Solids Determination

Introduction:

Solids refer to matter suspended or dissolved in water or wastewater. Solids may affect water or effluent quality adversely in a number of ways. Waters with high dissolved solids generally are of inferior palatability and may induce an unfavorable physiological reaction in the transient consumer. For these reasons, a limit of 500 mg dissolved solids per liter is desirable for drinking waters. Highly mineralized waters also are unsuitable for many industrial applications. Waters high in suspended solids may be esthetically unsatisfactory for such purposes as bathing. Solids analysis are important in the control of biological and physical wastewater treatment processes and for assessing compliance with regulatory agency wastewater effluent limitations.

Total Solids is the term applied to the material residue left in the vessel after evaporation of a sample and its subsequent drying in an oven at a defined temperature (103-105^{0}C). **Total suspended solids** refer to the nonfilterable residue retained by a standard filter disk and dried at 103-105^{0}C. **Total dissolved solids** refer to the filterable residue that pass through a standard filter disk and remain after evaporation and drying to constant weight at 103-105^{0}C.

The environmental impacts of solids are that solids in all forms have detrimental effects on quality since they cause putrifaction problems. Suspended solids exclude light, thus reducing the growth of oxygen producing plants. Solids impair aesthetic acceptability of water.

Objectives:

The objective of this experiment is to determine the various types of solids in tap water, drinking water, and secondary effluent

Materials:

Porcelain dish (100 ml), steam bath, drying oven, muffle furnace, desiccator, Gooch crucible, analytical balance, glass fiber filter disk, filtration apparatus, pipettes, measuring cylinders.

Procedure:

a) Total Solids

1. Ignite a clean evaporating dish at 550^{0}C in a muffle furnace for 1 hr.
2. Cool the dish, weigh and keep it in a desiccator.
3. Transfer carefully 50 ml of sample into the dish and evaporate to dryness on a steam bath.
4. Place the evaporated sample in an oven adjusted at 103^{0}C and dry it for 1 hr.

5. Repeat drying at 103^0C till constant weight is obtained.
6. Determine the total solids with the following formula:

mg/l total solids = ((A-B) * 10^6) / ml sample, where
A = weight of residue + dish
B = weight of dish

b) Total suspended solids:

1. Place a filter disk on the bottom of a clean Gooch crucible.
2. Pour 20 ml distilled water and apply vacuum. Repeat the process two more times.
3. Remove crucible to an oven and dry it for 1 hr at 103^0C.
4. After drying, the crucible is kept in a desiccator.
5. Weigh the crucible and place it on a suction unit.
6. Pour 25 ml of sample. Wash pipette with distilled water and pour the washing also into the crucible.
7. After filtration, dry the crucible at 103^0C for 1 hr
8. Weigh till constant weight is obtained.
9. Determine the total suspended solids with the following formula:

Mg/l total suspended solids = ((A-B) * 10^6) / ml sample

where: A = weight of residue and crucible
B = weight of crucible

c) Total Dissolved Solids:

1. Mg/l total dissolved solids = total solids – total suspended solids

d) Sample Calculation:

Problem: The following data was obtained from the analysis of wastewater from a food processing industry. Find out total solids, total suspended solids, and total dissolved solids.

1. **Total Solids**:

Volume of sample = 50 ml
Weight of dish = 65.7894 g
Weigh of dish and sample = 65.9679g

$$\text{Total Solids} = \frac{(65.9679 - 65.7894) * 10^6}{50} = 3570 \text{ mg/l}$$

2. **Total Suspended Solids**:

Volume of sample = 10 ml
Weight of crucible = 11.8986 g
Weight of crucible and sample = 11.9024 g

$$\text{Total suspended solids} = \frac{(11.9024 - 11.8986) * 10^6}{10}$$

$$= 380 \text{ mg/l}$$

3. **Total Dissolved Solids** = Total Solids – Total Suspended Solids
   Total Solids = (3570 – 380) = 3190 mg/l