TD N°5 : Determination of total limestone in soil
Bernard Calcimter Methode

Objective:

To quantify the total limestone (calcium carbonate, $CaCO_3$) content in a soil sample using the Bernard Calcimeter.

Principle of the Method:

When hydrochloric acid (HCl) reacts with calcium carbonate in the soil, carbon dioxide (CO_2) is released:

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$$

The volume of CO_2 produced is proportional to the amount of $CaCO_3$ in the sample. This CO_2 is collected in the Bernard Calcimeter, and the corresponding $CaCO_3$ content is calculated.

Materials Needed:

- Bernard calcimeter set
- Soil sample (air-dried and sieved)
- Hydrochloric acid (HCl), usually 1N
- Measuring cylinder or graduated pipette
- Analytical balance
- Watch glass or funnel
- Desiccator (optional)

Step-by-Step Procedure:

1. Sample Preparation

- Air-dry the soil sample.
- Sieve it through a 2 mm mesh.
- Weigh **5 g** of the soil sample accurately.

2. Setup of the Bernard Calcimeter

- Place the weighed soil into the reaction flask of the calcimeter.
- In the connected reservoir (usually a side arm or a funnel), add a measured volume (e.g., 10 mL) of **1N HCl**.

3. Reaction Initiation

- Carefully tilt or open the valve to let the HCl flow into the reaction flask containing soil.
- Immediately seal the system tightly to avoid gas escape.
- The acid reacts with the carbonate in the soil, producing CO_2 gas.

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4. CO_2 Collection

- The CO_2 produced displaces a liquid (usually water or a saline solution) in the graduated tube.
- Measure the **volume of displaced liquid**, which is equivalent to the volume of CO_2 released.

5. Calculation

- Convert the volume of CO_2 to the percentage of $CaCO_3$ using a calibration curve or the formula provided with your calcimeter.

Notes for Students:

- Ensure the apparatus is airtight to prevent CO_2 loss.
- Run a blank test to account for background CO_2, especially if high accuracy is needed.
- The Bernard Calcimeter is best suited for soils with significant carbonate content; for very low-$CaCO_3$ soils, more sensitive methods might be required

Example

Given:

- Weight of soil = **2.50 g**
- Volume of CO_2 = **80 mL**
- Constant **K = 0.056**

$$\% \text{ CaCO}_3 = \frac{80 \times 0.056}{2.50} = \frac{4.48}{2.50} = 1.79\%$$

This soil sample contains 1.79% $CaCO_3$.