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Legal status of chemical fingerprints under Section 45 of Malaysia's Evidence Act 1950

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Abstract

Effective enforcement of environmental legislation is the key to ensure successful environmental protection and pollution control. For cases brought under the Environmental Quality Act 1974, the decision of criminal case tried is derived from the application of the law of evidence, specifically the Evidence Act 1950. In environmental forensics, chemical fingerprinting is one of the tools used to help identify sources of pollution and may form a defensible piece of evidence for prosecutors. The objective of this paper is to examine the position of chemical fingerprint evidence under Section 45 of the Evidence Act 1950. This research can provide an introductory guideline that can be of use to environmental law enforcers, forensic experts and other relevant stakeholders.

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Keywords: Environmental law; Environmental Forensics; chemical fingerprinting; evidence law; environmental protection

1. Introduction

1.1 Environmental Forensics, pollution and environmental protection in Malaysia

The term forensics often evokes the unpleasant image of a crime scene, complete with yellow tape, bloodstains and a chalk outline of a body. Environmental forensics however, is not usually so gruesome. It is essentially defined as "*the systematic and scientific evaluation of physical, chemical and historical information for the purpose of developing defensible scientific and legal conclusions regarding the source or age of a contaminant released into the environment*" [1]. Today, environmental forensics plays an increasingly important role in environmental protection in Malaysia where there exists a constant struggle to balance between the needs of a still developing nation and increased international pressure to conserve what is left of the country's pristine environment.

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One of the major hurdles in improving the level of environmental protection is effective pollution control. The Environmental Quality Act 1974 ("EQA"), Malaysia's primary environmental legislation, provides for the prevention, abatement and control of pollution [2]. According to the Department of Environment, in 2011, a total of 811 offenses were prosecuted under the Act. Out of this total, over 63 % involved offences related to air pollution, whereas nearly 12 % of these cases involved inland water pollution concerning effluent discharges exceeding the stipulated standards. The Department of Environment, which is tasked to enforce the Act, must rely upon scientific evidence, including reports from the Chemistry Department, for the purpose of prosecution [3]. The Department of Environment Malaysia now also has a specific section that handles environmental forensics related cases [4].

1.2 What are chemical fingerprints?

One of the tools used in environmental forensics and by the Chemistry Department is the chemical fingerprinting technique. A chemical fingerprint is *a unique pattern indicating the presence of a particular molecule, based on specialized analytic techniques used to identify a pollutant, drug, contaminant, or other chemical in a test sample* [5]. Like normal human fingerprints, to render them viable in the identification process, there must be another matching set or a database of existing fingerprints to compare them with. This database of fingerprints is usually maintained by authorities. The same scenario occurs with chemical fingerprints, which has played an important role in the rapidly advancing field waterborne oil spills. Significant advances in chemical fingerprinting, driven by both the application of petroleum exploration and production geochemistry principles and by advancements in analytical methods and instrumentation, have resulted in the use of fingerprinting in nearly all oil spill investigations worldwide [6]. The complex chemical makeup of petroleum- which can contain tens of thousands of individual hydrocarbons and non-hydrocarbons – provides an opportunity to 'chemically fingerprint' petroleum contamination and thereby assess its relationship to known or suspected sources [7]. Over time, a sample database could be built to allow each new spill to be compared to the ever-growing database without the need to re-analyse or reproduce existing data.

The United States Environmental Protection Agency maintains quite an extensive collection of database (Envirofacts) including sample collection information and analytical hydrocarbon analyses of Hydrocarbon samples collected. Tables include Alkane, PAH, and Biomarker together with quality control codes for each analyze (tables QC code Alkane and QC code PAH). In Malaysia, existing literature on current oil spill analysis are normally used as reference as there is currently no existing database for analytical hydrocarbon though there are increasing efforts to establish one.

1.3 How do chemical fingerprints actually 'work'?

To further clarify our understanding on chemical fingerprints, let us take the most common example of their usage, chemical fingerprinting of oil contaminants. Like human "fingerprints", in which the differences in patterns of our fingers can be used to distinguish one person from another, the differences in the pattern of oil composition can distinguish one oil from another. This is done by first collecting a sample and separating it into various fractions. Each fraction is analysed using instruments to give "printouts" of their chemical compositions. The "printouts" are in the form of graphs called "chromatograms," which are then interpreted by chemists. One technique that is used to create the chromatograms is called Gas Chromatography-Mass Spectrometry (GC-MS). GC-MS is the most reliable method to fingerprint an oil sample since it uses a multi-parameter approach in which individual compounds present in a sample are identified.

Oil spills or operational discharges that enter surface water can be classified into two basic categories:

1) "mystery" spills
2) known-source spills

The first typically involves the discovery of a fugitive oil or oily waste at sea, in rivers or harbours, or in other water bodies either in the absence of any known incident or source, or in the presence of multiple source candidates. The second involve the release of oil or oily waste from an identified point source, or a known incident. In both situations, there is an opportunity for chemical fingerprinting to answer important questions, which can be used to