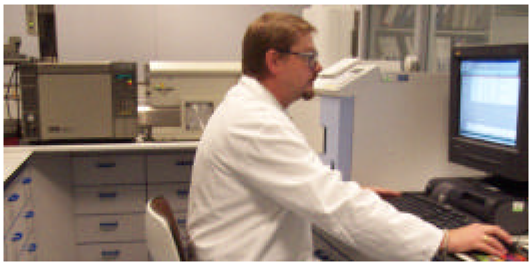
Analysis by Mass Spectroscopy (MS)

Mass Spectrometry (MS) is one of the most powerful analytical techniques available; its unequalled sensitivity and detection limits result in diverse applications, especially in combination with gas chromatography (GC) and liquid chromatography (LC).

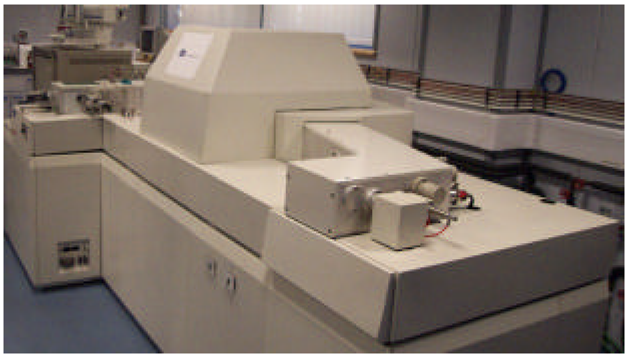
Intertek's Technology Centres in Sunbury and the Northwest house two quadrupole GC-MS instruments and 2 high-resolution magnetic sector mass spectrometers, covering the following ionization modes:



- Electron impact (EI)
- Chemical ionization (CI)
- Field ionization (FI)
- Field desorption (FD)
- Fast atom bombardment (FAB)

Our specialist chemists have a high level of expertise working with a wide range of products including petroleum, chemicals, household and personal care products, deposits, additives and water.

The instrumentation available can characterise and identify components and contaminants at trace levels. Specialist separations are performed when the components of interest need to be isolated from the bulk product. Our chemists are continually developing new methods to meet our customers' needs.



Some of the areas that can be investigated using Mass Spectrometry include:

- Identification/Determination of contaminants in liquids, solids and deposits
- Identification of water leach-able organic substances in water intended for human consumption according to *BS6920-4:2001*
- Expert support to legal cases by providing independent analysis, legal witnesses in the analysis of petroleum, petrochemicals and chemicals
- Qualitative and quantitative examination of hydrocarbons in petroleum based samples, e.g. kerosene, gas oil and diesel by modified ASTM matrix methods (e.g. 12x12)
- Direct analysis of volatiles by headspace and thermal desorption GC-MS
- Analysis of hydrocarbons and other materials by FI/FD MS and GCFIMS

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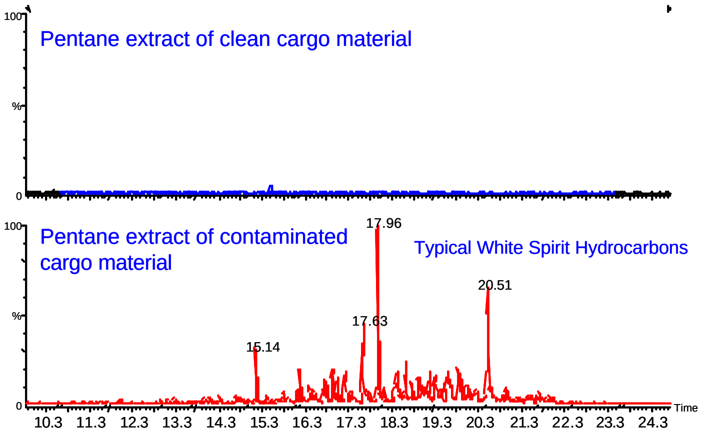
Case Study 1: Contaminated Cargo

A cargo was suspected of being contaminated by a previous consignment of white spirit.

Two different GC-MS techniques were employed to determine the volatile and non-volatile composition. The results indicated that the sample was indeed contaminated with white spirit but at levels of less than 1%.

Figure 1 shows the comparison of extracts from a clean sample of the cargo and the contaminated sample, where the lower chromatogram shows a typical hydrocarbon distribution for white spirit.



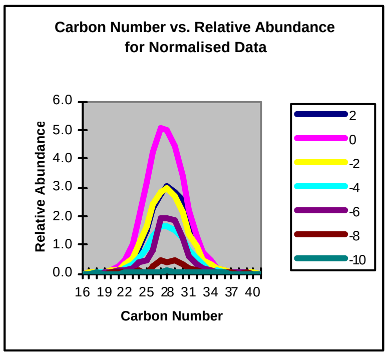
Case Study 2: Spanish oil slick

Following the sinking of the mv Prestige and the ensuing environmental disaster our chemists analysed a sample taken from a Spanish beach to determine the levels of harmful polyaromatic hydrocarbons to provide valuable information to the customer in predicting the environmental impact.

The bulk sample was treated to isolate the components of interest before GC-MS analysis. The testing was performed with witnesses and filmed for use in a national TV News broadcast.

Case Study 3: Analysis of saturated hydrocarbons in lubricating oil

Detailed information can be obtained on carbon number/cyclic ring distribution in hydrocarbon fractions by Field Ionisation Mass Spectrometry (FIMS). Since composition relates to physical properties knowledge of the hydrocarbon type distributions can be useful.



For lubricating oils, FIMS produces data from which the carbon number verses the Z number distribution is derived, where the Z number is a measure of the acyclic and cyclic structures in the sample (Z= 2 represents acyclic hydrocarbons, linear and branched, Z= 0 represents monocyclic hydrocarbons, e.g. alkyl cyclohexanes, etc.).

The figure shows a graphic representation of the distribution from a saturated hydrocarbon oil fraction, typical of lubricating oil. This data shows that alkyl monocyclic hydrocarbons (e.g. alkyl cyclohexanes) are the most abundant species over a carbon number range C_{16} to C_{40} and the distribution centred around C_{27-28}.

Lighter hydrocarbon fractions can also be analysed by combining with separation by gas chromatography (GCFIMS), when information can also be obtained on distribution of the normal and branched acyclic hydrocarbons, in addition to ring structures.

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