INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR
Department of Civil Engineering
Soil Mechanics Laboratory

HYDROMETER ANALYSIS

IS: 2720 (Part 4) – 1985 (Reaffirmed-2006)

THEORY:

Soil gradation is the distribution of different particle size expressed as a percent of the total dry weight. The results of grain size analysis are shown graphically in the form of a grain size distribution curve, in which the cumulative percentages finer are plotted against the particle size in the semilogarithmic scale. The grain size distribution (GSD) of soil is determined by conducting three tests: Wet sieving, Dry sieving and **Hydrometer analysis**.

NEED AND SCOPE:

The results of grain size analysis are used for the soil classification. GSD curves are also used in the design of earth dam filter to determine its suitability.

APPARATUS REQUIRED:

1. Glass cylinders of 1000-ml capacity
2. Thermometer
3. Hydrometer
4. Electric mixer with dispersing cup
5. Balance sensitive to ± 0.01g
6. Stop watch
7. Beaker

RE-AGENTS REQUIRED:

Dispersing solution- 4% (Dissolve 5 g of sodium hexa-metaphosphate in de-ionized water of 125 ml)

PROCEDURE:

Hydrometer Analysis:

1. Take 40 gm of the oven dry soil passed from 75-micron sample after removing soluble salts and organic matter if any.
2. It is then mixed with 4% solution of dispersing agent in water to get a known amount of suspension by volume and stirred well.
3. This suspension should be made 24 hrs before testing.
4. After 24 hours, the suspension is again mixed using Electric mixer with dispersing cup.
5. Following stirring with mixer, the suspension which is made up to 1000 ml in the measuring cylinder is turned end to end for even distribution of particles before the time‘t’ begins to be measured.
6. The hydrometer readings are recorded at regular intervals as indicated in the data sheet. From the data obtained the particle size distribution curve is plotted in the semi-logarithmic graph sheet along with the dry sieve analysis results.

CORRECTIONS (INDIVIDUAL):

Meniscus Correction (C_m):

Since the suspension is opaque, the readings will be taken at the top of the meniscus while the actual should be from the bottom of the meniscus. It is constant for a hydrometer (Always positive).

Temperature Correction (C_t):

If the temperature is less than 27^0C, the correction is negative and vice-versa. Temperature should be measured from starting till end of the tests at regular intervals and are averaged. Then it is compared with the standard temperature (27^0C).

Dispersion Agent Correction (C_d):

Addition of Calgon always increases the specific gravity of the specimen. Hence, this correction is always negative.

ALTERNATIVE CORRECTIONS (COMBINED):

***Composite Correction for Dispersion Agent and Temperature*, ($C_t - C_d$):**

Insert the hydrometer in the comparison cylinder containing dispersant solution in distilled water with the same concentration as used for making the soil suspension. The Composite correction ($C_t - C_d$) is negative of the hydrometer reading corresponding to the top meniscus. It has to be taken every 30 minutes throughout the test.

PRESENTATION OF DATA:

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1. Sample No:
2. Soil's specific gravity oil (G_s) =
3. Weight of oven dried soil
   In suspension (W_S) = 40 g
4. Hydrometer No. =
5. Dispersing agent correction (C_d) =
6. Temperature correction (C_t) =
7. Meniscus correction (C_m) =
8. Cross-sectional area of the jar =
9. Weight of soil for sieve analysis (W) = 500 g
10. Weight passing from 0.075 mm sieve (W_f) =

Actual time in IST	Elapsed time 'T' (in min)	Hydrometer Reading (R_H)	$R'_{H/} = (R_H + C_m)$	$R = R'_H + (C_t - C_d)$	L, Effective Depth [See Chart]	K See Table II	L/T (L in cm & T in min)	√L/T	Particle size $D = K\sqrt{L/T}$ (in mm)	Percent Finer N' %	% Finer on the total wt. N
	30 sec										
	1 min										
	2 min										
	5 min										
	10 min										
	15 min										
	30 min										
	1 hr.										
	2 hrs.										
	4 hrs.										
	8 hrs.										
	24 hrs.										

$$N' \% = \frac{G_S \times R}{(G_S - 1) \times W_S} \times 100$$

Where G_S = Specific Gravity of Soil
W_S = Dry Wt. of Soil sample

$$N \% = \frac{W_f}{W} \times N' \%$$