



Hannaford Forensic Services (Asia) Limited

Crude oil

Crude oil is a product of the remains of prehistoric plants and animals, buried in the primaeval mud of swamps, lakes and oceans. Crude oil is a 'highly complex mixture of paraffinic, cycloparaffinic (naphthenic) and aromatic hydrocarbons, containing low percentages of sulphur and trace amounts of nitrogen and oxygen compounds'. The exact mixture is dependent on the source of the oil, and with modern chemical techniques it is often possible to trace the well from which the oil originated.

In order to determine the source of a crude oil, analysis is undertaken of the relative abundance of some of the major individual compounds, such as n-alkanes, which form a chemical pattern due to the ratios of specific constituents. Analysis can also identify source-specific compounds or markers. These parameters depend mostly on the pre-burial environments of the living organisms, the depositional environments of the organic matter, and the diagenetic processes in the source material¹.

Different varieties of instrumental and non-instrumental techniques are currently used in the analysis of crude oils, including such as Gas Chromatography (GC) and Gas Chromatography-Mass Spectrometry (GC-MS). These methods can be used to determine the oil 'fingerprint' and biomarkers, as discussed below.

Biomarkers are naturally occurring stable complexes, and generally for each separate well crude oils exhibit unique biomarker fingerprints. However, much like

¹ Yasser M. Moustafa and Rania E. Morsi (2012). Biomarkers, Chromatography and Its Applications, Dr. Sasikumar Dhanarasu (Ed.), ISBN: 978-953-51-0357-8, InTech

Hannaford Forensic Services (Asia) Limited

1001, Wayson Commercial Building

28 Connaught Road West, Sheung Wan, Hong Kong

Telephone: +852 2548 0577 | Fax: +852 2548 0588 | email: hongkong@hfs-asia.com | www.hfs-asia.com

Hannaford Forensic Services (Asia) Limited

fingerprints, using biomarkers to determine the source of a crude oil requires a database of oils to compare against. Many of the larger companies offering oil analysis services, such as SGS, Intertek, Saybolt etc., state that they maintain detailed databases of oils.

However, whilst it may be relatively easy to determine if a crude oil originates from a single well or source, often they are mixed with the output from other wells or sources. As such, the determination of the source of oil is unlikely to be accomplished using a single 'quick' test. Rather, the determination of source will require information regarding the expected source of the oil and ideally a certified sample from the expected source. With this information, or a sample, an experienced laboratory should be able to compare the analysis of the unknown sample against its database to confirm that it originated from the expected source. However, if this information is not available, then it is likely that more detailed testing and analysis will be required in order to confirm the source of the oil.

Finally, it should be noted that as with all analytical techniques, the quality and provenance of the sample provided to the laboratory are paramount. Without good sample provenance, there is little point in undertaking any analysis.

I trust this short note is of some assistance. However, a complex subject such as this cannot be fully explored in a brief document, and if further information is required please contact the Club.

Dr John Allum