Soil organic matter

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Carbon in soil

- Carbon is the main constituent of organic matter and presents in the soil in the form:

1. Organic C (SOM) consists of:
    - microbial cells.
    - plant and animal residues at various stages of decomposition.
    - stable humus (humic acids, humins) synthesized from residues by microorganisms.
    - highly carbonized compounds (e.g., charcoal, graphite, coal).
2. Non organic C in form of carbonate, mostly CaCo3.

Importance:

- It influences:
    - nutrient supply (mainly N, P, S).
    - cation exchange capacity.
    - adsorption of pollutants.
    - infiltration and retention of water.
    - soil structure.
    - soil color.
    - Organic material is essential as a nutrient source for all heterotrophic soil organisms.

SOM analysis

- Most often SOM content of soils is determined by carbon analysis.
- A conversion factor of 1.724 has been proposed on assumption that 58% of SOM is C.

Methods of analysis

1. Dry combustion method.
2. Wet digestion method.
3. Loss on ignition method.

1- Loss On Ignition Method (LOI)

- **Principle:**
  - The LOI method is based on ignition (550 ± 25 ◦C) of a dried (105 ◦C) soil sample.
  - The SOM content is calculated from the mass difference before and after heating.
- ■ **Equipment**
  • Sieves, 2- or 5-mm mesh size
  • Drying oven, 105 ± 2 ◦C
  • Muffle furnace, 550 ± 25 ◦C
- • Analytical balance, accuracy 0.01 g
  • crucibles.
  • Desiccator.

Sample Preparation

- Use field-moist, sieved (< 5 mm) soil or air-dried, sieved (< 2 mm) soil.

- Dry the soil to 105 ◦C prior to organic matter determination.

Procedure

- Heat crucibles 550 ± 25 ◦C for 20 min, cool in a desiccator and determine tare mass (*m*t) to 0.1 g.
- Weigh 5−20 g (accuracy 0.01 g) of oven-dried (105 ◦C) soil in crucibles (ms).
- Heat in the muffle furnace gradually to 550 ± 25 ◦C for 2−4 h.
- Open the door and cool the muffle furnace down to 100 ◦C.
- Place the crucibles/bowls in the desiccator and cool them to room temperature (approx. 1 h).
- Measure the mass of the filled crucibles (*m*c + *m*t).

Calculation

- Calculate the loss of mass (Δ*m*; g) after ignition at 550 ◦C using the following equation:
  $\Delta m = m\text{s} + m\text{t} - m\text{c} + m\text{t} = m\text{s} - m\text{c}$
- The LOI(Δ*m)* corresponds to the SOM and can be calculated using the following equation:
  $\text{LOI } \% = \Delta m/m\text{s} \times 100$
- Δ*m* loss of mass of the soil after ignition at 550 ◦C (g)
- *m*s mass of the soil dried at 105 ◦C (g)
- *m*t mass of the crucibles ignited to 550 ◦C (g)
- *m*c mass of the soil ignited to 550 ◦C (g)