans by the generation of reactive oxygen species (ROS) in the body. Oxidative stress is a process that occurs through free radicals at the cell membrane and leads to cell membrane damage and peroxidation, eventually causing cell dysfunction. Due to limits on total aromatics content and polynuclear aromatic hydrocarbon content of motor diesel fuel by environmental regulation agencies, it is required to show compliance with appropriate analytical determination.

Aromatic Hydrocarbon Analyser is a dedicated system based on high-performance liquid chromatography (HPLC) to determine aromatic hydrocarbon types including monoaromatic, di-aromatic, and polyaromatic hydrocarbon contents in kerosene, diesel fuels and petroleum distillates boiling in the range from 150 to 400 °C. The total aromatic content in % m/m is

[1] Concawe report no. 94/58

calculated from the sum of the individual aromatic hydrocarbon types. This system uses normal phase liquid chromatography method in heptane mobile phase that separate and quantitate aromatics from fuel samples by refractive index detection. The method that is used by this analyser is calibrated for distillates containing from 4 to 40 % (m/m) mono-aromatic hydrocarbons, 0 to 20 % (m/m) di-aromatic hydrocarbons, 0 to 6 % (m/m) polycyclic aromatic hydrocarbons, and 4 to 65 % (m/m) total aromatic hydrocarbons.

Results:

After set the instrument parameters and equilibrate the system, the sample and standard were injected to the column and switch the back flushing valve at 8 min after injection. Fig.1 shows the chromatogram of NA (None Aromatic), MAH, DAH and TRI+ (mono-, di-, and tri-plus aromatic hydrocarbon) compounds and table 1 demonstrate the chromatogram results.

Table 1 Results of NA, MAH, DAH and TRI+ chromatogram

Component	Area	Height	Concentration	Units
None Aromatic	493.525	87.513	0.5	%w/v
MAH	1118.213	91.324	0.25	%w/v
DAH	1888.224	148.564	0.25	%w/v
TRI+	238.387	17.847	0.05	%w/v

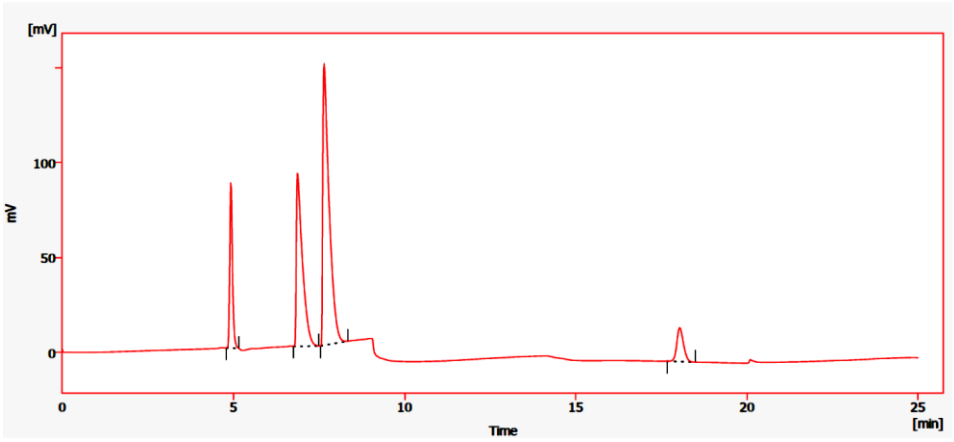

Fig.1 Chromatogram of NA, MAH, DAH and TRI+