Identification and quantification technology of petroleum biomarkers for the contamination sites in Taiwan

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Oil spills incidents were frequently found in environments due to spill incidents of the daily operation of the gas station, oil-processing facilities. Nowadays, there are still many contaminated sites that contain undetected, unknown or unspecified pollutants under the surface. In which, the forensic chemical analyses and chemical fingerprinting analyses have been proved to be sound and reliable methods for investigating and identifying possible sources of pollutants. Petroleum biomarkers are the high molecular mass, weathering-resistant compounds in the fossil oils, which can be used to trace back to the possible anthropogenic sources. To date, the application of GC/MS accompanied with biomarker identification was the key methods to identify possible constituents in a spill site. Depending on the various sources of crude oil and refining processes there are differences groups of biomarkers contain within it.

In Taiwan, there are always disputes over who is the responsible party for an unknown oil leak or spill, due to the high density of gas stations and population. In our studies, we have examined groups of biomarkers (C_{10} to C_{36}) in the oil products (gasoline, diesel, lubricant), soils and sediments samples. Moreover, we also developed a cleanup method accompanying with the related identification and quantification protocols to study 17 adamantanes, 10 sesquiterpanes, 37 terpanes and 17 steranes in the variety of samples. In which, the GC/MS, major internal standards, proper surrogate internal standards, calibration standards, the retention index (RI or Kováts Index), relative response factors (RRF) and diagnostic ratios are the major methods used in identifying various biomarkers and unknown spills in the soils and sediments. Finally, our forensic chemical analysis technology was able to distinguish the variety of oil products and the trace amount of biomarkers in samples. Furthermore, by using the calculated normalization ratios, diagnostic ratios, we were also identified the differences among gasoline, diesel and distilled residual oil products and link them to the source of pollutants in the contaminated soils and recognizes the signs of the aging spill and the indications of weathering effects.