

ABSTRACT

FINGERPRINTING OF PELAGIC AND STRANDED POLLUTANTS IN THE MARINE ENVIRONMENT

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The deleterious effects of a crude oil spill or discharge in the marine environment are well documented. From the point of view of environmental management agencies, additional problems are encountered in determining the exact source of the spill and in trying to obtain some measure of compensation. This thesis addresses the problem of identifying the source of an oil spill and in providing a foundation from which litigation and/or liability costs may be derived from an offending party responsible for the spill.

To achieve these goals a multimethod chemical analysis system was employed to characterize various chemical components in a crude oil. Hierarchical cluster analysis was used to compare similar chemical data for spill and suspect source samples. An attempt was also

made to determine the degree of weathering to which a spill sample may be subjected before the fingerprinting system developed yielded ambiguous results.

Analytical techniques of infrared, synchronous scan fluorescence and atomic absorption spectroscopy, together with carbon-13 nuclear magnetic resonance spectrometry and capillary gas chromatography, were combined into the multimethod fingerprinting system. The SPSS/PC + software package was used for statistical interpretation of data.

The combination of these five analytical techniques was found to provide good correlation between spill and suspect sources even after exposure to one week of weathering. The application of carbon-13 nuclear magnetic resonance in crude oil fingerprinting however posed some problems and further refinement of this technique is needed.

One of the final outcomes of this study was the creation of a data bank containing chemical fingerprint data for a number of local crude oils. At present samples of crude oil from thirty-five fields have been characterized using the technique of infrared, fluorescence and atomic absorption spectroscopy. The carbon-13 nuclear magnetic resonance spectra of nineteen have also been acquired.

An attempt was also made to quantify the distribution of tar and plastics in the Gulf-of-Paria, Trinidad. The results obtained were however inconclusive.