Creosote Contamination

TECHNICAL BULLETIN

Creosote is a complex mixture of aromatic and heterocyclic organic compounds obtained from the fractional distillation of coal tar. It has been used as a fungicide, insecticide, and sporicide. It has also been used extensively as a wood preservative in terrestrial and marine environments. Creosote wood preservatives are often used to pressure treat railroad ties/crossties and utility poles or crossarms[1].

Background

Identification and characterization of creosote contamination poses significant challenges for the commercial laboratory. The complex nature of its composition can vary depending on the source of creosote. Typical concentration ranges for the major components of creosote are provided in Table 1.

Further changes to the creosote composition due to its behavior in the environment further complicates its measurement. Volatilization of the lighter components, leaching of the more soluble compounds into groundwater and adsorption of the higher molecular weight species to solid matrices further alters the composition of creosote impacts.

Groundwater samples contain a high percentage of BTEX, non-chlorinated phenols and heterocyclics because of their water solubility. Soil samples contain higher percentages of insoluble polycyclic aromatic hydrocarbons (PAH) and alkylated PAH. Pentachlorophenol (PCP) was often added to creosote to enhance its wood preserving capability.

Characterization of Creosote Impacts

Based on our experience with countless site remediation projects, Maxxam has developed and recommends the following approach.

Phase 1

Analyze investigative samples for petroleum hydrocarbons by gas chromatography and flame-ionization detection (GC/FID). Visually evaluate the chromatogram for peak profiles that are characteristic of and therefore may represent creosote contamination.

Perform an aliphatic/aromatic fractionation using silica gel and analyze both fractions by GC/FID. If the sample contains only aromatics, combined with the previous data, this is a strong indication that creosote is present.

Phase 2

Analyze for target and alkylated PAH and non-chlorinated phenols by gas chromatography coupled with mass spectrometry (GC/MS). Because these are major components of creosote, their presence and relative concentrations may provide a line of evidence supportive of creosote.

Phase 3

If the hydrocarbon concentrations determined by GC/FID (Phase 1) are at least ten times the Reporting Detection Limit (RDL), you might consider performing an open characterization using GCMS to further characterize additional creosote-specific compounds such as dibenzo-furan and aromatic amines. (It should be noted that samples having hydrocarbon concentrations less than ten times the RDL by GC/FID should not be submitted for open characterization due to insufficient sensitivity.)

[1] National Pesticide Information Centre, article: Creosote Human Risk Characterization

Table 1: Concentration ranges of major creosote components

CLASS	SUBCLASS	RANGE
Aromatics	PAH & alkylated PAH	30% - 90%
	BTEX, MAH	1% - 5%*
Non-Chlorinated Phenols	Phenols, cresols, xylenols, napthols	3% - 17%
O - heterocyclics	Dibenzofurans	5% - 8%
N - heterocyclics	Pyridines, quinolines, acridines, benzoquinolines, indulines, carbazoles	4% - 9%
Aromatic amines	Aniline, amino PAH	1% - 3%
S - heterocyclics	Benzothiophenes and derivatives	1% - 3%

* Present in fresh creosote. Typically not found in weathered product

Contact Maxxam to learn about several other techniques that provide further confirmation of creosote contamination, or to have our experts provide a written opinion.

About Us

Maxxam is a leading North American provider of analytical services and solutions to the energy, environmental, food, Industrial Hygiene and DNA industries. We are a member of the Bureau Veritas Group of companies – a world leader in testing, inspection and certification services. We support critical decisions made by our customers through the application of rigorous science and the knowledge and expertise of over 2,500 employees.

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