Abstract
Hydrocarbon pollution detection using spectroscopic technique

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Introduction

The content of this poster will present the design of a laboratory experiment aiming at creation of a model built on statistical relationships between spectral soil properties, soil hydrocarbon pollution, soil geo-physical parameters, and time, in order to detect, monitor, and predict hydrocarbon pollution. Preliminary analysis and visualisation of measured spectra will be presented. Some diagnostic features of hydrocarbon-polluted soil will be investigated and described.

Materials and methods

A laboratory experiment was set up dealing with three types of soils (Table 1); three types of hydrocarbons in three pollution levels (Table 2).

Table 1. Soil preparation.

Selected soil type	Amount of soil	Moisture (%)	g H_2O/50g soil
Clean fine sand	50g	5	2.5
Organic fine sand	50g	15	7.5
Clay	50g	15	7.5

Table 2. Hydrocarbon preparation.

Hydrocarbon	Hydrocarbon type	Pollution levels/ g HCs/50g soil		
Toluene	Light	2% (1)/1g	5%(2)/2.5g	8%(3)/4g
Regular gasoline 95	Intermediate	2% (1)/1g	5%(2)/2.5g	8%(3)/4g
Lubricating oil (mineral oil-multi-grade)	Heavy	2% (1)/1g	5%(2)/2.5g	8%(3)/4g

A total of 420 samples were prepared and put in double air-tight bottles to prevent hydrocarbons from evaporating. The experiment was set-up for two years, divided into 14 times of measurements. The basic instrument for spectral measurements was a Bruker Vertex 70 Fourier Transform Infrared (FT-IR) spectrometer brought by ITC laboratory.

Initial results and discussions

The first set of measurements shows that different soils and different hydrocarbons show different spectral absorption positions and overall reflectance values. There are very clear absorption features in the MIR region caused by hydrocarbons in soils; the higher the hydrocarbon concentrations the larger the values of absorption depths.

These measurements will be used to investigate statistical relationships of hydrocarbon concentrations and absorption features of soil spectral properties. Hydrocarbon pollution prediction will be obtained using regression analyses.

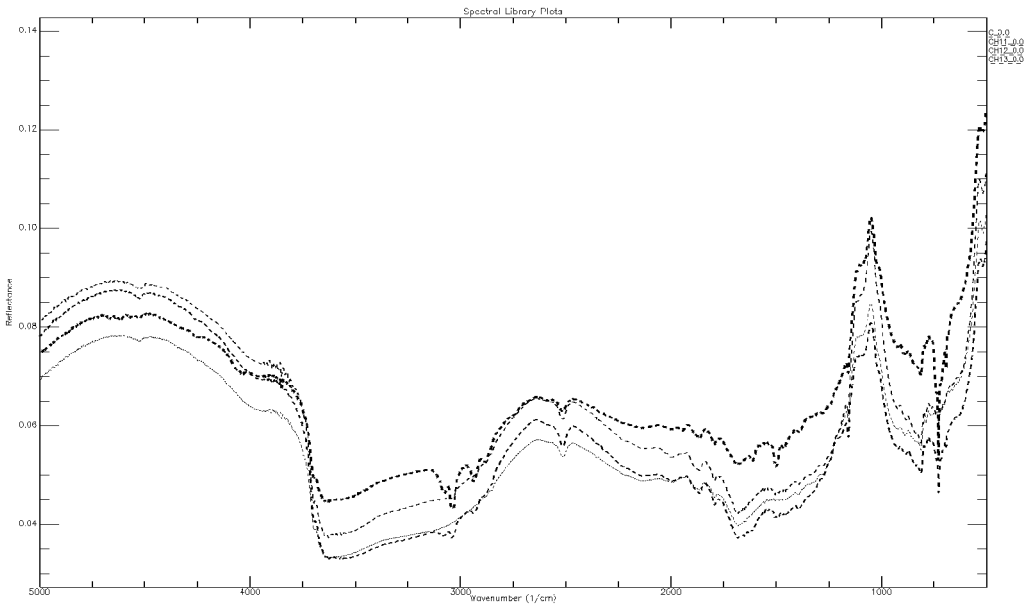

Figure 1. Spectral plot of clay polluted with different concentrations of toluene.

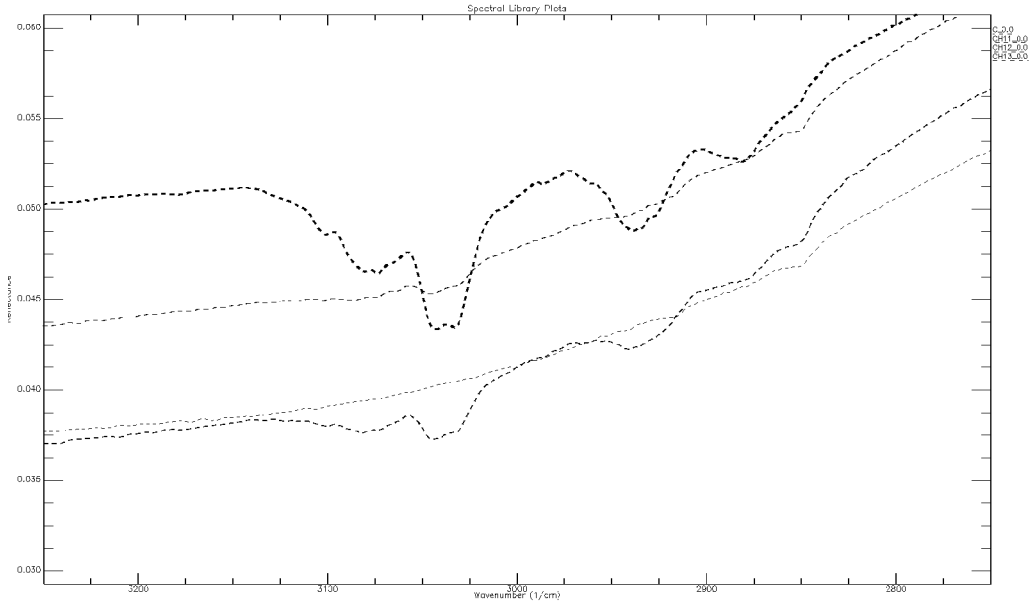

Figure 2. Spectral plots showing typical absorption feature of clay polluted by different concentrations of toluene.