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NASA TECH BRIEF

Ames Research Center

Soil Moisture by Extraction and Gas Chromatography

The problem:

To determine the moisture content of soils rapidly and conveniently by gas chromatography.

The solution:

Extract the moisture with methanol and determine the water content of the methanol extract by gas chromatography.

How it's done:

A 1.000-g sample of soil in a 16- x 100-mm screw-cap test tube is treated with 3.00 ml of chromatographic-grade methanol; depending on temperature, the volume of methanol usually has a weight of 2.346 to 2.355 g. A second tube containing the same volume of methanol is used as reference. The tubes are capped tightly and agitated for 30 minutes on a reciprocating shaker. The tubes are then centrifuged at 1200 rpm (16-cm radius) for 5 minutes.

A one-microliter aliquot of the supernatant liquid is then analyzed for water by gas chromatography, using a column packed with 50- to 80-mesh porous polymer beads. The column is maintained at 125°C, the helium flow at 150 ml/min, the detector oven temperature at 150°C, and the injection block temperature at 200°C. The gas chromatograph is calibrated with mixtures of water in methanol.

Moisture content of the sample is calculated from the weight of water and methanol in the aliquot and the weight of methanol added to the sample:

$$\frac{(\text{water in aliquot}) \times (\text{methanol added to soil})}{(\text{methanol in aliquot})}$$

Higher moisture contents are obtainable by this extraction procedure than by the customary oven-drying method, except in the instances of organic-rich soils where part of the measured weight loss may be attributed to loss of volatile organic compounds. The minimum detectable quantity of water in a 1-μl aliquot is 200 μg per gram of sample; aliquots of 100 μl would, of course, increase sensitivity proportionately if the water in the reagent methanol ($\approx$0.05%) could be reduced proportionately.

Reference:

Merek, E. L. and Carle, G. C.: The Determination of Soil Moisture by Extraction and Gas Chromatography. Soil Science (late 1973).

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Patent status:

NASA has decided not to apply for a patent.

Source: Edward L. Merek and Glenn C. Carle
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(ARC-10748)

Category 04