

Identifying polychlorinated biphenyl sources in environmental media

GLENN W. JOHNSON

Energy & Geoscience Institute, University of Utah, Salt Lake City, Utah, USA (gjohnson@egi.utah.edu)

Polychlorinated biphenyls (PCBs) are a class of chlorinated organic chemicals that were produced and marketed commercially from the 1930s to the 1970s. PCBs were used for a variety of industrial uses (e.g. dielectric fluids in electrical equipment). PCB products were produced commercially by chlorination of biphenyl. The resulting products were mixtures of a number of congeners in relatively stable proportions. Their manufacture and use ceased in the 1970s because of mounting scientific evidence that PCBs accumulated in the environment and could adversely impact biota. However, due to their persistence in the environment, PCBs continue to be an environmental contaminant of concern.

Environmental forensics investigations of sites contaminated with polychlorinated biphenyls (PCBs) present unique challenges. Source inference in environmental media requires a broad range of knowledge in a number of subdisciplines.

In this presentation we will review PCB industrial use/associations, PCB chemistry, analytical laboratory methods, and the congener patterns associated with commonly encountered sources. While PCBs are more recalcitrant to weathering and alteration, they can be altered in the environment. We will review known PCB alteration patterns and discuss how such alteration can be recognized in environmental field studies. The implications of these topics will be illustrated using case studies conducted in a variety of different environmental media (air, water, sediment and biota). Finally, we will discuss the importance of data preparation, data analysis and data visualization in environmental forensics investigations involving PCBs.

Use of alkylated PAH source parameters in environmental forensic studies: Testing the paradigm

ROBERT HADDAD, PH.D.

Applied Geochemical Strategies, Inc., 2670 Appaloosa Way, Arroyo Grande, CA 93420, USA (rhaddad@charter.net)

The application of alkylated polycyclic aromatic hydrocarbon (PAH) analytical methods provide opportunities to more effectively characterize diesel-range petroleum mixtures released into the environment and to use this information for liability allocation in environmental forensic studies. Successful use of this information in forensic studies requires an understanding PAH distributions in various source materials and how these PAH distributions may change in respond to environmental weathering processes. While there are many studies documenting PAH distributions of various source materials, to date there are few published reports which document the effect of environmental weathering on the distributions and thus little available information on which to base conclusions regarding the use of PAH ratios as indicators of either source or diagenesis.

In this study, geochemical data are presented for eight crude oils obtained from a single oil field and potentially representing various stages of in-reservoir degradation. The objectives of the study were to (1) demonstrate a single common source for all eight oils, (2) define the oils as part of an in-reservoir weathering sequence, and (3) use these data to examine the effects of weathering on various PAH parameters commonly used as either source characterization or environmental weathering indicators.

Results of cluster and principal component analyses indicate that these oils have a common source and that differences are due to in-reservoir weathering processes. These weathering processes have resulted in the substantial addition of organic sulfur to the oils as evidenced in the various PAH ratios by a preferential preservation of the sulfur-containing PAHs (benzothiophenes, dibenzothiophenes, etc.) The significance of these results regarding source characterization and specific weathering processes will be discussed.