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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

STANDARD: IS: 2386 (Part 1) -1963

- This standard covers the procedure for the determination of Particle size distribution of Fine & Coarse and all-in-aggregates by sieving or screening.

APPARATUS/EQUIPMENT:

1. Sieves- Sieves (Conforming to IS:460-1962) of size 63mm, 50mm, 40mm,31.5mm, 25mm, 20mm, 16mm, 12.5mm, 10mm, 6.3mm, 4.75mm, 2.36mm, 1.18mm, 600-micron, 300 micron, 150 microns, 75micron.
2. The balance or scale shall be such that it is readable and accurate to 0.1 percent of weight of the test sample.
3. Sieve shaker and Riffler sampler.
4. Thermostatically controlled oven with maintain a temperature of 100^{o}C to 110^{o}C.

TEST SAMPLE:

- The weight of the sample available shall not be less than the weight given in the table below. The sample for sieving shall be prepared from the larger sample either by quartering or by means of sample divider.

Maximum Size present in Substantial proportions (mm)	**Minimum weight of sample required for quartering (Kg)**
63 & 50	100
40 & 25	50
20 & 16	25
12.5	16
10.0	6
6.3	3

- Minimum weight of sample required for Sieve analysis after Quartering shall be as follows.

Maximum Size present in Substantial proportions (mm)	**Minimum weight of sample required for Sieve analysis (Kg)**
63	50
50	35
40 & 31.5	15
25	5
20 & 16	2
Maximum Size present in Substantial	**Minimum weight of sample required**

proportions (mm)	for Sieve analysis (Kg)
12.5	1
10	0.5
6.3	0.2
4.75	0.2
2.36	0.1

PROCEDURE

- Bring the sample to an air-dry or oven dry 100°C to110°C condition before weighing and sieving.
- Weight the air-dry sample and sieve successfully on the appropriate sieves starting with the largest.
- Each sieve shall be shaken separately over a clean tray until not more than a trace passes, but in any case, for a period of not less than 2 minutes.
- Shake with a varied motion so that the material is kept moving over sieve surface in frequently changing directions.
- Material shall not be forced through the sieve by hand pressure but on sieves coarser than 20 mm, placing of particles is permitted.
- Light brushing of the underside of sieve with a soft brush may be used to clear the sieve openings.
- On completion of sieving the material retained on each sieve together with any material cleaned from the mesh, shall be weighed.

-- End of SOP –

DETERMINATION OF BULK DENSITY

STANDARD: IS: 2386 (Part 3) -1963

- This standard covers the method of test deals with the procedure for determining unit weight or bulk density and void of aggregates.

APPARATUS/EQUIPMENT

1. Balance sensitive to 0.5% of the wt. of sample to be weighed.
2. Cylinder Metal Measure of capacity 3 lit for Fine Aggregate.
3. 15 lit and 30 lit for Coarse Aggregate.
4. Tamping rod of 16mm diameter with 60 cm long rounded at one end.

PROCEDURE

- Take representative sample of aggregate as required for the test according to maximum size of aggregate and the container required from Table below.
- Determine the empty weight (M_1) and the volume (V) of the cylinder at27°C.

Size of containers for bulk density

Size of largest particle in mm	Nominal capacity	Inside diameter cm	Inside Height cm	Thickness of metal in mm
Under 4.75	3	15	17	3.15
Over 4.75 to 40	15	25	30	4.00
Over 40	30	35	31	5.00

RODDED/COMPACTED WEIGHT

- Fill the container in three equal layers, each layer being subjected to 25 strokes with the rounded end of the tamping rod.
- Struck off the surplus aggregate using the tamping rod as a straight edge and weigh (M_2).

LOOSE WEIGHT

- Over flow the container by pouring the material from a height of not exceeding 5 cm above the top of the cylinder.
- Struck off the surplus aggregate using the tamping rod as a straight edge and weigh (M_3).

-- End of SOP –

DETERMINATION OF INDICES (FLAKINESS AND ELONGATION INDEX)

STANDARD: IS: 2386 (Part 1) -1963

- This standard covers the method of test lays down the procedure for determining the flakiness index of coarse aggregate.

DEFINITION

- The Flakiness Index of aggregates is the percentage by weight of particles whose least dimension (thickness) is less than 0.6 times their mean dimension.
- The Elongation Index of aggregates is the percentage by weight of particles whose greatest dimension (length) is greater than 1.8 times their mean dimension.

APPARTUS

- Standard thickness gauge.
- Standard length gauge.
- IS sieves 63mm, 50mm, 40mm, 31.50mm, 25mm, 20mm,16mm, 12.50mm,10mm and 6.30mm.
- Balance of capacity 15 kg and sensitivity 1 gm and shall have an accuracy of 0.1% of the weight of the test sample.
- Thermostatically controlled oven with maintain a temperature of 100°C to 110°C.

PROCEDURE

- Take representative sample of aggregates from the stock pile.
- Dry the whole sample in the oven to a constant weight at temperature of 100°C to 110 °C and cooling room temperature.
- Sieve the whole sample through the sieves mentioned in the columns (1) and (2) of the below table.

FLAKINESS INDEX

- Take minimum of 200 pieces from each fraction and weigh (A).$a_1+a_2+a_3+a_4+a_5+\ldots\ldots\ldots=A$.
- Separate flaky material from each fraction by gauging through the standard thickness gauge.
- Weigh the flaky material passing through the specified gauge from each fraction $b_1+b_2+b_3+b_4+b_5+\ldots\ldots\ldots=B$.

ELONGATION INDEX

- Take minimum of 200 pieces from each fraction and weigh (F).

- Separate the elongated material from each fraction by gauging through the standard-length gauge.
- Weigh the elongated material passing through the specified gauge from each fraction $C_1+C_2+C_3+C_4+C_5+\ldots\ldots\ldots= C$.

Dimension of Thickness and Length Gauges

Size of Aggregate		Thickness Gauge * (mm)	Length Gauge ↑ (mm)
Passing Through IS Sieve	Retained on IS Sieve		
(1)	(2)	(3)	(4)
63 mm	50 mm	33.90	--
50 mm	40 mm	27.00	81.0
40 mm	31.5 mm	21.5	64.4
31.5 mm	25 mm	16.95	50.9
25 mm	20 mm	13.50	40.5
20 mm	16 mm	10.80	32.4
16 mm	12.5 mm	8.55	25.6
12.5 mm	10 mm	6.75	20.2
10 mm	6.3 mm	4.89	14.7

* This dimension is equal to 0.6 times the mean sieve size

↑ This dimension is equal to 1.8 times the mean sieve size

-- End of SOP –

DETERMINATION OF AGGREGATE IMPACT VALUE

STANDARD: 2386 (Part 4) -1963

- This standard covers the method for determining the aggregate impact value of coarse aggregates.

DEFINATION:

- Aggregate Impact value is the ratio between the weights of the fines passing 2.36 mm sieve and the total sample.
- The 'aggregate impact value' gives a relative measure of the resistance of an aggregate to sudden or impact, which in some aggregate differs from its resistance to a slow compressive load.

APPARATUS:

- Standard Impact Testing Machine.
- Cylindrical steel cup 6.3 mm thick and having internal diameter of 75 mm and depth of 50 mm.
- Cylindrical steel cup 6.3 mm thick and having internal diameter of 102 mm and depth of 50 mm.
- Hammer weight 13.5 to 14.0 Kg.
- Hammer lower end of which shall be cylindrical in shape,100 mm dia. and 50 mm long.
- A straight metal tamping rod of circular cross section 10mm diameter and 230mm long, rounded at one end.
- 12.5 mm, 10mm and 2.36 mm IS sieves.
- Balance of capacity not less than 500 gm and sensitivity 0.1 gm.
- Thermostatically controlled oven with maintain a temperature of 100°Cto110°C.

PROCEDURE:

- Take re-presentative sample of aggregates passing 12.5 mm IS sieve & retained on10 mm IS sieve.
- Keep the sample in the oven for a period of four hours till the time the weight becomes constant a temperature of 100^{o}C to 110^{o}C and cool to room temperature.
- Fill the cup in three equal layers, each layer being subjected to 25 strokes with the rounded

end of the tamping rod.

- Struck off the aggregates using tamping rod as a straight edge.
- Determine the net weight (A) of the aggregate in the cup.
- Now transfer the material in to the cup of Impact machine, which is fixed firmly in position.
- Compact the material in the cup by a single tamping of 25 strokes with the tamping rod.
- Subject the test sample to a total of 15 blows by the hammer of the Impact machine each being delivered at an interval of not less than one second and from a height of 380±5 mm above the upper face of the aggregate.
- Remove the crushed aggregates from the cup and sieve the whole sample on the 2.36mm IS sieve till no further significant amount passes through the sieve in one minute& weigh (B).
- Weigh the material that has passed through the sieve(C).
- If the total weight (B+C) is less than the original weight (A) by more than one gram, discard the result and conduct a fresh test.

PRECAUTION

- Care shall be taken that the Impact machine shall rest without wedging or packing upon the level plate, block or floor, so that it is rigid and the hammer guide collars are vertical.

-- End of SOP –

DETERMINATION OF ABRASION VALUE

STANDARD: 2386 (Part 4) -1963

- This standard covers the method for the determining the aggregate abrasion value of coarse aggregates.

APPARATUS:

- Abrasion Testing Machine.
- Abrasion charge of dia. approximately 48 mm and weight (390 – 445) g.
- IS sieves 80.0mm, 63mm, 50mm, 40mm, 25mm, 20mm,12.50mm, 10mm, 6.30mm, 4.75mm & 1.70mm.
- Balance of capacity 15 kg and sensitivity 1 gm.
- Thermostatically controlled oven with maintain a temperature of 100°Cto110°C.

PROCEDURE:

- The Aggregate shall be taken as per the grading of below Table and kept in oven105 °Cto110°C for 24 hours and weighed (A).
- The sample to be tested shall be put in Abrasion Testing Machine and the number of abrasive charges shall be put according to the grading requirement of the aggregate.
- The test sample and the abrasive charge is to be placed in the machine and rotated at a speed of 20 to 33 rev/min.
- The machine shall be allowed to rotate for 500 revolutions for grading A, B, C, D and 1000 revolutions for grading E, F and G.
- After the completion of the test, the sample shall be taken out of the machine and sieved 1.7 mm IS sieve (B).

Sieve Size (Square Hole)		**Weight in gm of test sample for grade.**						
Passing mm	**Retained on mm**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
80	*63*	–	–	–	–	*2500**	–	–
63	*50*	–	–	–	–	*2500**	–	–
Sieve Size (Square Hole)		*Weight in gm of test sample for grade.*						
Passing mm	**Retained on mm**	**A**	**B**	**C**	**D**	**E**	**F**	**G**

50	40	_	_	_	_	5000*	5000*	_
40	25	1250*	_	_	_	_	5000*	5000*
25	20	1250*	_	_	_	_	_	5000*
20	12.5	1250*	2500*	_	_	_	_	_
12.5	10	1250*	2500*	_	_	_	_	_
10	6.3	_	_	2500*	_	_	_	_
6.3	4.75	_	_	2500*	_	_	_	_
4.75	2.36	_	_	_	5000*	_	_	_

*Tolerance of ±2% permitted.

-- End of SOP –

DETERMINATION OF AGGREGATE CRUSHING VALUE

STANDARD: 2386 (Part 4) -1963

- This standard covers the method for the determining the aggregate crushing value of coarse aggregates.

APPRATUS

- Compression Testing Machine.
- Calibrated Sieves of size 12.5mm; 10mm; 2.36mm.
- Balance readable to an accuracy of 1 gm.
- Measuring cylinder of dia. 11.5 cm and ht. 18 cm.
- Tamping Rod of 16mm dia. and 45 to 60 cm long.
- Thermostatically controlled oven with maintain a temperature of 100°C to 110°C.

TEST SAMPLE

- Take approximately 6.5 kg of sample which is passing through 12.5 mm and retained in 10mm sieve after that keep the sample in oven for the period of 4hrs at 100°Cto110°Cand cool to room temperature.
- Now fill the sample in the measuring cylinder in three layers, each layer being tamped 25 times.
- Now level the sample in the measuring cylinder.
- Note down the weight of the Sample (A).

PROCEDURE

- Fix the Crushing Cylinder in the base plate and put the weighed sample in the mould in 3 layers and tamp for 25 strokes in each layer.
- Keep the plunger in position on top of the aggregate.
- Place the sample in Compression Testing Machine, Centre it and apply a uniform load of 40 tons reached in 10 minutes.
- Release the load.
- Take the sample out of the mould and sieve through 2.36mm.
- The fraction passing through 2.36mm sieve shall be noted down (B).
- Two trials shall be done and the mean value to be reported.

-- End of SOP --

DETERMINATION OF SPECIFIC GRAVITY AND WATER ABSORPTION

STANDARD: 2386 (Part 3) -1963

- This standard covers the method for the determining the specific gravity, apparent specific gravity and water absorption of aggregates for coarse aggregates.

DEFINITION:

- Specific gravity is the ratio of the mass of a given volume of the substance to the mass of an equal volume of water.

APPARATUS:

1. Balance of capacity not less than 3 kg with accuracy of 0.5 gm.
2. Oven to maintain a temperature of 100^{o}Cto110^{o}C.
3. A watertight container in which the basket may be freely suspended.
4. Two dry soft absorbent cloths.
5. Tray for drying the sample.
6. A wire basket of not more than6.3 mm mesh.

PROCEDURE:

- A sample of not less than 2000 g of the aggregate shall be tested.
- Coarse aggregate sample about an aggregate & wash thoroughly & remove the fines with a cover of at least 5 cm of water above the top of the basket
- Keep the sample to be tested in water at 22°C to 32°C for 24 ± ½ hour and after immersion the entrapped air shall be removed from the sample by lifting the basket containing it 25 mm above the base of the tank and allowing it to drop 25 times at the rate of about one drop per second.
- After 24 hours of process, weight the sample in water as A.
- Empty the sample from bucket and replace the bucket in water and weight it as B.
- Drain the water and place the sample on dry cloth gently dry the sample and again transfer them to another dry cloth and make them surface dry for 10 mins, transfer it to a metal tray & weight it as C.
- The sample kept in the tray should be kept in oven for 24 ± ½ hour at 100°C -110°C.

- Take the sample from the oven and cool it to room temperature.
- Note down the weight of aggregate (D).

CALCULATION

I. Specific Gravity = $\boldsymbol{D/[C-(A-B)]}$

II. Water Absorption (%) = $\boldsymbol{(C-D/D)*100}$

- Here,
  A = Total weight of Sample + Wire Basket in water.
  B = Weight of Empty Wire Basket in Water.
  C = Saturated Surface Dry weight of aggregate.
  D = Oven Dry weight after 24 hours.

PRECAUTION

- The difference in temperature of the water in the pycnometer during the first and second weighing shall not exceed 2°C.

-- End of SOP –

DETERMINATION OF SOUNDNESS OF AGGREGATES

STANDARD: IS: 2386 (Part 5) -1963

- This standard covers the method of test deals with the procedure for determining the soundness of aggregates.

APPARATUS

- Sieves of size 80mm, 63mm, 50mm, 40mm, 31.50mm, 25mm, 20mm, 16mm, 12.50mm, 10mm, 8mm, 4.75mm, 4mm, 2.36mm, 1.18mm, 600microns, 300microns and 150 microns with square openings conforming to IS:460.
- Containers for immersing the samples shall be perforated so as to permit free access of the solution from the sample and drainage of the solution from the sample without loss of aggregate.
- Arrangements shall also be available to ensure that the volume of the solution in which samples are to be immersed shall be at least five times the volume of the sample immersed at any one time.
- Balance of capacity 500 gm sensitivity to 0.01 gm.
- Balance of capacity 10 kg sensitivity to 1 gm.
- Thermostatically controlled oven capable of being maintained at $105^{o}C$ to $110^{o}C$.
- The rate of evaporation, at this range of temperature shall be at least25gm/hour for four hours which period the doors of the oven kept closed.

SODIUM SULPHATE SOLUTION

- Prepare saturated solution of sodium sulphate technical grade, conforming to IS:255- 1950 or an equivalent grade of the salt of either the anhydrous (Na_2SO_4) or the crystalline ($Na_2SO_4.10\ H_2O$) form in water at temperature of 25 to $30^{o}C$.
- For making of the solution, 420gms of anhydrous salt or 1300 gm of decahydrate salt per liter of water are sufficient for saturation at $28^{o}C$.
- The mixer shall be thoroughly stirred during the addition of salt and the solution shall be stirred at frequent intervals until used.
- The solution shall be cooled to a temperature of $27\pm2^{o}C$ and maintained at that temperature for at least 48 hours before use.

- Salt cakes if any shall be broken and sp. gravity of the solution shall be determined.
- When used, the solution shall have specific gravity of 1.151 to1.174.
- Discolored solution shall be discarded, or filtered and checked again for specific gravity.

Fine Aggregates

- An aggregate passing 4.75 mm IS Sieve shall be considered as fine aggregates.
- Sample shall be of such size that it will yield not less than 100 gm of each of the sizes shown in Table 1.

Coarse Aggregates

- Aggregates of size more than 4.75 mm shall be considered as coarse aggregates.
- Samples has been of such size that it will yield not less than following amounts of different sizes, mentioned in **Table 2** which shall be available in amounts of 5% or more.

Table 1

Passing IS sieve	Retained on IS sieve
600 microns	300 microns
1.18 mm	600 microns
2.36 mm	1.18 mm
4.75 mm	2.36 mm
10 mm	4.75 mm

Table 2

Size	Yield
10 mm to 4.75 mm	300 g
20 mm to 10 mm	1000 g (consisting of 12.5 mm to 10 mm = 33% and 20 mm to 12.5 mm = 67%)
40 mm to 20 mm	1500 g (consisting of 25 mm to 20 mm = 33% and 40 mm to 25 mm = 67%)
63 mm to 40 mm	3000 g (consisting of 50 mm to 40 mm = 50% and 63 mm to 50 mm = 50%)
80 mm and larger	3000 g

All in Aggregates

- Separate all in aggregates in to two major fractions such as smaller than 4.75 and coarser than 4.75.
- The former shall be fine aggregates and the latter as coarse aggregates.

Preparation of Test Sample Fine Aggregates

- Thoroughly, wash fine aggregates on 300 micron IS sieve and dry to constant weight at 105°C to 110°C & separate in to different sizes through the sieves mention in **Table 1.**

Coarse Aggregates

- Thoroughly wash and dry aggregates to a constant weight in a no vent temperature of 105°C to 110°C.
- Separate in to desired fraction by sieving through the sieves mention in **Table 2**.
- Weight the required size of fraction and place in to separate containers.
- In the case of fraction coarser than 20 mm the number of particles shall also be counted.

PROCEDURE

Storage of Sample in Solution

- Immerse the samples in the prepared solution of sodium sulphate for not less than 16hrs nor more than 18hrs in such a manner that solution covers the sample to a depth of at least 15 mm.
- Cover the containers to reduce the evaporation & to prevent accidental condition of extraneous substances.
- The temperature in the solution shall be maintained within 27±1°C throughout the immersion period.
- After the immersion period remove the aggregates from the solution and permit to drain for 15 ± 5 minutes and place in the oven at a temperature of 105 to 110°C until it attains a constant weight.
- During this period remove the aggregates from the oven cool to room temperature and weigh at intervals not less than 4 hours nor more than 18hours.
- Constant weight may consider to have been achieved when two successive weights for any one sample shall not differ by more than 0.1gm for fine aggregates and 1gm for coarse aggregates.
- After the constant weight has been achieved remove the aggregates from the oven and cool to room temperature.
- Again, immerse the aggregates in solution for next cycle and repeat the same procedure as described above.
- The number of cycles to be conducted shall be as per specifications.
- After the completion of the final cycle cool the sample and wash the sample free from sulphate.

- This may be determined when there is no more reaction of the washed water with barium chloride. (When there is no white precipitation when barium chloride is added to washed water, it can be said that there is no sulphate with washed water)
- Dry each faction of sample in an oven at a temperature of 105 to 110°C to constant weight and weigh.
- Sieve the fine aggregates over the same sieve on which it was retained before the test.
- Sieve the coarse aggregates over the sieves of sizes shown in Table 3 for appropriate size of particle.

Table 3

Size of aggregates	Sieve Size used to determine loss
63 to 40 mm	31.50 mm
40to20mm	16 mm
20to10mm	8 mm
10to 4.75 mm	4 mm

- Exam in visually each size of aggregates to see if the any evidence of excessive platting, crumbling or disintegration of the grains.
- Conduct a combined sieve analysis of all the material subject to the above test to note the variation from the original grain size analysis of the sample.

- End of SOP –

DETERMINATION OF TEN PERCENT FINES VALUE

STANDARD: IS:2386 (Part 4) -1963

DEFINITION

- Ten percent fines value is defined as the load taken by the soaked sample at ten percent of fines.

APPARATUS

- Compression Testing Machine.
- Calibrated Sieves of size 12.5mm; 10mm; 2.36mm.
- Balance readable to an accuracy of 1 gm.
- Measuring cylinder of dia. 11.5 cm and ht. 18 cm.
- Tamping Rod of 16mm dia. and 45 to 60 cm long.
- Thermostatically controlled oven with maintain a temperature of 100°C to 110°C.

TEST SAMPLE

- Take approximately 6.5 kg of sample which is passing through 12.5 mm and retained in 10mm sieve after that keep the sample in oven for the period of 4hrs at 100 °C to 110°C and cool to room temperature.
- Now fill the sample in the measuring cylinder in three layers, each layer being tamped 25 times.
- Now level the sample in the measuring cylinder.
- Note down the weight of the Sample (A).

PROCEDURE

- Fix the Crushing Cylinder in the base plate and put the weighed sample in the mould in 3 layers and tamp for 25 strokes in each layer.
- Keep the plunger in position on top of the aggregate.
- Place the sample in Compression Testing Machine.
- The load shall be applied at a uniform rate so as to cause a total penetration of the plunger in 10 minutes.
    - 15.0mm-rounded or partially rounded aggregates

- 20.0mm-normal crushed aggregates
- 24.0mm-honeycombed aggregates

❖ After reaching the required maximum penetration.

❖ Released the load, removed the material and sieved on 2.36mm.

❖ The fines passing of the weight and this weight of percentage in range of 7.5 % to 12.5%.

❖ Repeat the complete test shall be made at the loads that gives a percentage fines value within the range of 7.5% to 12.5%.

CALCULATION

10% fine value = $\frac{14*X}{Y+4}$

PRECAUTION

❖ The nearest whole number for loads of 10 tones more, the nearest 0.5 tone for loads of less than 10 tones.

-- End of SOP –

DETERMINATION OF ALKALI REACTIVITY OF COARSE AGGREGATES

STANDARD: IS: 2386 (Part 7) – 1963

- This method of test covers a chemical method for determining the potential reactivity of an aggregate with alkalis in Portland cement concrete as indicated by the amount of reaction during 24 h at 80 °C between 1 N sodium hydroxide solution and aggregate that has been crushed and sieved to pass a 300-micron IS Sieve and be retained on a 150-micron IS Sieve.

APPARATUS

1. Balance
2. Sieves (300 &150 mm)
3. Reaction Containers
4. Constant temp. bath
5. Crushing Equipment

REAGENTS

1. NaOH
2. Conc HCL
3. H_2SO_4
4. HF
5. Phenolphthalein Indicator.

PROCEDURE

- Prepare the test sample from representative portion of the aggregate by crushing so as to pass a 300-micron IS Sieve and retain on 150-micron IS Sieve.
- To ensure that all material finer than the 150-micron IS Sieve has been removed, wash the sample over a 150-micron IS Sieve.
- Dry the washed sample at 100 °Cto110 °C. for 20±4 h. Cool the sample and again sieve on the 150-micron IS Sieve.
- Weigh three representative 25.00 ±0.05 g portions of the dry 300-micron to 150-micron test sample. Place one portion in each of three of the reaction containers and add 25 ml of the 1.0 N caustic soda solution.
- To a fourth reaction container, by means of a pipette or burette, add 25 ml of the same caustic soda solution to serve as a blank. Seal the four containers and gently swirl them to liberate trapped air.

- Immediately after the containers have been sealed, place them in a liquid bath maintained at 80±1.0°C After 24±1 h remove the containers from the bath and cool them under flowing water for 15±2 minutes to below 30 °C.
- After the containers have been cooled, open them and filter the solution from the aggregate residue.
- Immediately following the completion of filtration, stir the filtrate to assume homogeneity, then take an aliquot of 10 ml of the filtrate and dilute with water to 200 ml in a volumetric flask. Reserve the diluted solution for the determination of dissolved silica and reduction in alkalinity.
- Transfer 100 ml of the dilute solution to an evaporating dish. add 5 to 10 ml of hydrochloric acid (Sp. Gr. 1.19), and evaporate to dryness on a steam-bath.
- Repeat the above action twice. and then without heating the solution add equal amount of water and 10 ml of HCl. Cover the bowl for 10 min and then dilute it with an equal volume of water.
- Again, evaporate the filtrate in an Oven for 1 hour. Take the residue with 10 to 15 ml of hydrochloric acid (1:1) and heat on the bath. Dilute the solution with an equal volume of hot water and filter it on a filter paper.
- Transfer the filter papers containing the residue to a crucible. Dry and ignite the papers, first at a low heat until the carbon of the filter paper is completely consumed without inflaming, and finally at 1100 to 1200 °C until the weight becomes constant.
- Treat silica thus obtained, which will contain small amounts of impurities., in the crucible with a few drops of water, about 10 ml of hydrofluoric acid, and one drop of sulphuric acid, and evaporate cautiously to dryness. Finally, heat the residue at 1050 to 1100°C for 1 to 2 minutes cool and weigh. The difference between this weight and the weight previously obtained represents the amount of silica.
- Make a blank determination, following the same procedure, using the same amount of diluted solution from the blank and the same amount of' reagents.
- By substituting these values in the required equations, we get silica content.

Reduction in Alkalinity

- Procedure — Transfer a 20-ml aliquot of the dilute solution to a 125-ml flask, add 2 or 3 drops of phenolphthalein solution, and titrate with 0.05 N hydrochloric acid to the phenolphthalein end point.
- By substituting the above value in the required equation, we get R_c Reduction in Alkalinity.

-- End of SOP --