

HYDROCARBONS - DEFINITIONS & EXPLANATION

1. PETROLEUM HYDROCARBONS - APPROPRIATE METHOD SELECTION AND INTERPRETATION

Petroleum or fuel analyses seems to consist of a mass of acronyms. The following is intended as a brief guide to selection of the appropriate testing procedures.

Petroleum hydrocarbons are a large group of varied compounds. The compounds can be classified by number of carbon molecules and arrangement. The more carbons in a given compound, the less volatile, or higher the boiling point.

Table 1: Example of some materials and their carbon content

	NUMBER OF CARBON MOLECULES					
	C1	C10	C20	C30	C40	C50
Gasoline		----				
#2 Diesel		-----				
Jet fuel/Kerosene		-----				
Waste Oil			-----			
#6 oil		-----				

Petroleum testing is largely method dependent - HOW YOU MEASURE DETERMINES WHAT YOU FIND

Analysis of these compounds depends on two factors:

How they were extracted, and

How they were measured and identified.

To decide which method of analysis is chosen, consider:

- a) If the suspected material is heavy fuel, lubricating oil or similar product, choose TOTAL OIL AND GREASE. The method is not specific but the cost is low and the method will include some very heavy, complex fuels that other methods may miss.
- b) If presence of non-fuel type oils involved (e.g. animal fat) that should be separated from petroleum products, CHOOSE MINERAL OIL & GREASE.

TOTAL & MINERAL oil and grease do not yield information about the specific compounds found, only their presence.

For SPECIFIC REGULATORY REQUIREMENTS, OR when you have to know the specific compound.

If specific regulations are to be met, (e.g. VH, VPH, LEPH/HEPH) the method will be mandated by the regulator. These methods normally require the use of GAS CHROMATOGRAPHY. Once extracted, the material is injected into a column and separated by boiling point, chemical affinity to the column and mass (if GC/MS) is used. For method descriptions, see below.

Unfortunately, it is very difficult to separate all the compounds involved in one analysis. Consequently, the very light, volatile compounds (few carbons, usually 4-10) are determined separately from the medium and heavy compounds. Heavy, non volatile compounds that are the result of partial combustion of fuels are also to be determined separately, and the values are subtracted from the middle - weight compounds. This is done for regulatory purposes since these compounds are especially nasty, and their permissible levels are dictated as a separate item.

2. METHODS

a) Total Oil and Grease

The material of interest is extracted with n-Hexane. The solvent, Hexane is boiled off and the residue is weighed.

WHAT IS BEING MEASURED?

The test should be called N-Hexane extractable hydrocarbons. The test detects hydrocarbons that are relative non volatile (boiling point greater than 85C), vegetable oils, animal fat, waxes soaps, greases and related material. Some heavy oils (nC50 or more- 50 carbons) may also be detected.

WHAT IS NOT MEASURED ?

Volatile materials such as gasoline to fuel #2 will NOT BE detected by this method. Some crude oils and heavy fuel oils are not soluble in hexane. These compounds will not be accounted for in this analysis.

1.2 MINERAL OIL & GREASE (also called TOTAL PETROLEUM HYDROCARBONS)

The material of interest is extracted with n-Hexane. Silica gel is used to remove non-target compounds (e.g. fatty acids). The silica gel is removed, leaving aliphatic (straight chain) compounds to be measured. The solvent, Hexane is boiled off and the residue is weighed.

WHAT IS BEING MEASURED ?

This method is a subset of the total oil and grease, having removed some components such as fatty-acids. The measured material consists of aliphatic petroleum hydrocarbons but also any other product extracted with hexane but NOT adsorbed on silica gel. The method will measure heavier fuels (#3- 6), hydraulic oils, mineral/dielectric fluids IT WILL NOT detect jet fuel JP4 and JP8, kerosene or Jet A.

2. VOLATILE (VPH) AND EXTRACTABLE PETROLEUM HYDROCARBONS (TEH=LEPH, HEPH)

2.1 VPH/LEPH/HEPH

WHAT IS MEASURED?

Hydrocarbons (mixture of compounds) calculated as the total measured minus various non-applicable fractions. The compounds are grouped according to the number of carbon molecules in the chain. Chain length is directly related to boiling point, and the mean boiling point is used to separate them.

VPH: volatiles, with 6-10 carbons, including gasoline, paint thinners, mineral spirits are volatile.

LEPH: light extractable hydrocarbons contain 10-19 carbons and

HEPH: heavy extractable hydrocarbons CONTAINING 20-32 CARBONS constitute TEH or

TOTAL EXTRACTABLE HYDROCARBONS: These include most diesels, lubricating oils, greases, waxes, hydraulic oils. Some products (e.g. kerosene, jet fuels, weathered gasoline) contain both volatile and semi- volatile products.

WHAT IS NOT MEASURED?

Depending on the extraction method, some very light compounds may be lost prior to analysis. Very heavy compounds with many carbons (more than 40) will likely NOT be found. Heavy lubricating oil and some crude oils are examples of compounds that would not be normally found in a TEH analysis.

PAHs, a group of heavy (non volatile) toxic compounds, which partially fall in the HEPH are specifically removed from the total calculations because they are very toxic and therefore regulated as a separate category.

The large number of compounds involved in petroleum products dictates that these analyses will never be as accurate as the total of the individual compounds.

SOME COMMONLY USED ACRONYMS:

DRO	diesel range organics (APPROX = HEPH)
EPA 1664	gravimetric method for hexane extractable material
EPH	extractable petroleum hydrocarbons
GRO	gasoline range (APPROX = LEPH)
HEM	n-Hexane extractable material
MAH	monocyclic aromatic hydrocarbons i.e BTEX, STYRENE
Oil & Grease	solvent (usually hexane) defined extractable material
PHC	petroleum hydrocarbons in soil
SGT-HEM	silica gel treated n-hexane extractable material
TEH	total extractable hydrocarbons
TPH	total petroleum hydrocarbons
VPH	volatile petroleum hydrocarbons, nC10-nC32 most diesel
VH + EPH	kerosene, jet fuel, weathered gasoline
VHw	volatile hydrocarbons in water nC6-nC10
VPH	volatile petroleum hydrocarbons
nC6-nC10	unweathered gasoline, mineral spirits, paint thinners

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