

Fiber optical ATR-IR spectroscopic analyzer of oil-contaminated soil

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Oil-contaminated soil and others heterophase wastes have a negative impact on the environment. Nowadays there is an increasing need in the environmental monitoring, rapid response to emergency situations and field control of contaminants assimilation.

The basis of the present analyzer is an infrared spectrometer. It has been equipped with a fiber optical probe that acquires IR absorption spectra of the soil through an attenuated total reflectance (ATR) measurement head. A portable infrared spectrometer is connected to the probe head with a flexible IR fiber cable. The probe crystal and fiber material were selected taking their transmission ranges into account.

Spectra of oil-contaminated soils have a group of characteristic peaks of the hydrocarbons between 2925 and 2860  $\text{cm}^{-1}$  that exhibits an evident correlation with oil content. At the same time, even the spectra of non-contaminated soils experience the contribution of organic substances of natural origin. A broad and intensive peak in the region 3500 - 3300  $\text{cm}^{-1}$  is related to the absorption of water significantly interfering with the signals of interest. The "fingerprint" region also comprises characteristic peaks of the hydrocarbon groups. Their intensity is lower and the interpretation difficult because of the signal overlay.

PLS regression model for the quantitative determination of the oil products in soils has been built based on both design laboratory and field samples. The experimental and modelling issues have been considered in the present work. The accuracy improvement potentials are outlined.

The immersion probe can be used to control the composition of oil-contaminated soils in the field conditions without or with a minimal sample

preparation. The method is also applicable under conditions of a bioremediation processes.