GAS CHROMATOGRAPHY (GC)

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Basic Competencies:
Students can describe the separation of GC, interpretation chromatograms, and apply this separation method for the analysis of a sample.
The oil (petroleum)
The field of essential oils
The field of medicine
Chemistry / research
Pesticide
Environment / pollution
BENEFITS OF USE GC

- Fast
- Operation is simple
- Sensitive (order of ppm, ppt), mL, mg
- The separation (resolution) high
- Qualitative and quantitative analysis
- High repeatability
ANALYSIS OF CHROMATOGRAPHY

- GAS-LIQUID: PARTITION
- GAS-SOLID: ADSORPTION
- Qualitative analysis: based on chromatogram peak that appears
- Quantitative analysis: a high peak areas or peak chromatogram
Gas-Solid Chromatography (GSC)

- Mobile phase: gas
- Stationary phase: non-volatile solids, stable
  For example: spheron (Grafite-coal), linden (molecular sieves) porapak, polypak, chromosorb
- Basic work: the separation of molecules based on size
Gas-Liquid Chromatography (GLC)

- Terms of the solid support:
  1. Stable at high temperatures
  2. Inert, not reacting with samples & stationary phase
  3. The large surface area (grain)
  4. Ideal situation (same size)

- Examples of solid support:
  Diatoport, cilite, chromosorb (G, P, W)

- Working basis:
  Separation based on partition between mobile phase and stationary phase
Gas-Liquid Chromatography (GLC)

- Mobile phase: gas
- Stationary phases: liquid, the condition:
  1. Non volatile
  2. Inert & stable
  3. Very viscous
  4. Spread & bound to a solid support
  5. Soluble in organic solvent (ether)
Gas-Liquid Chromatography (GLC)

- This type of stationary phase: polar, semi polar, non polar
- Examples of polar stationary phases: carbowax 20M, PEGA, DEGS, castorwax, amine 220, versamid 900, PDEAS
- Examples of semipolar stationary phases: dionilftalat, SE-52 (OV-17)
- Examples of non-polar stationary phases: apiezon, Squalane, SE-30
Classification of compounds

POLAR
  water
  Glycol, glycerol
  alcohol
  Oksim
  Hydroxy acids
  ester
  etc.
Classification of compounds

SEMI POLAR
  ether
  ketone
  aldehyde
  tertiary amine
  etc.

• NON POLAR
  CHCl3
  CH2Cl2
  aromatic hydrocarbons
  olefin hydrocarbons
  CH3CHCl2
  etc.
### BASIC SEPARATION

Rule: like dissolves like

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Stationary Phase</th>
<th>nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polar</td>
<td>Polar</td>
<td>Soluble</td>
</tr>
<tr>
<td>Non polar</td>
<td>Non polar</td>
<td>Soluble</td>
</tr>
<tr>
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</tbody>
</table>
**CHROMATOGRAM**

- **GAUSS CURVE**
  1. Eddy diffusion and molecular
  2. The balance of slow
  3. Price K is not fixed

- **IDEAL chromatogram**
  1. Quickly balance
  2. No diffusion
  3. uniform column
COMPONENTS INSTRUMENTS GC

- Carrier gas tank (+ regulator)
- Place the sample injection
- column
- detector
- Amplifier + Recorder
Carrier gas tank (+ regulator)

gas travels through the metal tubing
and is dispersed to each GC in turn
Place the sample injection
column

detector is in here

oven chamber

column
Detector

- FID
- TCD
- FPD
- ECD
FID Detector

- **Basic work**: sample + burner gas (H2 + air/O2) burned → Ionization occurs: positive ion to negative electrode, negative ion to positive electrode

- On electrodes occurs: Change Voltage (V) Change of voltage forwarded to the recorder and produce chromatogram.

- **Advantages**: highly sensitive (1000xTCD).

- **Disadvantages**: damaged samples, detecting water insoluble, CS2, O2, N2, CO2, and the noble gases.
TCD Detector /Chatarometer

- **Conditions**: the temperature of the detector must be higher than column temperature
- **Basic principles**: Components which have been separated from the column carried by the carrier gas on the filament. Change of filament temperature causes filament resistance. Resistance filaments changed by Wheatstone bridge become current. Change current arus forwarded to the recorder and then converted become chromatogram.
TCD Detector /Chatarometer

• **Advantages:**
  1. Does not destroy the sample
  2. All kinds of compounds can be detected.

• **Disadvantage:**
  less sensitive.