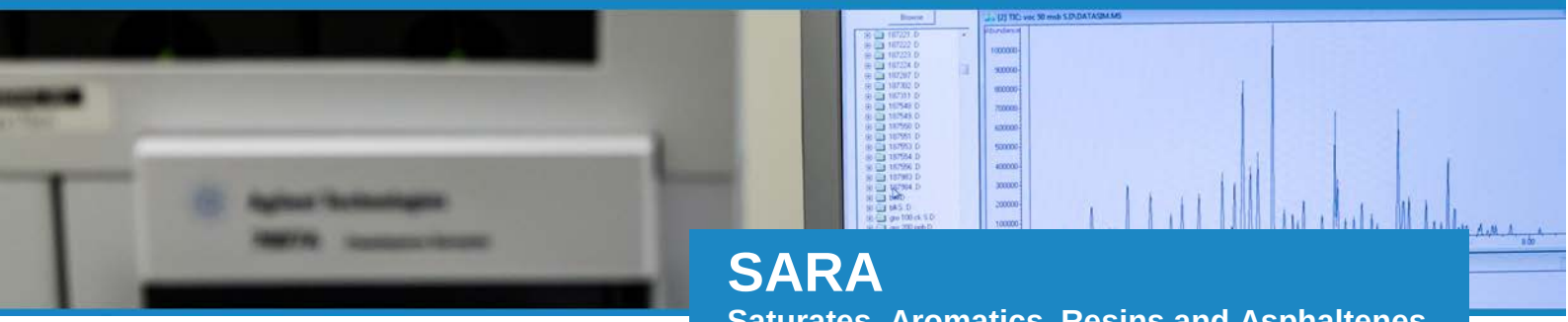


SARA

Saturates, Aromatics, Resins and Asphaltenes

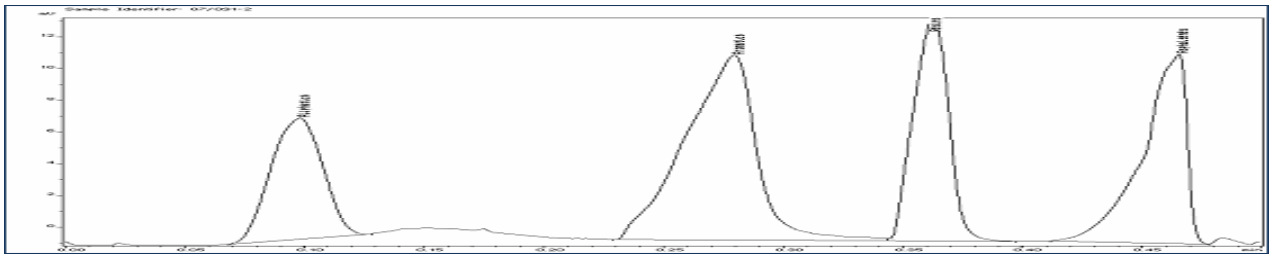
A technique finding increasing application in the characterization of weathered hydrocarbon wastes and tarry material is Iatroscantm Thin Layer Chromatography with Flame Ionization Detection (TLC-FID).

By facilitating the rapid component class fingerprinting of a wide variety of solvent extractable hydrocarbons from soils and products from petroleum or coal tar contaminated sites, TLC-FID allows waste extracts or products to be classified according to their composition.

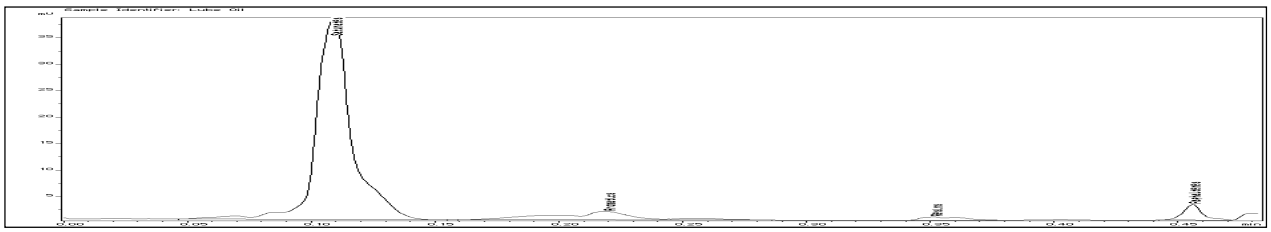
TLC–FID is particularly useful in separating maltenes and asphaltenes in bitumen and asphalt and NSO compounds in coal tar. Other chromatographic techniques do not detect these compounds as they are retained on the chromatographic column or in the case of the TPHCWG approach where they are physically removed prior to analysis.

The TLC-FID method is based upon polarity and affinity chromatography. The soil extract or product is dissolved in a non-polar solvent and injected onto silica rods. The non-polar species have more affinity for the solvent and move up the rod by capillary action. The rods are placed in a bath containing a polar solvent and the aromatic species, which have more affinity for this solvent than the silica, move up the rods. This process is continued until the resins (NSOs) and asphaltenes are separated. The rods are then placed on a FID scanner to quantify the chromatography. The separation of the class components into the following fractions provide a bulk composition of the material tested.

- **Saturates** - aliphatic compounds
- **Aromatics** - includes mono-aromatics and polycyclic aromatics
- **Resins** - heterocyclic (NSO) compounds such as acids, bases, phenolics, naturally occurring compounds (humic acids)
- **Asphaltenes** - high molecular weight complex matrix



Typical SARA chromatogram of bitumen



Typical SARA chromatogram of fresh lube oil

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