Practical Work n°1 :

Particle-Size Analysis and Determination of Soil Texture : Sedimentation Cylinder Method

1. Introduction

Soil texture, also referred to as particle-size composition, describes the size and, particularly, the relative proportions of the different mineral particles that make up the soil fine earth fraction. It is mainly defined by the proportions of : sand, silt and clay.

The soil texture triangle is a triangular diagram used to determine the textural class of a soil by plotting the percentages of the different fine-earth fractions along the sides of the triangle.

2. Objective

Determination of the particle-size composition of a soil sample.

3. Principle

Particle-size analysis is carried out on a fine-earth sample (particles smaller than 2 mm). Its purpose is to determine the percentage of the different mineral particle-size fractions that make up the soil aggregates.

Mineral particles can be classified as follows :

-Clay : < 2 µm

-Coarse silt : 2–20 µm

-Fine silt : 20–50 µm

-Fine sand : 50–200 µm

-Coarse sand : 0.2–2 mm

-Gravel: 2–20 mm

-Stones: > 20 mm

4. Materials

-Soil sample ;

-Distilled water ;

-Precision balance ;

-1 L graduated cylinder ;

-Beakers ;

-Spatula ;

-2 mm sieve ;

-Graduated ruler ;

-Soil texture triangle.

5. Experimental Protocol

-Place approximately 100 g of air-dried, sieved soil (<2 mm) into a 1 L graduated cylinder.

-Then add distilled water, leaving a small amount of air at the top of the cylinder.

-Mix thoroughly for a few minutes and then allow the suspension to stand undisturbed.

6. Procedure

-Soil is composed mainly of sand, silt, and clay. Because of their larger particle size, sand particles settle rapidly at the bottom of the graduated cylinder, while silt particles settle more slowly. Clay particles are much finer and therefore remain suspended for a longer period. Depending on the composition of the soil sample, sufficient time should be allowed for the finer particles to settle and for the suspension to become relatively clear.

-After sedimentation, distinct layers of different particle-size fractions can be observed in the graduated cylinder. Sand forms the lower layer and is generally visible to the naked eye. Silt forms the intermediate layer between the sand and clay fractions. Clay, being the finest fraction, remains suspended for the longest period and may form the uppermost part of the sediment. Any floating plant debris or other light material at the surface should be identified as organic matter and should not be included in the mineral fractions.

-Measure the height of each sediment layer and the total height of the sediment using a ruler.

-Calculate the percentage of each particle-size fraction using the following equations:

$$\% \text{ sand} = (\text{Sand layer height} \times 100) / \text{Total height}$$

$$\% \text{ silt} = (\text{Silt layer height} \times 100) / \text{Total height}$$

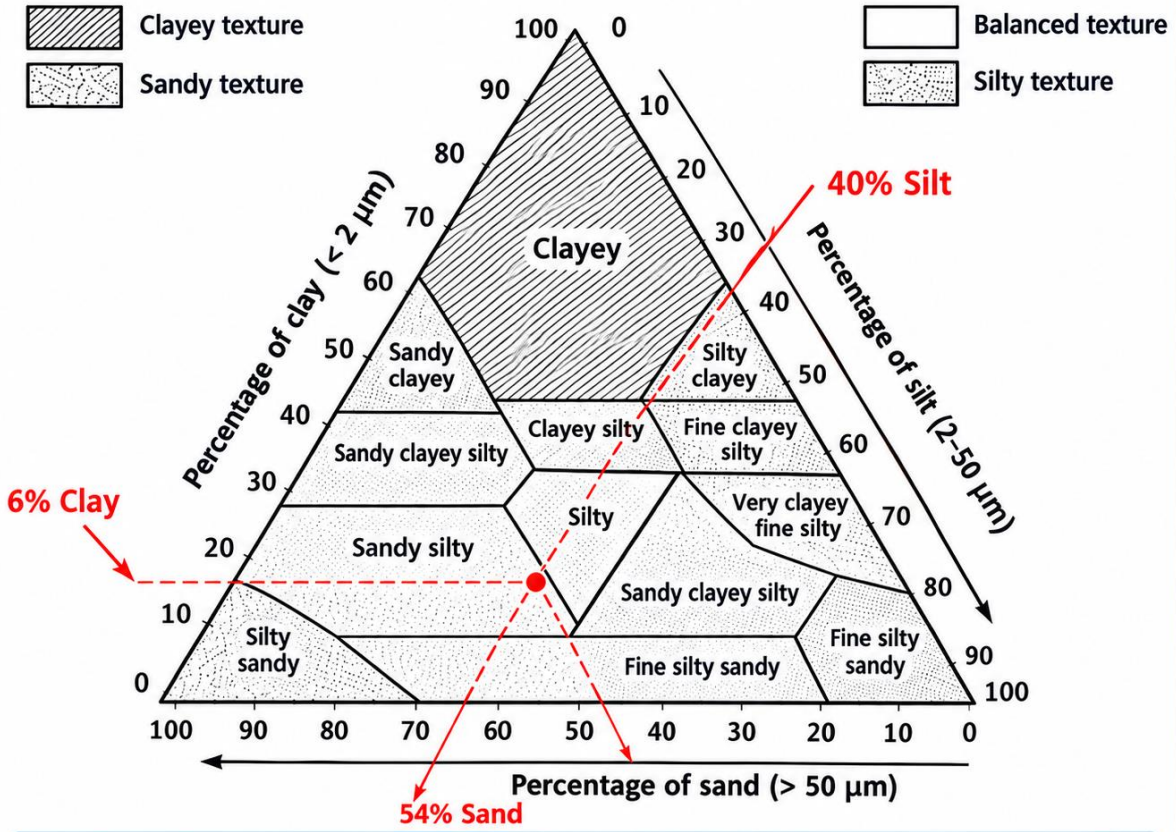
$$\% \text{ clay} = (\text{Clay layer height} \times 100) / \text{Total height}$$

To determine the soil texture, the soil-texture triangle is used. The percentages of clay, silt, and sand are plotted along the three axes. For each point obtained, draw a line parallel to the corresponding axis, following the indicated direction of the arrows. Thus, to plot the silt percentage, locate the value on the silt axis and draw a line parallel to the clay axis. For sand, the line should be drawn parallel to the clay axis, while for clay, the line should be drawn parallel to the sand axis.

-The soil texture class is then determined by referring to the following table :

Soil Texture	**% Sand**	**% Silt**	**% Clay**
Sandy soils	70% and above	0–30%	0–15%
Silty soils	0–20	≥80	0–15
Clayey soils	0–45	0–40	≥25
Loamy soils	40–60	30–50	15–25

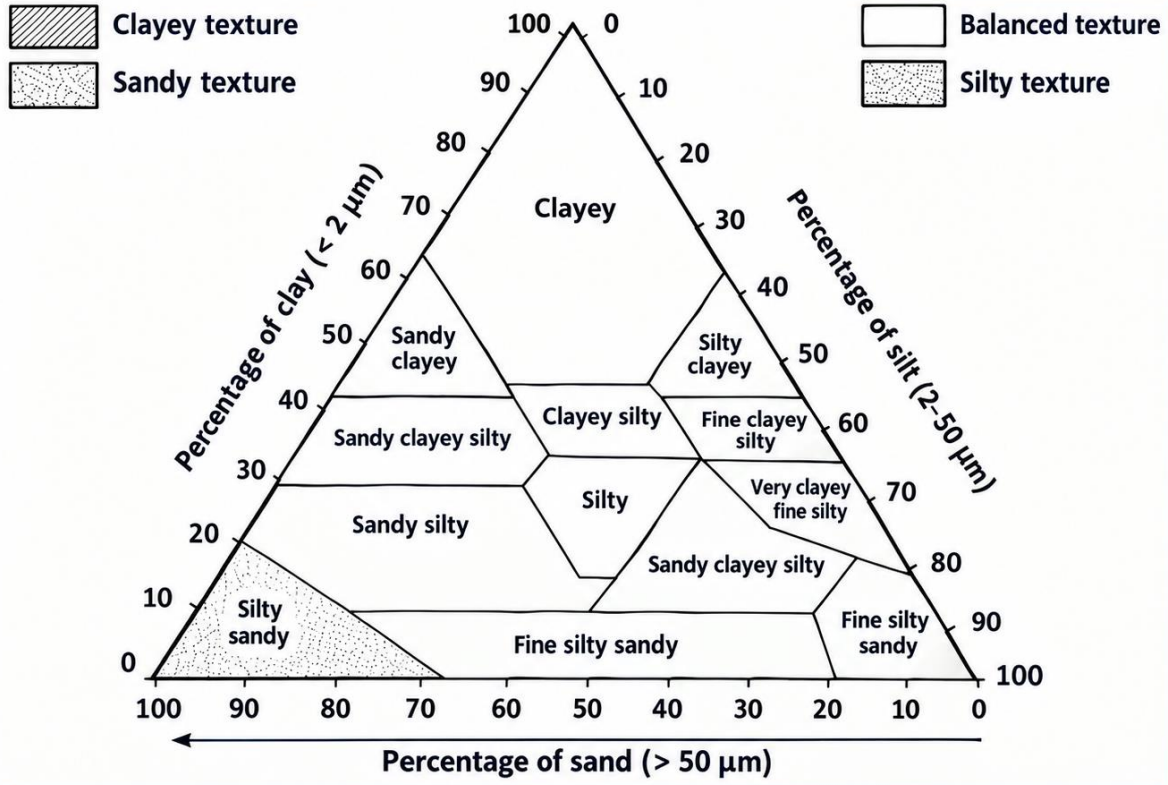
1. Worked example



Sample: Sand = 54% | Silt = 40% | Clay = 6%

Soil texture class: Sandy silty

2. Student exercise



Sample: _____

Sand: _____ % Silt: _____ % Clay: _____ %

Soil texture class: _____