SEDIMENNTATION TEST

Size determination of fine sized particles is usually carried out to 38 microns. However, in sedimentation tests, the size distribution of particles at 1-100 microns can be easily determined. Sedimentation methods is generally based on the sedimentation of solid particles in liquid or gas medium with the help of gravity forces. In a fluidized medium, light or finer sized particles sediment slower than denser and coarser sized particles. Therefore, in a fluidized medium, sedimentation velocities also give an information about the particle sizes. Particles in a sedimentation medium, reaches to a maximum sedimentation speed and continue sedimentation with that speed. The period for maximum sedimentation speed mostly depends on the particle size.

During sedimentation process, for obtaining homogenous distribution of particles, and also in order to prevent the coagulation or flocculation of these systems, specific dispersants are used. For a sedimentation test, particles should be mixed in a liquid in a narrow and cylindrical container. Approximately 1 gr sample put into this container and after shaking, all particles put into a flat plate. It can be well observed that, coarse particles sediments faster compared to finer particles to the bottom of container. According to Stokes rule, sedimentation velocity (v) can be defined for spherical particles as shown below.

$$V = (\gamma - \rho)^{*} g^{*} d^{2} / 18\,\eta = h / t$$

In this equation,

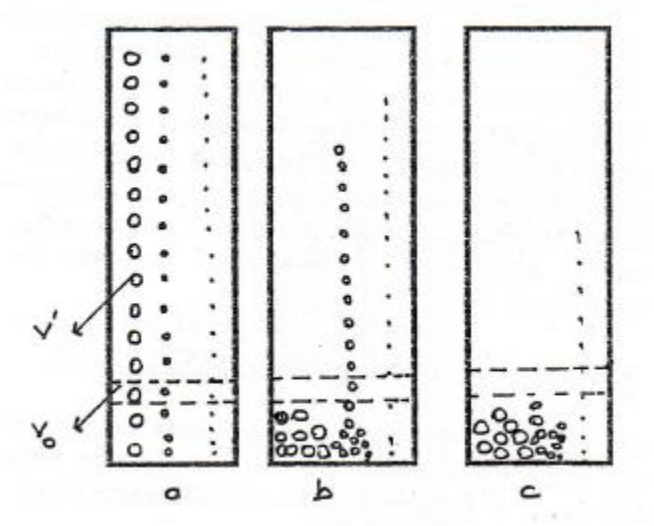
d; Stokes diameter (cm)
γ; The density of solid particle (g/cm3)
ρ; The density of liquid (g/cm3)
g; Gravity force (cm/sn2)
μ; The viscosity of liquid (g/ cm.s)
h; The height of sedimentation (cm)
t; Sedimentation time (s)

However, this equation is only valid for spherical particles and in the ideal conditions of which free sedimentation formed. It can also be used for a specific particle size range (1-60 microns) in laminar flow conditions. In this equation, two main forces affects the sediment particle; these are gravity and tensile forces whereas in practice, particles are not spherical. In addition, extreme forces can also effect on particles besides gravity and strength forces (interaction between particles as attractive-repulsive forces-van der Waals forces, Brownian motion and etc.). So, the diameter obtained from Stokes equation is an approximate diameter and called Stokes diameter or sedimentation diameter.

Decantation, Andresane Pippette, photo sedimentation and x-ray sedimentation is the most used methods for precipitation.

Within these ones, decantation method, is the oldest method for analyzing of fine sized particles. This method basically depends on siphoning from a suspension in pre-defined time periods from a scaled cover. After determining the particle sizes and siphoning depth, the precipitation velocities for particles at these fractions can be calculated. In addition, the precipitation time can be also determined with distance and velocity. For the coarsest particle size, following the final precipitation time and distance, siphoning is applied. By this way, particles at that size fraction and coarser ones expelled from container. The same procedure can

be also applied for the fine size fractions. Furthermore, for getting a reliable result, each experiment should be carried out for at least 5 times.



Schematic Presentation of Sedimentation Process

EXPERIMENTAL STUDIES

In this experiment, the particle size distribution of a quartz sample under 100 micron will be used. During experiments, a timer will be used for keeping the time and dispersant will be used for preventing the aggregation of particles. From first graduated cylinder 80 cc (12.4 cm) will be taken in 15 seconds and placed on a watch glass, dried and weighed. The same procedure was applied for second graduated cylinder for 30 seconds, third graduated cylinder for 45 seconds, fourth graduated cylinder for 60 seconds and finally fifth graduated cylinder for 90 seconds.

Stokes diameter (mm)	Weight Amount,gr
74	
55	
45	
38	
30	
Total	

The particle size distribution of samples

Size Range, mm	Weight, gr	Weight, %	Oversize, %	Undersize, %
Total				

THE EVALUATION OF RESULTS

a) Give a brief literature review about sedimentation processes and write your references in the end of your report.
b) Explain the experimental studies for each step.
c) Draw the particle size distribution of samples based on the results of experimental studies.