

## Lab Demo - 1&2

### 1. Total Carbon (TC) and Total Organic Carbon (TOC) Analyser

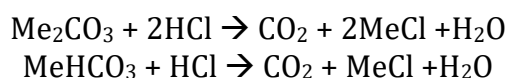
#### [A] Liquid Samples

##### **Total Carbon (TC) Measurement:**

Carrier gas (purified air) is passed at a controlled flow rate of 150 mL/min through an oxidation catalyst filled TC combustion tube, heated at 680°C. When the sample pretreatment/injection system injects the sample into the combustion tube, the TC in the sample is oxidized or decomposes to create carbon dioxide. The carrier gas carrying the combustion products from the combustion tube is cooled and dehumidified in the dehumidifier before passing via the halogen scrubber into the sample cell of the non-dispersive infrared detector (NDIR), where the carbon dioxide is detected. The NDIR analog signal forms a peak, and the data processor calculates the peak area. To measure the TC concentration of the sample, the relationship between the TC concentration and peak area (calibration curve) is predetermined using a TC standard solution, to express the peak area as a ratio of the TC concentration. TC comprises TOC (Total Organic Carbon) and IC (Inorganic Carbon).

##### **Inorganic Carbon (IC) Measurement:**

The IC comprises the carbon contained in carbonates, bicarbonates and in the carbon dioxide dissolved in water. By acidifying the sample with a small amount of HCl to obtain a pH <3, all carbonates are converted to CO<sub>2</sub> by the following reactions



The acidified sample is sparged with the carrier gas (purified air) to convert only the IC in the sample to carbon dioxide. This carbon dioxide is detected by the NDIR and the sample IC concentration is measured in the same way as TC.

##### **Total Organic Carbon (TOC) Measurement (TC-IC):**

Subtracting the IC concentration from the TC concentration determines the TOC concentration.

#### [B] Solid Samples:

Samples are pulverized and dried prior to analysis. Samples are separately analyzed for their TC and IC content. The IC fraction is subtracted from the TC result to determine the TOC content.

##### **Total Carbon (TC) Analysis:**

The sample is combusted at 900°C in a column containing a platinum and cobalt oxide catalyst. Under these conditions all carbon compounds in the sample are converted to carbon dioxide, which is detected by an infrared detector.

##### **Inorganic Carbon (IC) Analysis:**

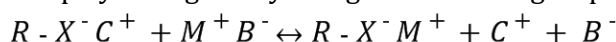
The inorganic component of the sample is oxidized with concentrated phosphoric acid at 200°C to form carbon dioxide, which is detected by an infrared detector.

## 2. Ion Chromatography (IC)

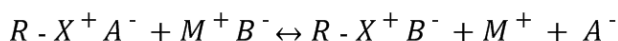
Ion-exchange chromatography (or ion chromatography) is a process that allows the separation of ions and polar molecules based on the charge properties of the molecules. It can be used for almost any kind of charged molecule including large proteins, small nucleotides and amino acids. The solution to be injected is usually called a sample, and the individually separated components are called analytes. It is often used in protein purification, water analysis, and quality control.

### Basic principle:

Ion exchange chromatography retains analyte molecules based on coulombic (ionic) interactions. The stationary phase surface displays ionic functional groups (R-X) that interact with analyte ions of opposite charge. This type of chromatography is further subdivided into cation exchange chromatography and anion exchange chromatography. The ionic compound consisting of the cationic species  $M^+$  and the anionic species  $B^-$  can be retained by the stationary phase. Cation exchange chromatography retains positively charged cations because the stationary phase displays a negatively charged functional group:



Anion exchange chromatography retains anions using positively charged functional group:



Note that the ion strength of either  $C^+$  or  $A^-$  in the mobile phase can be adjusted to shift the equilibrium position and thus retention time.

### Features of 761 Compact IC:

- Extremely compact design - the 761 Compact IC finds enough space on every laboratory bench
- Perfect integration - injection valve, double-piston pump, column, Metrohm Suppressor Module, high-performance detector, peristaltic pump, data processing - all combined in a very small space
- Minimum peripherals - one connection to a free COM interface on the PC is all that is needed
- One-button operation - the only switch is the on/off switch
- PC-control - all the 761's functions are PC-controlled
- Rapid start - click on the required application in the menu and the IC System is ready and configured
- Analog output for connection to external data systems
- Online applications - updating the applications can be carried out at any time by downloading the latest methods into the 761 Compact IC

### Operational procedure:

A sample is introduced, either manually or with an auto-sampler, into a sample loop of known volume. A buffered aqueous solution known as the mobile phase carries the sample from the loop onto a column that contains some form of stationary phase material. This is typically a resin or gel matrix consisting of agarose or cellulose beads with covalently bonded charged functional groups. The target analytes (anions or cations) are retained on the stationary phase but can be eluted by increasing the concentration of a similarly charged species that will displace the analyte ions from the stationary phase. For example, in cation exchange chromatography, the positively charged analyte could be displaced by the addition of positively charged sodium ions. The analytes of interest must then be detected by some means, typically by conductivity or UV/Visible light absorbance.