

Petroleum Contamination Assessment and Bio-remediation Processes

Invited Speaker: Prof. Dr. Joan Albaiges (CID-CSIC, Barcelona, Spain)

Abstract: Marine pollution by oil is a well known problem that has become particularly evident at the time of massive accidental spills, such as the Prestige or, more recently, the BP platform in the Gulf of Mexico. However, operational discharges in coastal areas or offshore (e.g. urban effluents or oil tank washings) are more widespread and become confused with the accidental spills, when the acute phase is gone. The presentation will show the approach followed in Europe to establish a surveillance system of oil spills, from remote sensing to the collection of samples and their final identification. Efficient and unambiguous analytical methods for the characterization of these spillages are needed from the standpoint of the enforcement of the pollution control laws, designed to protect the public health and the environment. In this respect, we will describe the methodology adopted and currently assessed by the Oil Spill Identification Network of Experts (OSINET), which will be illustrated by the results of several real cases.

Sampling is the first step in obtaining information about the spill. Sampling at sea is carried out with

special devices for collecting surface oil, patches, slicks or sheens. Sampling of tanks on the vessels must be comprehensive and representative.

The identification of the samples is carried out by GC-MS, considering different sectors of the chromatographic profile and the hydrocarbon families associated with them. These include n-alkanes, acyclic isoprenoids, sesquiterpenes, steranes, triterpanes and alkyl aromatics. To this end, a number of source and weathering indices, based on the determination of specific compounds (molecular markers) have been proposed for comparison of samples, and multivariate statistical methods are applied to improve the diagnostic capability of this methodology. Obviously, the specific distributions of hydrocarbon families need to be properly used for the characterization of the spills. Particularly, the effects of the processes of evaporation, dissolution, photooxidation and biodegradation on the spilled samples need to be taken into account for the adequate interpretation of the results.

This methodology will be illustrated with examples

of accidental and operational discharges. Among the former we refer to a spill in the Strait of Gibraltar where the aging of the samples collected at sea was a factor to be taken into account when making comparisons with reference samples.

Among the operational discharges, the most common are those related to washing tanks or bilges. In this case, the identification of such residues is particularly difficult because its composition, a mixture of products used in a vessel (fuel oils and lubricating oils), is very variable. The difficulties are even more important when spills occur in ports, where potential sources are numerous. In this case, we present two cases of spills occurred in fishing ports, where the cause of the spill among four potential sources should be identified.

Short Curriculum Vitae: Prof. Joan Albaiges is Research Professor of the Spanish Research Council

(CSIC) where he established in 1979 the Department of Environmental Chemistry, where pioneering and internationally well known research activities on environmental organic geochemistry started to develop. He has contributed over 250 refereed articles to scientific journals, being Editor-in-Chief of the International Journal of Environmental Analytical Chemistry, vice-president of the International Association of Environmental Analytical Chemistry (IAEAC) and member of several Academies. In 2002 he was appointed vice-chair of the Scientific Advisory Committee on the Prestige accident; in 2004, coordinator of the European Network on Accidental Marine Pollution (AMPERA) and, since 2010, of the ERA-Net "Towards integrated European marine research strategy and programs" (SEAS-ERA).