

2011 Standardization of an Analytical Method to Differentiate Petrogenic and Biogenic Inputs in Contaminated and Background Soils

Total petroleum hydrocarbons (TPHs) or petroleum hydrocarbons (PHCs) are one of the most widespread soil pollutants in Canada, North America, and worldwide. Clean-up of PHC-contaminated soils and sediments costs the Canadian economy hundreds of million of dollars annually. Much of this activity is driven by the need to meet regulated levels of PHC in soil.

In the environment, soil contamination generally originates from three main sources: biogenic, pyrogenic and petrogenic hydrocarbons. Biogenic substances are produced by organisms or generated from naturally occurring organic matter. These naturally occurring biogenic organic compounds (BOCs) are usually non-toxic and less hazardous than those from petrogenic and pyrogenic sources. BOCs present in soils and wet sediments can be easily misidentified and quantified as regulated PHCs during analysis using

such methods for PHC determination. In some cases, biogenic interferences can exceed regulatory levels, resulting in unnecessary and costly remediation measures, while also wasting valuable landfill space. Therefore, it is critically important to characterize and differentiate PHCs and BOCs in contaminated sediments in PHC analysis.

This method describes a procedure for determining hydrocarbon constituents in soil or sediment samples by Soxhlet extraction or other suitable extraction techniques, silica-gel column cleanup, followed by gas chromatographic analysis. However, this method may be applied to liquid environmental samples, provided that the samples are extracted by appropriate techniques. Total petroleum hydrocarbons (PHCs) are quantitatively determined using gas chromatograph-flame ionization detection (GC/FID). In addition, a series of target hydrocarbons including n-alkanes, polycyclic aromatic hydrocarbons (PAHs), petroleum biomarkers including bicyclic sesquiterpanes (see list of analytes in Appendix Table 1) are investigated for identification and differentiation of the presence/absence of petrogenic and biogenic compounds in soil and sediment samples by gas chromatography-mass spectrometry (GC/MS). This method does not aim to quantitatively allocate the contribution of each source to PHCs in the sample.

The method reporting limits are <50 g/g for total petroleum hydrocarbons (based upon extraction of 5.0 g

soil in dry weight, or 10 g soil in wet weight, a final pre-injection extract volume of 1.0 mL, and a sample extract injection volume of 1.0 L to GC).

This method is restricted to use by or under the supervision of analysts experienced in the use and interpretation of Gas Chromatography with Flame Ionization Detection (GC/FID) and GC coupled with mass spectrometry (GC/MS).

2009 UoW and Env Canada_Biogenic Presentation

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