



Since the creation of the United States Environmental Protection Agency (USEPA) and subsequent implementation of the Clean Water Act in the early 1970s, poultry processing plants have been required to continually improve the quality of their process wastewater effluent discharges. The determination of wastewater quality set forth in environmental permits has been established in a series of laboratory analytical tests focused in four (4) major categories: organics, *solids*, nutrients and physical properties.

For most poultry professionals a complete understanding of the standard methods required to accurately complete critical wastewater analytical tests is not necessary. However, a fundamental understanding of the theory behind and working knowledge of the basic procedures used to complete these wastewater tests, and the answers to commonly asked questions about each test can be a valuable tool for anyone involved in generating, monitoring, treating or discharging process wastewater.

Measuring SOLIDS in Wastewater

A number of analytical tests have been developed and are used to determine the concentration (in milligrams per liter - *mg/L* - or the equivalent unit of parts per million - *ppm*) of the various forms SOLIDS can exist within a wastewater sample. One of the laboratory tests most widely used to establish and monitor environmental permit limits for the concentration of SOLIDS in wastewater samples is **total volatile solids (TVS)**.

SOLIDS in wastewater can be viewed in two basic ways: *particulate size* or *particulate composition*. The TVS test is based within the category of *particulate composition* and is represented in the following equation:

$$\text{Total Solids (TS)} = \text{Total Volatile Solids (TVS)} + \text{Total Fixed Solids (TFS)}$$

In this equation TS represents all solids contained in a measured volume of water, and can be subdivided into the categories of TVS (those solids that are *Organic* and will thus volatilize during combustion) and TFS (those solids that are *Inorganic* and thus will NOT volatilize during combustion).

Basics of the TVS Test

The TVS test starts with performing the TS (Standard Method 2540B) test on a measured volume of wastewater sample. In the TS test, a measured volume of wastewater sample is poured into a dry, weighed, nonflammable metal or ceramic dish and all moisture is removed by placing the dish in an evaporative oven set at 103 – 105°C. Once the dried dish and remaining solids have cooled to room temperature in a desiccator, the dish and solids are reweighed and a final volume of solids is established for the original volume of wastewater sample. The volume of wastewater sample used in the TS test should be selected so that the yield of dried solids is between 10 – 200 mg. A calculation is then performed to establish the concentration (mg/L) of TS in the wastewater sample.

Once the TS test is complete and the final dried weight of the dish and solids is recorded, the TVS (Standard Method 2540E) test can be conducted. The dish and solids from the TS test are placed in a muffle furnace (*see Figure 1*). Inside the muffle furnace, set at 500 ± 50°C, the portion

of solids that are *organic* (i.e., carbon-containing compounds) will combust and volatilize with the resulting vapor exiting the furnace.



Figure 1. Example of a laboratory bench scale muffle furnace used for the Total Volatile Solids (TVS) test. (<http://www.capitolscientific.com/Thermo-Scientific-FD1535M?>)

After 15 – 30 minutes, the dish and remaining non-volatilized solids (i.e., **TFS**, non-carbon containing compounds) are removed from the furnace and placed in a desiccator to cool to room temperature. The **TFS** at this point are commonly known as “ash”. Once cooled, the dried dish and **TFS** are weighed, and the original weight of the dried dish is subtracted from that total. This calculation establishes the final weight of **TFS**. The final **TFS** weight can then be subtracted from the **TS** weight to determine the weight of **TVS** by calculation. This final **TVS** weight can then be used to calculate the concentration (mg/L) of **TVS** in the original wastewater sample.

Critical elements of the **TVS** analytical procedure include:

1. Absolute dryness of dish and solids for accurate weight measurement,
2. Accurate measurement of the measured volume of the wastewater sample utilized, and
3. Accurate completion of calculations, converting weights to final concentration (mg/L).

APHA, 1992. Standard Methods for the Examination of Water and Wastewater. 18th Edition. American Public, Health Association, Washington, D.C.

For more information or to have questions answered concerning TSS or any wastewater analytical test contact your local University of Georgia Cooperative Extension Agent.