



Biomarker Analysis

Biomarkers are naturally occurring, ubiquitous and stable hydrocarbons that occur in crude oils and most petroleum products. Biomarkers are sometimes called “molecular fossils” as they retain all or most of the original carbon skeleton derived from once-living organisms. Biomarkers’ specificity, diversity complexity and relative resistance to microbial attack (degradation) therefore make them extremely useful ‘markers’ in the characterisation and differentiation of spilled oils and candidate source oils. The profile and distribution pattern of biomarkers generally differs between oils derived from different sources.

Most knowledge of biomarkers and their diagnostic ratios comes from oil geochemistry and a wide variety of biomarkers have been identified as being of use in the characterisation of crude oils and oil fractions. However, although a wide range of biomarkers can be used for correlation, those most appropriate to environmental forensics are hopanes (m/z191), triaromatic steranes (m/z231) and sesquiterpanes (m/z123). The isoprenoids, pristane and phytane, can also be used as biomarkers for correlation purposes, however, since their ratio can be affected by many factors it should not be considered as a major correlation parameter.

Hopanes – m/z191

Hopanes are nC₂₇ - nC₃₅ pentacyclic alkanes which dominate the triterpanes found in ancient sediments and crude oils. They are generally derived from bacteria and can be used for ‘oil to oil’ and/or ‘oil to source rock’ correlations.

Triaromatic steranes – m/z231

This group of biomarkers are normally found in petrogenic oils such as crude oils but are removed in lube oils and middle distillates during the refining process. By targeting this group of compounds it is possible to distinguish between refined lube oil and a heavy fuel/bunker fuel oil.

Sesquiterpanes – m/z123

This group of biomarkers are found in the range nC₁₃ - nC₁₇ and are made up of three isoprene units which may be either cyclic or acyclic. They are derived from higher plants, resins, essential oils and some bacteria. They can be useful when correlating lighter petroleum products such as kerosene and diesel.

Isoprenoids – pristane and phytane

Pristane - IP₁₉ and phytane IP₂₀ are branched alkanes which are derived from the side chain of the chlorophyll molecule. They are ubiquitous in most oils and sediment extracts making them the most important biological markers which can be used for ‘oil to oil’ and/or ‘oil to source rock’ correlations.