

Lesson 02

Title of the Experiment: Determination of water percentage in a soil sample by gravimetric analysis

(Activity number of the GCE Advanced Level practical Guide - 02)

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Introduction:

The soil moisture content is expressed by weight as the ratio of the mass of water present to the dry to the dry weight of the soil sample. To determine any of these ratios for a particular soil sample, the water mass must be determined by drying the soil to constant weight and measuring the soil sample mass after and before drying. The water mass (or weight) is the difference between the weights of the wet and oven dry samples. The criterion for a dry soil sample is the soil sample that has been dried to constant weight in oven at temperature between 100 – 110 °C (105 °C is typical). It seems that this temperature range has been based on water boiling temperature and does not consider the soil physical and chemical characteristics

Learning outcomes:

At the end of the experiment, students will be able to

- develop skills in soil sampling
- develop skills to measure soil samples and crucibles accurately using an electronic balance
- calculate the percentage of water in a soil sample

Materials/Equipment:

Soil sample
Burner
Electronic balance
Desiccator
Crucible
Galvanized metal cylinder about 10 cm of height

Methodology/Procedure:

1. Remove any weeds on the ground before obtaining the soil sample.
2. Sharpen on edge of the galvanized metal cylinder.
3. Keep the sharpen edge of the cylinder on the ground and leave a piece of wood on the other edge. Then tap it by a hammer.
4. Take the cylinder out when it is filled with soil and remove any excess soil in the outside of the cylinder.
5. Cover the cylinder containing the soil sample by a piece of polythene and bring it to the laboratory.
6. Obtain an empty crucible and determine the mass and record. (W_1 g)
7. Add no more than 50 g of the soil sample to the crucible. Measure and record the combined mass of the crucible and soil. (W_2 g)
8. Heat the sample in the crucible at 105 °C until a constant weight is obtained. (W_3 g)
9. Calculate the moisture percentage as given below from the data obtained.

Readings/Observations:

Mass of the crucible	= (W ₁ g)
Mass of the crucible + wet soil	= (W ₂ g)
Mass of the crucible + dried soil	= (W ₃ g)

Calculations:

$$\begin{aligned} \text{Percentage of moisture (on dry basis)} &= \frac{\text{mass of the water in the soil sample}}{\text{mass of the dried soil}} \times 100 \\ &= \frac{(W_2 - W_1) \text{ g} - W_3 \text{ g}}{(W_3 - W_1) \text{ g}} \times 100 \end{aligned}$$

Discussions:

1. Soil sample obtained should be a good representative sample of the test area.
2. Soil sample is wrapped by a polythene to prevent any moisture absorption from air or any water loss from the soil.
3. The heated soil sample should be taken out of the oven after 8 hours and leave in a desiccator to cool before weighing. Take the sample out of the oven, weigh and repeat until a constant mass is obtained.

References:

Soil Sampling and Methods of Analysis (*Second Edition*) 2006, Edited by M.R. Carter and E.G. Gregorich, Canadian Society of Soil Science, Taylor & Francis Group.