Utilizing Carbon Ranges, Unresolved Complex Mixtures and Carbon Prefereence Index Signatures as a New Tool for Quantifying Biogenic vs. Petrogenic Hydrocarbons in Soils Contaminated with Heavy Petroleum Products

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The Canadian Council of Ministers of the Environment (CCME) reference method for the Canada-wide standard (CWS) for petroleum hydrocarbon (PHC) in soil provides chemistry analysis standards and guidelines for the management of contaminated sites. However, these methods can coextract natural biogenic organic compounds (BOCs) from organic soils, causing false exceedences of toxicity guidelines. The present 300-d

microcosm experiment used CWS PHC tier 1 soil extraction and gas chromatography–flame ionization detector (GC-FID) analysis to develop a new tier 2 mathematical approach to resolving this problem. Carbon fractions F2 (C10– C16), F3 (C16–C34), and F4 (>C34) as well as subfractions F3a (C16–C22) and F3b (C22–C34) were studied in peat and sand spiked once with Federated crude oil. These carbon ranges were also studied in 14 light to heavy crude oils. The F3 range in the clean peat was dominated by F3b, whereas the crude oils had approximately equal F3a and F3b distributions. The F2 was nondetectable in the clean peat but was a significant component in crude oil. The crude oil–spiked peat had elevated F2 and F3a distributions. The BOC-adjusted PHC F3 calculation estimated the true PHC concentrations in the spiked peat. The F2:F3b ratio of less than 0.10 indicated PHC absence in the clean peat, and the ratio of greater than or equal to 0.10 indicated PHC presence in the spiked peat and sand. Validation studies are required to confirm whether this new tier 2 approach is applicable to real-case scenarios. Potential adoption of this approach could minimize unnecessary ecological disruptions of thousands of peatlands throughout Canada while also saving millions of dollars in management costs.

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