

SOLIDS

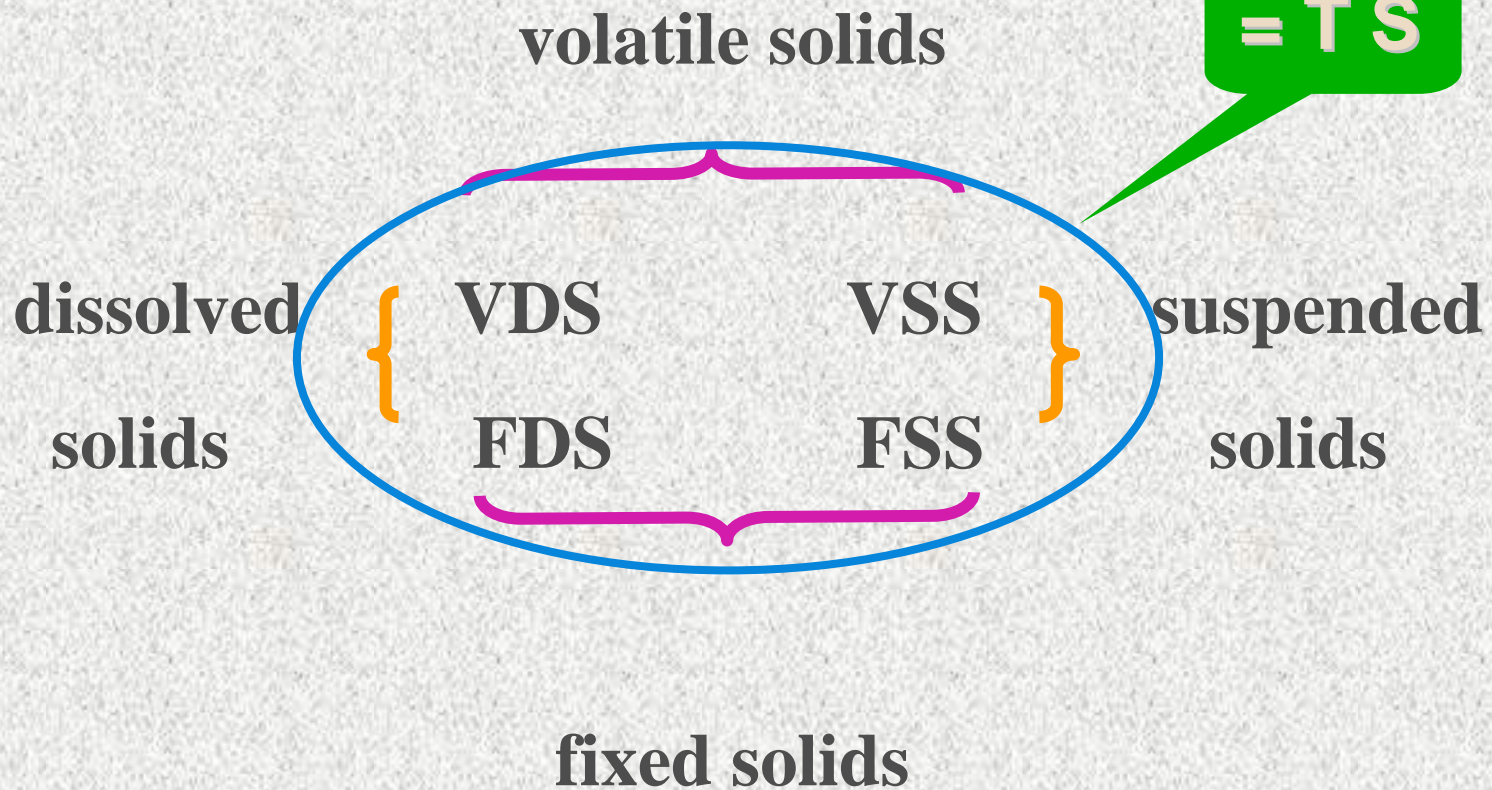
General Considerations

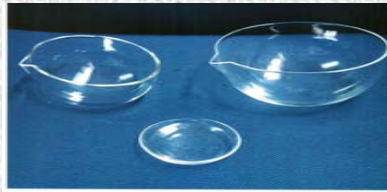
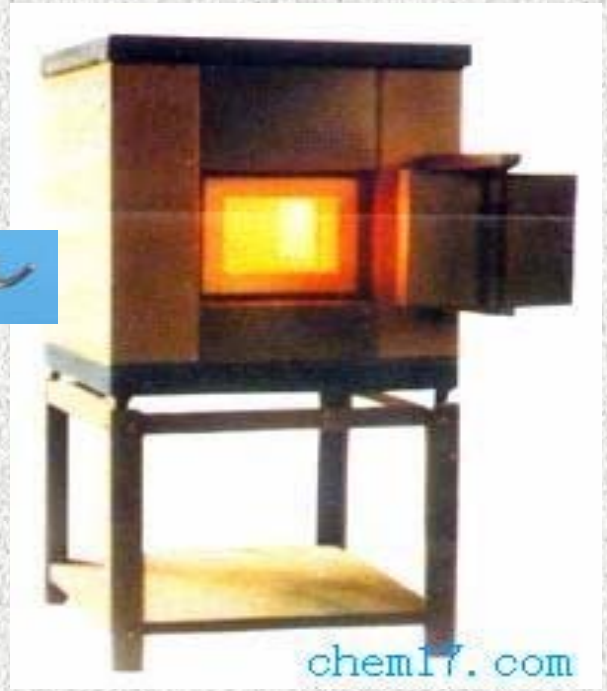
Strictly speaking, solid matter is **all matter except water** that is contained in liquid materials.

The usual definition of solids is that matter that remains as residue upon evaporation and drying at 103-105° C.

In analyzing for solids a wide variety of inorganic or organic materials are encountered, depends on the samples one is analyzing.

Classes of Solids





Dissolved Solids — The portion of solids that passes through a 0.45 μ m filter.

Undissolved Solids — Portion of solids retained by a 0.45 μ m filter, also called **total suspended solids**.

Volatile Solids — The portion of solids that could be oxidized and volatile under 550° C . It could represent the amount of organic solids in water.



Fixed Solids — Residue left after ignition at 550 °C , also called **non-volatile solids**.

Settleable Solids — Solids in suspension that will settle, under quiescent conditions, due to the influence of gravity, within a prescribed time frame. Done by setting in an imhoff cone for 1 hr.

Significance of Solids Determinations

Total Solids —used in **water supply**; are of little value in the analysis of polluted waters and domestic wastewaters; was originally designed to evaluate the amount of polluting matter in wastewaters.

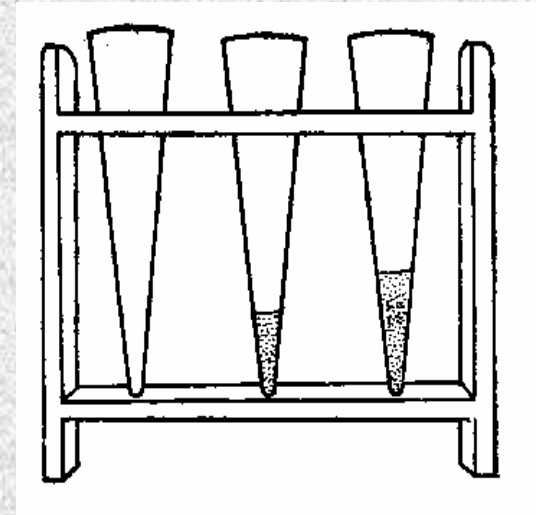
Dissolved Solids —used to help determine whether a water supply is suitable for **domestic use**; important in reuse applications.

Suspended Solids —very important in the analysis of **polluted waters**; in terms of engineering, SS and VSS are used to aid in the analysis of wastewater to determine **raw waste characteristics** and clarifier requirements for primary and secondary treatment needs, etc..

Settleable Solids —used in determine the need for **sedimentation units** and determination of **clarifier efficiencies**.

Determination Methods

All solids test are easy to perform. **Gravimetric methods** are used in almost all tests, except for **settleable solids** and the estimate of **dissolved solids** by specific conductive measurements.



Imhoff cone for settleable solids measurement

Possible Errors

- **Suspended Solids**

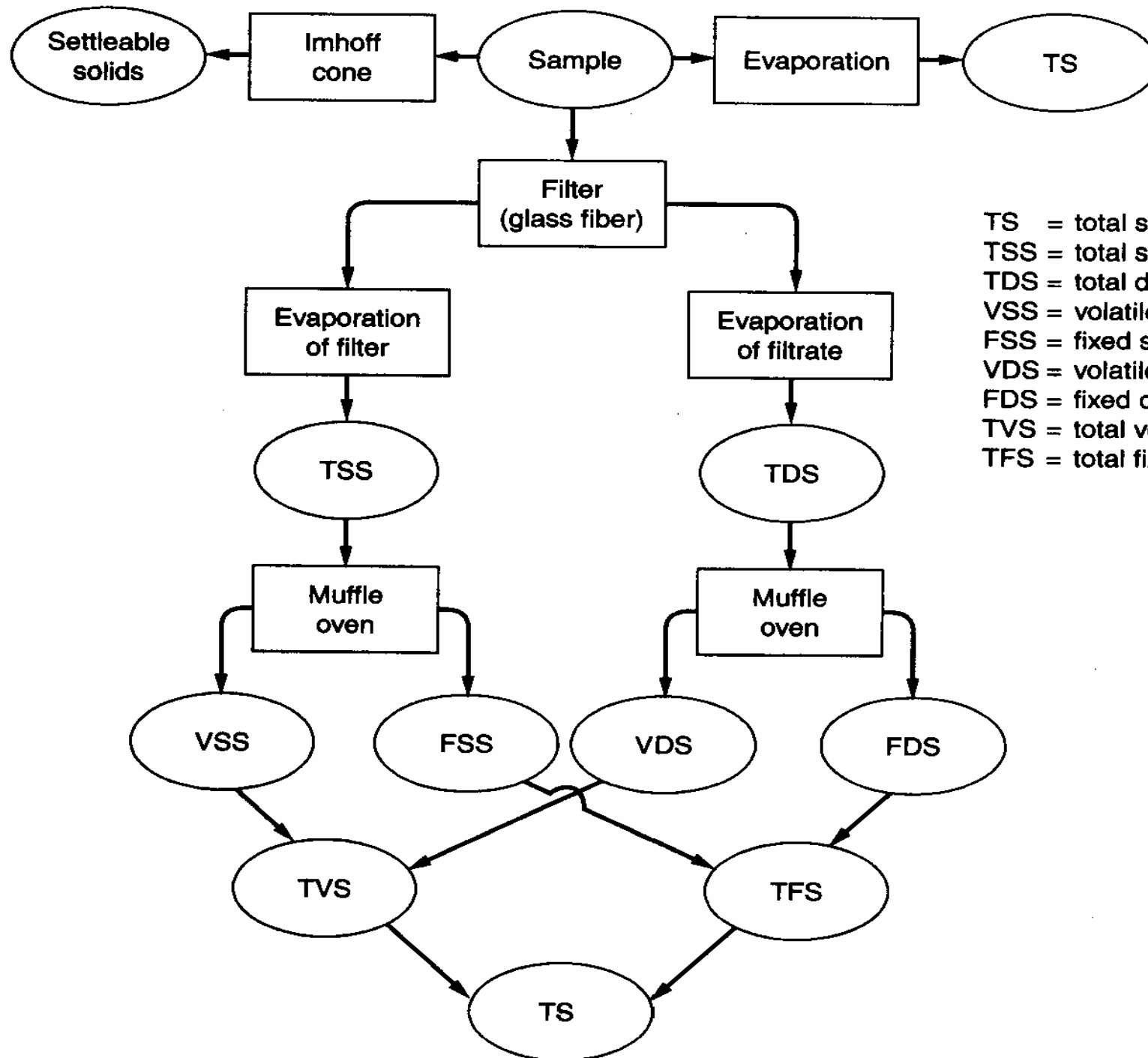
Some solid materials exert a significant vapor pressure at 103-105 °C and are lost with water during evaporation.

● Volatile Solids

The **volatile solids** fraction of the total solids is a measure of **the organic fraction**.

This test is done by igniting the total or dissolved solids fraction at 550°C for 15 minutes. At 550°C , **most organics** are **decomposed** while **most inorganic salts** keep **stable**, with the **exception of Ammonium compounds and MgCO_3** .





- TS = total solids
- TSS = total suspended solids
- TDS = total dissolved solids
- VSS = volatile suspended solids
- FSS = fixed suspended solids
- VDS = volatile dissolved solids
- FDS = fixed dissolved solids
- TVS = total volatile solids
- TFS = total fixed solids

TS = total solids

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VDS = volatile dissolved solids

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TVS = total volatile solids

TFS = total fixed solids

Discussion:

Is TS-1 absolutely equivalent to TS-2 without considering measure bias?

Problems

- What is it that differentiates between total solids, total dissolved solids and total suspended solids in samples?
- What significant information is furnished by the determination of volatile solids? Why?
- Would you expect the analytical results to be higher than, lower than, or the same as the true value under the following conditions, and why?
 - ◆ Weighing a warm crucible of a sludge sample estimating organic content by combustion at 550°C with a high magnesium carbonate content.
 - ◆ Estimating the organic content by volatile-solids analysis of a sample containing a large quantity of organic materials having a high vapor pressure.
 - ◆ Estimating the organic content of a sample by combustion at 800 °C rather than at 550°C .