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Soil quality — Screening soils for isopropanol-extractable organic compounds by determining emulsification index by light attenuation

Qualité du sol — Analyse rapide des sols pour les composés organiques extractibles à l'isopropanol en déterminant l'indice d'émulsification par l'atténuation de la lumière



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical methods and soil characteristics*.

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Introduction

Light attenuation due to light scattering/absorption by emulsions can be used to screen for a variety of isopropanol-extractable organic substances such as total petroleum hydrocarbons (TPH). This is one of the main organic contaminants of many contaminated land sites.

Petroleum hydrocarbons do not typically have many functional groups or contain any hetero-atoms that are easily detected in common analytical procedures. When the non-polar nature of organic compounds is targeted, as in this proposed method, turbidity/emulsification is produced by a number of organic compounds including BTEX (benzene, toluene, ethylbenzene and xylenes); PNAs (poly-nuclear aromatics); fuels; oils and greases that frequently are found at contaminated land sites.

This method can be used for screening soil samples to estimate the total amount of recoverable petroleum hydrocarbon contamination in soil including a wide range of fuels, oils, and greases. The emulsification approach in this method is incorporated to rapidly screen soil samples using a system calibrated with the organic substance present on the investigated site. If the contaminant is unknown, commercially available diesel oil can be used for calibration. This makes turbidity/emulsification analysis a very versatile analytical method that can be used on most hydrocarbon/non-polar organic substance spills without prior knowledge of the exact BTEX or PNA content or composition of the contaminant. This method is more sensitive to non-polar heavier organic compounds from jet fuel to oils and greases, but less sensitive to more volatile and lighter hydrocarbon fuels. A turbidity analysis assists the user in recognizing the contamination by non-polar organic compounds at a given site.

This International Standard describes the procedure for on-site soil screening of organic compounds using emulsification and light attenuation due to light scattering/absorption analysis.

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Soil quality — Screening soils for isopropanol-extractable organic compounds by determining emulsification index by light attenuation

1 Scope

This International Standard specifies the procedure to screen highly contaminated soils to detect organic compounds extractable with isopropanol, including a wide range of fuels, oils, and greases. The method is useful for finding hot spots. It is applicable both in laboratories and for site screening in the field. The working range is approximately 0,01 to 0,3 in absorbance units, corresponding to approximately 500 mg/kg to 10 000 mg/kg of isopropanol-extractable organic compounds in soil.

The light attenuation due to light scattering/absorption approach in this method is designed to quickly screen soil samples using calibration with the most appropriate substance(s) likely to be present on a given site to indicate the concentration levels.

This screening technique is applicable for a broad spectrum of organic compounds, mainly hydrocarbons. Organic compounds are a very broadly defined mixture of compounds, which show their own specific emulsification indices (see Annex A) and a gross emulsification index in a mixture sample, defined primarily by their insolubility in water. The more insoluble the compounds (e.g. non-polar compounds), the higher the response. Hydrocarbons are generally less-reactive and have little polarity. Determination of emulsification indexes uses their non-polar nature to detect organic compounds including a wide range of hydrocarbons from about C_8 to about C_{36}.

NOTE This method can also be applied to biological substances such as vegetable oils.

This method is not applicable for determination of specific organic compounds or groups of compounds that may be part of a larger organic compound mixture. As with other screening techniques, it is advisable to confirm a certain percentage of both positive and negative test results, especially when near or above a regulatory action limit or when the presence of background or when interfering organic compounds such as surface active substances are suspected to be present.

This method does not address the evaporation of any volatile organic compound mixtures (i.e., gasoline) during sampling, preparation and detection. Although the screening method can be used for the quantitative detection of volatile hydrocarbons, it is not intended that the method be used for the quantitative determination of volatile petroleum hydrocarbons unless evaporation during sample handling is addressed; the response factor be appropriately corrected, or the method performance be demonstrated on real samples.

If emulsifiers or surface active substances (e.g. detergents) are present, significantly negatively-biased or false negative results can be obtained. If there is any evidence for the presence of surfactances in the soil, this method cannot be applied.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11074, *Soil quality — Vocabulary*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11074 and the following apply.

3.1
emulsification index
ratio of the sample measured absorbance value under the conditions of this test compared with that of the single calibration standard

4 Principle

4.1 General

This emulsification method for detection of organic contaminants in soil consists of three basic steps:

— extraction: extraction of organic compounds from soil samples with isopropanol;

— salting-out: decrease the water solubility of the extracted organic compounds in the water diluted isopropanol by increasing the ionic strength of this solution adding sodium chloride solution (salting-out effect);

— detection: measuring the light absorbance at 585 nm of the resulting salting-out solution in a 10 mm path length cell.

4.2 Interferences or other surfactants

Surface-active agents such as soap and common surfactants adversely affect emulsification or reduce the degree thereof.

NOTE Shaking a mixture of 1 g of soil sample and 10 ml of water to look for formation of pronounced foam may be useful to confirm the probability that significant amounts of surface-active agents are present in soil samples.

5 Reagents

5.1 Isopropanol.

5.2 Sodium chloride solution 30 % (m/V).

Mix 300 g of water-free NaCl with approximately 500 ml of water and dilute to 1 l.

6 Apparatus

6.1 Spectrometer, handheld, portable, or laboratory spectrophotometer working at a wavelength range of (585 ± 10) nm.

6.2 Spoon, metal or plastic (10 ml to 20 ml).

6.3 Sample tube, suitable glass tube (typically about 15 ml) with a tight-fitting cap for extraction by shaking.

6.4 Glass cell, 10 mm path length glass cell for assessing the degree of emulsification via light absorption at 585 nm. Disposable plastic 10 mm path length cells may also be used.

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