Experiment No. 3

Aim: To analyse the size distribution of granular solid by sieve analysis with Ro-Tap® sieve shaker and perform differential and cumulative screen analysis.

Apparatus and materials required:

1. Sand / rock granular solid particles
2. Different sieves of BSS(Bronze standard sieve) size.
3. Weight balance
4. Ro-Tap® sieve shaker

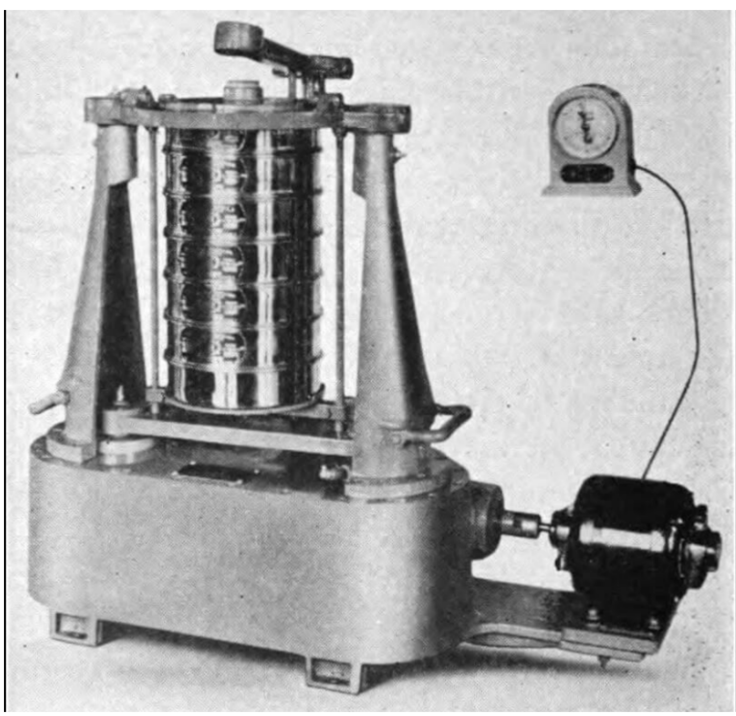
Theory: Sieve analysis is a technique which is used for particles distribution on the basis of its size and shape. Some terms and parameters used in sieve analysis:

Mesh number: It is defined as number of openings per linear inch.

$$\text{Mesh number} \propto 1/(\text{size of screen}) \propto (\text{thickness of wire}) \propto \text{fineness}$$

size of screen: It is the distance between two consecutive wires.

Sieve shaker: Many natural and manufactured products or materials occur in a dispersed form, it may consist of different shape and size of particles. The particles size distribution is responsible for physical, chemical, and mechanical properties. To know the particle size distribution a sieve shaker is used. A common sieve shaker used is Ro-Tap® sieve shaker. The Ro-Tap® stands for "rotating and tapping". The name has became the copright of W.S Tyler™.



Sieve analysis: It is carried out to determine the particle size by using mechanical sieving.

Mass fraction: It is defined as the ratio of mass retained to the total mass taken. The cumulative mass fraction is the sum of all the previous mass fraction values.

Differential screen analysis: An analysis reported in a tabular form is called a differential analysis.The material that is retained on the screen is oversize and the material pass it is undersize. Thus for example, -8 to +10 fraction mean that fraction of the material that passes through 8 mesh screen but is retained on 10 mesh screen.

Cumulative screen analysis: It is obtained from the differential analysis by adding cumulatively, the individual weight fractions of material retained on each screen, starting with that retained on the largest mesh, and tabulating the cumulative sums against the screen opening of the retaining screen of the last to be added.
If we define **ϕ** by the equation of the form:

$$\boxed{\emptyset = \Delta\emptyset_1 + \Delta\emptyset_2 + \cdots + \Delta\emptyset_{N_T} = \sum_{N=1}^{N_T} \Delta\emptyset_N}$$

Where, Δ **ϕ**1, Δ **ϕ**2, ….. are the weight fractions of material retained on screens 1,2,…….. numbered serially from top of the deck.

Procedure:

1. First of all 500 gm of dry sample is taken through a weight balance and then fed in to a Ro-Tap® sieve shaker.

2. The Ro-Tap® sieve shaker has six sieves with mesh no. 4, 7, 10, 14, 28, and 65. The sieves are arranged in ascending order so that 4 mesh no. is placed at the top and mesh no. 65 at the bottom.

3. At the bottom most, the pan is placed.

4. The machine is then started by switching on the knob at bottom .

5. After the completion of 15 minutes, switch off the machine.

6. The residue on different sieves are collected and weighted.

Tabulation:

S.No.	Sieve Numer	Sieve opening	Avg. Particle size (D_{pi})	Mass retained	Mass fraction	Comulative mass fraction	Reciprocal of avg. Particle size ($1/D_{pi}$)

Calculation:

The area under the avg. particle size ($1/D_{pi}$) Vs cumulative mass fraction graph is calculated, and the reciprocal of that area gives the avg. product size.

Conclusion:

From the above experiment, we plotted the graph between reciprocal of avg. particle size ($1/D_{pi}$) vs cumulating mass fraction, and calculated the avg. product size mechanically.