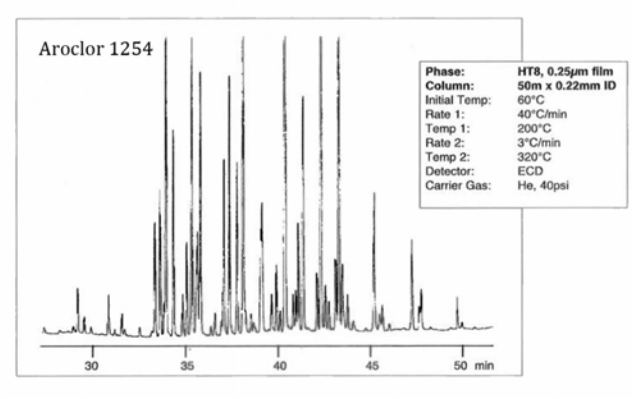
Polychlorinated Biphenyl Analysis

Polychlorinated biphenyls (PCBs) are part of a family of organic chemicals known as chlorinated hydrocarbons that have been synthetically produced by combining one or more chlorine atoms and a biphenyl molecule. It has been determined that PCBs are hazardous when they come in contact with human skin, and can cause a painful, disfiguring skin condition called chlorance, eye irritation, bronchitis, nausea, dizziness, and even liver damage. As a result, the production and use of PCBs are severely limited. One of the major applications of PCBs is to act as a fire retardant in transformer oils. Since the early 1980's, their detection, removal and destruction has be a major focus for the Environmental Protection Agency (EPA).

Traditional Analysis

The EPA approved analytical method is by Gas Chromatography (GC). Since PCBs are truly a complex mixture of many different isomers, the resulting chromatogram is quite complex. Due to the high molecular weight of these materials, the column must be run at quite a high temperature for quite a long time. These analytical challenges are clearly illustrated in a typical chromatogram of Aroclor 1254 (the trade name for a typical PCB that is approximately 54% of the chlorine by weight.)



In actual practice, the PCBs must be detected in transformer oil inside transformers that have been returned to maintenance facilities which are prepared to rebuild the transformer. The first step in this process is to drain the oil and to test for possible reuse later. One of the key criteria is the level of PCBs present in the oil. With many transformers requiring work at the same time, a quick, easy and reliable test was required. One hour per analysis on a GC was considered acceptable.

As a result, the EPA commissioned the Electric Power Research Institute (EPRI) to find an alternative quick screening tool. The GC method remains the preferred (referee) method, but the screening instrument would provide acceptable (go, no go) type of data. The screening method approved by EPRI was Energy Dispersive X-ray Fluorescence (EDXRF) with the HORIBA MESA-200. For more than 25 years, this analytical instrument has been successfully used to perform this screening function.

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Newer Technology

This technology is now quite old and required upgrading and replacement. The MESA-200 has now been superseded by the new MESA-6000. Using the tried-and-true EDXRF technology, it provides PCB detection down to very low PPM levels, plus quantification of the sulfur levels also present in the transformer oil. Typical data for new transformer oil can be seen below:

Sulfur in Oil

Serial Number: 420003
Calibration Name: 0-50 ppm mo-01_20_2003 01_26_04
Sample Name: transformer oil
Date/Time: 02/17/2003 06:27:48
Notes: 0 50 ppm
Measurement Time: 180 sec
Repeats: 3

Element	S (ppm)
Average:	32.3
Stdev:	0.5
Trend:	0.2
Test 1	32.5
Test 2	31.6
Test 3	32.8

Chlorine

Serial Number: 420003
Calibration Name: 0-25 ppm Chlorine x 2-03_24_2010 08_38_31
Sample Name: transformer oil
Date/Time: 02/17/2003 08:38:29
Notes: 0 -50 ppm chlorine
Measurement Time: 200 sec
Repeats: 3

Element	Cl (ppm)	Aroclor equiv. (ppm)
Average:	0.0	0.0
Stdev:	0.0	0.0
Trend:	0.0	0.0
Test 1	0.0	0.0
Test 2	0.0	0.0
Test 3	0.0	0.0

Thus, two analytical results come from one very rapid analysis that can easily be performed by a plant operator.

The speed, cost per analysis, the non-destructive nature of the test and the regulatory acceptance of the data makes it the perfect analyzer for this application.

For more information on **MESA 6000**, please visit: www.horiba.com/us/oil.

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