Total Organic Carbon Analysis

INTRODUCTION: Total organic carbon (TOC) analysis grew from the need to analyze wastewater and municipal water from organic matter. Measurement of TOC is a much more fast method to determine the organic matter content in water and wastewater, which is directly related to total organic content. TOC analysis is also widely used in monitoring the quality of process water in the semiconductor and pharmaceutical industries. Furthermore, TOC analysis in solids, such as soils and sediments is also important for soil science, etc.

Generally, TOC measurement involves: (1) oxidizing organic carbon in a sample; (2) detecting and quantifying the oxidized product (CO_2); (3) presenting the result in units of mass of carbon per volume of sample (liquids) or per mass of solid (solids). Carbon in the sample is first converted to CO_2 by the combustion furnace for TOC and TC (total carbon) analysis or by the IC (Inorganic carbon) sparger for IC analysis. A carrier gas then sweeps the derived CO_2 through a nondispersive infrared (NDIR) detector. Sensitive to the absorption frequency of CO_2, the NDIR detector generates a non-linear signal that is proportional to the instantaneous concentration of CO_2 in the carrier gas. That signal is then linearized and integrated over the sample analysis time. The resulting area is then compared to stored calibration data and a sample concentration is calculated.

OBJECTIVE: The objective of the experiment is to determine total organic carbon in water, wastewater, and sediments, using TOC Analyzer.

APPARATUS: TOC analyzer; Filtration assembly; Pipets; 50 ml pyrex tubes; Nitrogen regulator and de-gassing equipment; and Analytical balance

WATER AND WASTEWATER

REAGENTS:

Organic Carbon Stock Solution:

This solution is only needed to make standard solution.

Dissolve 2.127 gm of Potassium Hydrogen Thalate in 1,000 ml of carbon-free distilled water. This solution will be 1000 ppm TOC.

Standard Solutions:

Dilute the 1000 ppm TOC stock solution to make a series of standards.

Standard Solutions for TOC in water samples

Volume used of the Stock solution diluted to 100 ml.	Standard Conc. (ppm of TOC)
ZERO	BLANK
0.1 ml (100 µl)	1.0
0.25 ml (250 µl)	2.5
0.5 ml (500 µl)	5.0
1.0 ml (1000 µl)	10.0
1.5 ml	15.0
2.0 ml	20.0

PROCEDURE:

- Take 25 ml sample in a 50-ml graduated tube
- Add 2ml conc. H_2SO_4 and gently shake for few seconds
- Degas with Nitrogen for 10-15 mins.
- Run the standards on TOC ASI – V analyzer as per standard procedure
- Run the samples as per the standard procedure

SOIL AND SEDIMENT

REAGENTS:

- Anhydrous Dextrose (glucose) is used for TOC standard.
- Na_2CO_3 is used for inorganic carbon standard.

- A mixture containing 8.0172 gm of glucose and 7.066 gm of Na_2CO_3 is well homogenized and it contains 80 % TOC and 20 % IC.

PROCEDURE:

All the standards and the samples are weighed in duplicate (weights taken near to each other) in two different ceramic boats. The first weighing is for TC and the other is for the IC measurement. At least four calibration points are taken for TC and IC. For each calibration point, weight of standard mixture has to be given with estimated amount of TC or IC in mg, µg, or percentage in the mixture. This has to be done for all the calibration points. Weight of mixture for calibration points are taken as multiples of 1, 2, 3, 4, 5, etc. for drawing a calibration curve. This is done for both TC and IC calibration curves.

Standards and the samples are run on the TOC – SSM analyzer as per standard procedure.