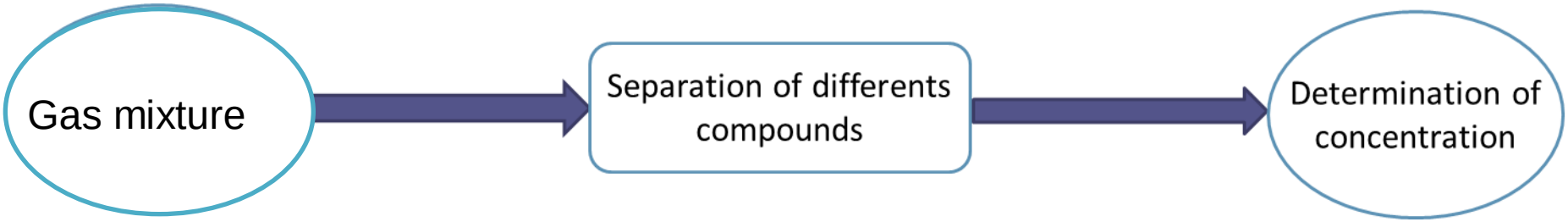
# Gas Chromatography Introduction

Chromatotec®

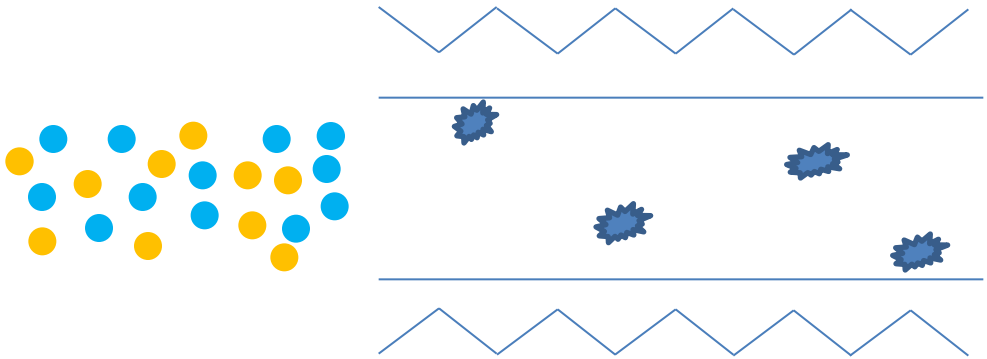
# Principle




A technique in which separation is accomplished by partitioning volatilized substances between a mobile carrier gas and a stationary phase. The technique is often termed “GC.”

- GC is done using an instrument called a gas chromatograph
- The separation is done in a column, which is contained in the oven of the gas chromatograph.

# Chromatography principle



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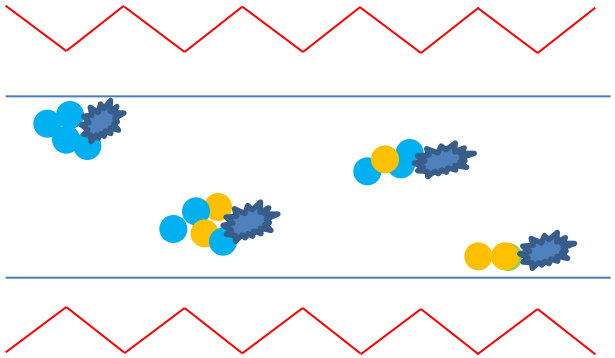

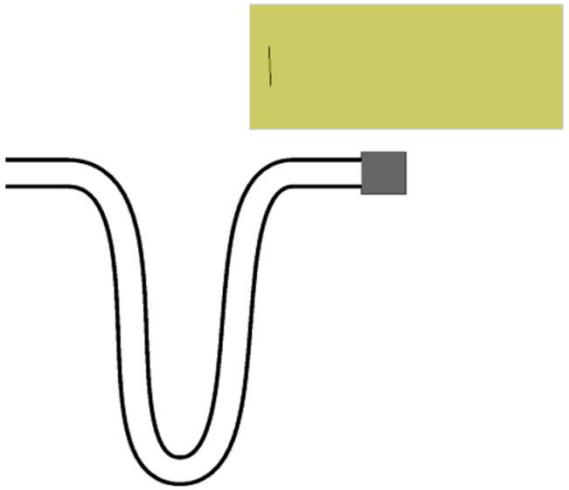

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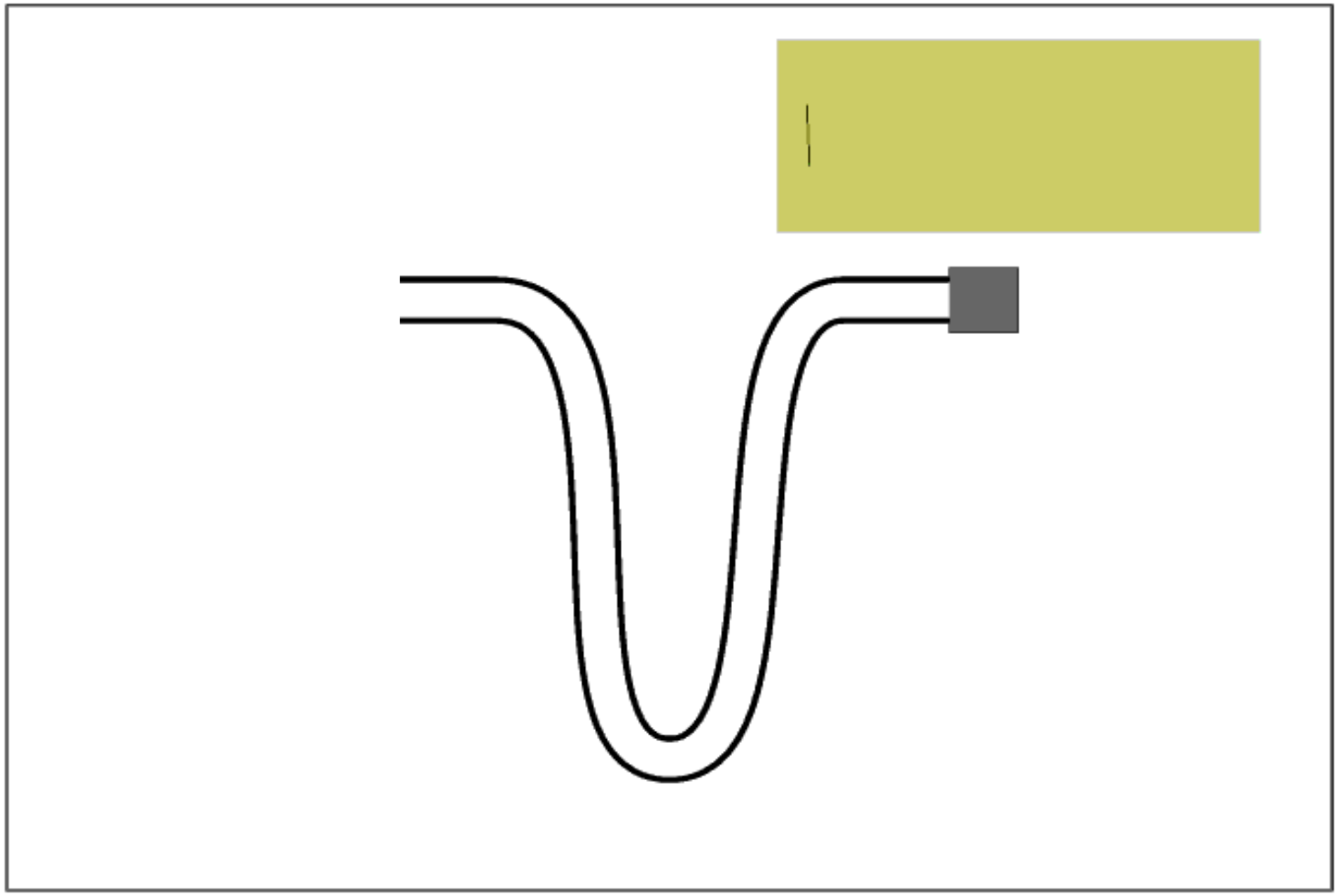
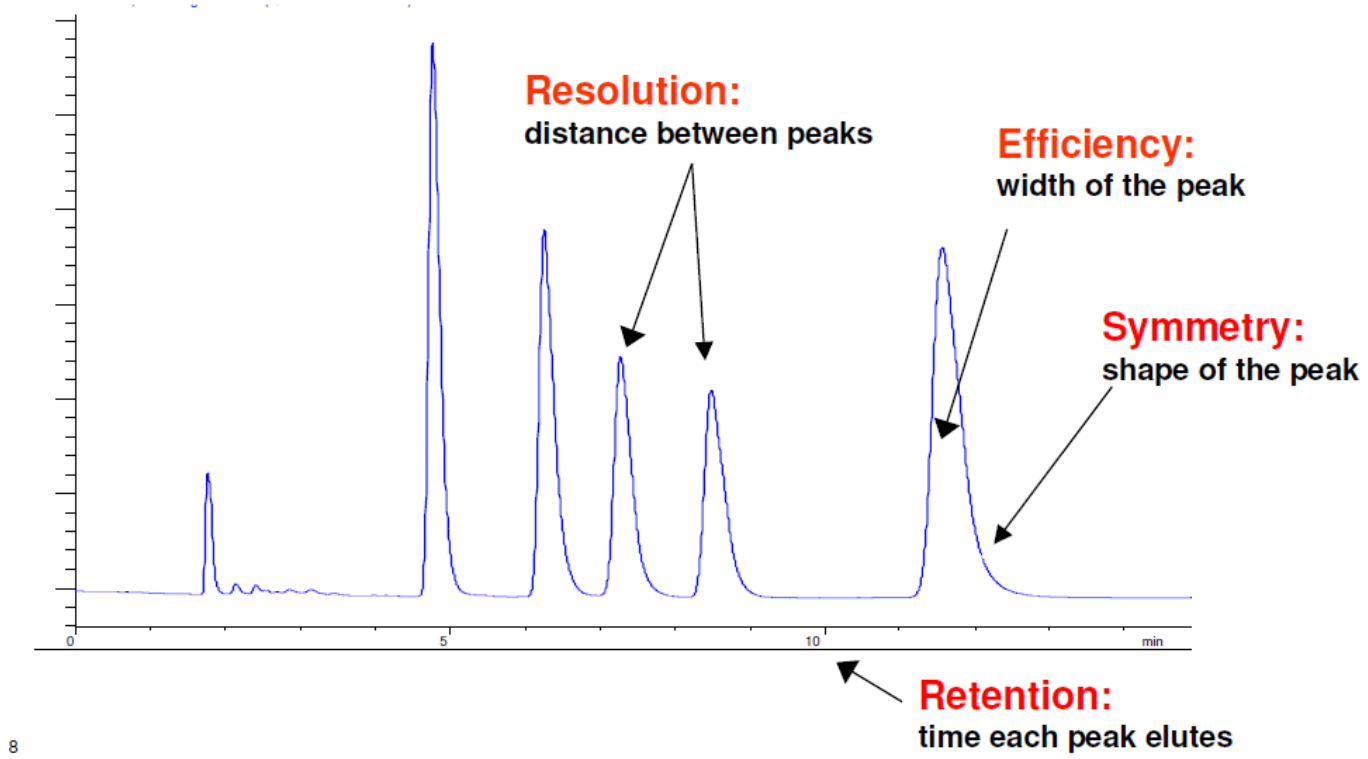


# Aquisition




- The retention time is used to identify compounds
- Area of the peak is used for compound quantifications

# Gas chromatography

- Advantages of Gas chromatography
  - Efficient, providing high resolution
  - Highly accurate quantitative analysis, tipically RSDs of 1-5 %
  - Requieres small volumes
  - Reliable and simple
  - Inexpensive

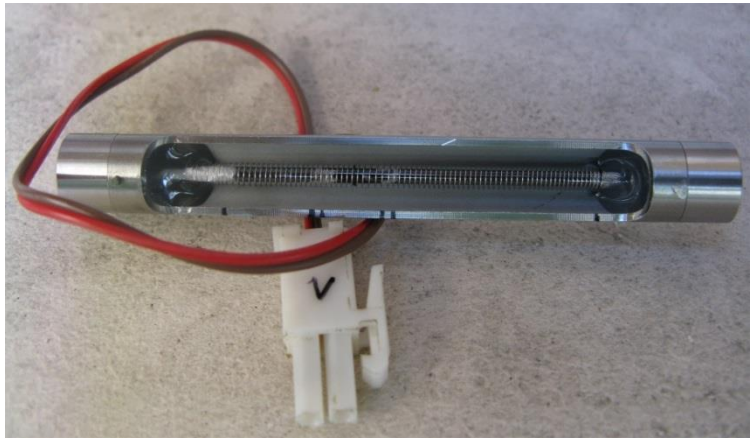
- Gas chromatograph designed by Chromatotec:
  - Online instruments
  - Designed for industrial applications
  - Continuous monitoring
  - Communication devices optimized for industrial applications
  - Optimized instruments depending on the applications
  - …

# 3 different steps :

# Sampling

Loops of different volumes:

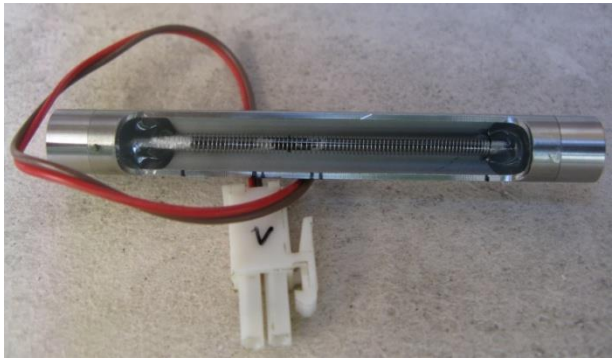
- Concentrated samples
- Molecules which cannot be pre-concentrated



Different adsorbents can be used in the field of thermal adsorption/desorption.
Choosing the right adsorbent can be difficult. The goal in selecting the proper adsorbent is to choose one that can:

- Retain a specific or group of analytes for a specified sample volume.
- However, just as important the adsorbent must also be ableto release the analyte(s) during the desorption process.

Molecules are adsorbed on adsorbant in the trap



ABsorption


ADsorption

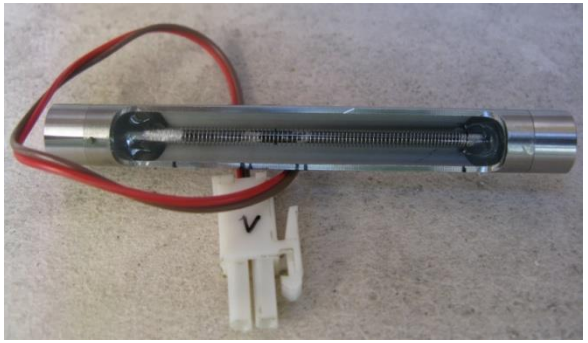


Chromatography: Concepts and Contrasts, 2nd ed., John Wiley & Sons, Hoboken, NJ, 2005

# Sampling

Chromatotec® develops specific traps to meet requirements of different applications:

- Trap for C2-C6
- Trap for C6-C12
- Trap for Sulfur compounds
- …

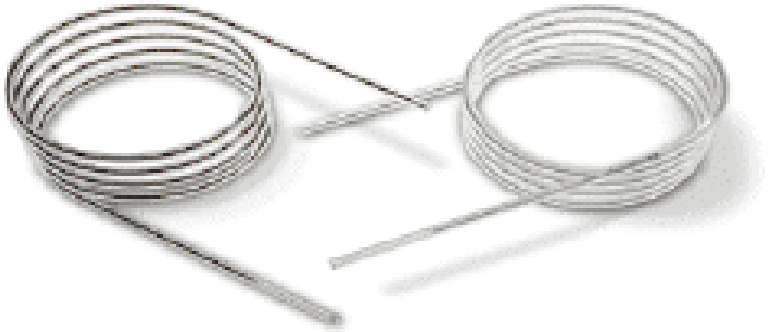


Depending on the application, the trap can be cooled down to increase the trapping efficiency.

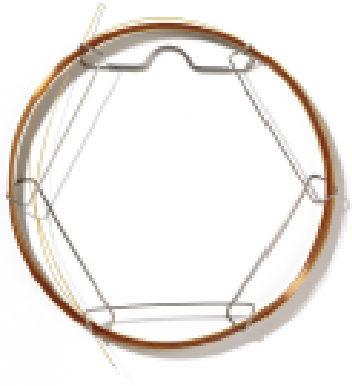
To increase the desorption efficiency, the thermal desorption temperature will be optimized depending on the application.

# 3 different steps :

# Separation



Packed Columns



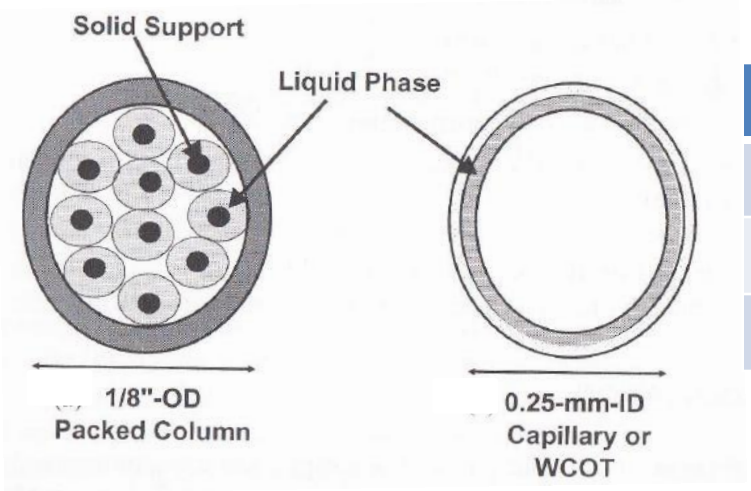
Capillary columns

# Separation

Separation is the heart of gas chromatography. The first columns were metal tubes packed with inert supports on which stationnary liquids were coated.

Today, the most popular columns are made of fused silica and are open tubes with capillary dimensions. The stationnary phase is coated on the surface of the wall.

Packed Columns Capillary columns




| | Capillary | Packed |
|---|---|---|
| Length | 60 m | 2 m |
| Theoretical plates | 3000 – 5000 | 2000 |
| Total plates | 180K – 300K | 4000 |



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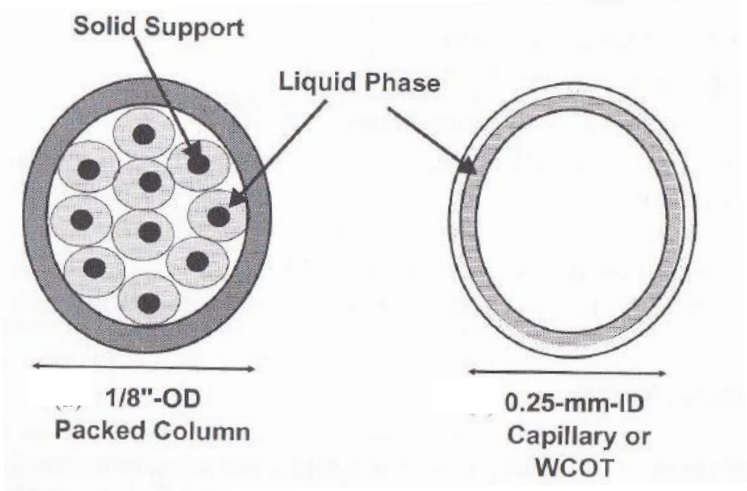


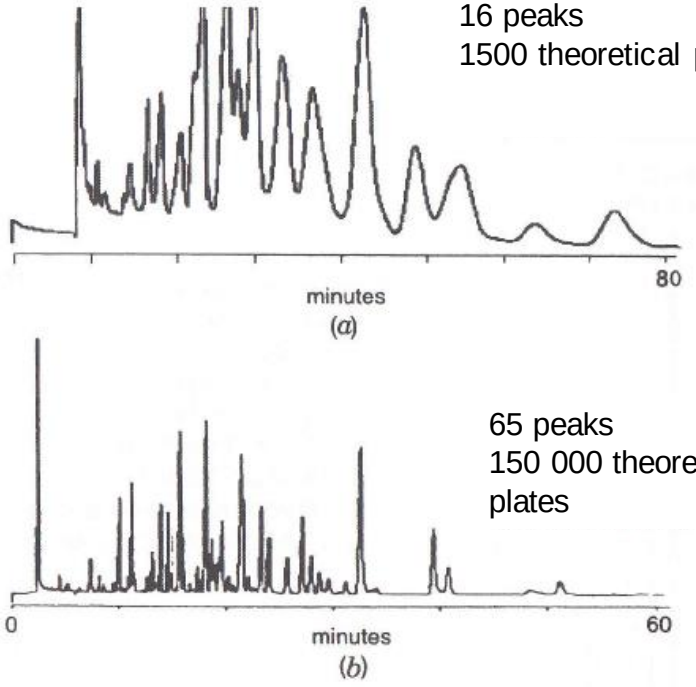




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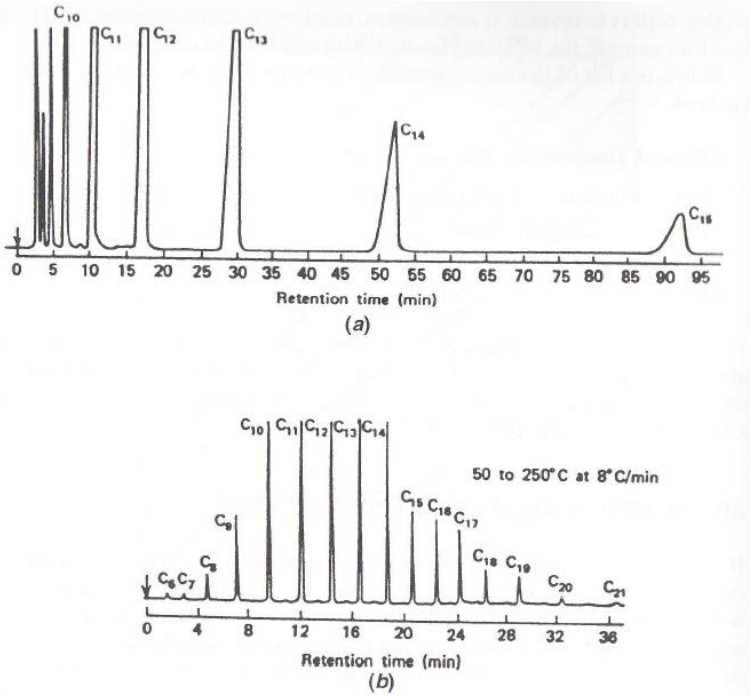
# Separation

- For each application, GCs designed by Chromatotec® have specific:
  - Column types
  - Pressure program
  - Temperature program
- All capillary columns are metallic columns:
  - Unbreakable
  - Can be heat up above 200 °C



# 3 different steps :

# Kinds of detectors

- Many different GC detectors are available. Some are universal in that nearly all compounds will give some signal. Some are selective or specific to a class of compound

Universal

- MSD (mass spectrometry): ID compounds based on weight of fragments and fragmentation pattern.
  TCD (thermal conductivity): ID compounds based on differences in their conductance of heat

Selective

- NPD (Nitrogen phosphorous detector): N and P
  FPD (flame photometric): Sulfur, phosphorous
  MS (Mass spectrometer)

| Model | Compounds | Application | Concentration | Loop / Trap | Detector | Carrier Gas |
|---|---|---|---|---|---|---|
| airmoVOC C2-C6 | Light hydrocarbons from C2 to C6 | Ambient / General | ppt / ppb / ppm | Trap with Peltier cooler | FID | H2 |
| airmoVOC C6-C12 | Heavy hydrocarbons from C6 to C12 | Ambient / General | ppt / ppb / ppm | Trap | FID | H2 |
| airmoVOC BTEX | BTEX | contaminated land | ppt / ppb / ppm | Trap | FID | H2 |
| airTOXIC | BTEX and option: 1,3-butadiene | Ambient / General | ppt / ppb / ppm | Trap | PID | N2 |
| chromaFID | VOCs, BTEX, light compounds | General | ppm | Loop | FID | H2 |
| chromaTHC | VOCs, CH4 and total hydrocarbons | General | ppm | Loop | FID | N2 / H2 / air |
| chromaTCD | Ne / H2 / O2 / N2 / CO / CO2 / CH4 | Pure gas | ppm / % | Loop | TCD | He / Ar / N2 |
| chromaDID | Ne / H2 / O2 / N2 / CO / CO2 / CH4 | Pure gas | ppb / ppm | Loop | DID | He |
| chromaS | Total sulfurs / COS / SO2 / CS2 / H2S | Paper / waste water / Natural gas / CO2 | ppb / ppm | Loop | FPD | H2 / air |
| TRSMEDOR | TRS / H2S / DMS / Mercaptans / SO2 | Waste water / Ambient / Odor emissions | ppb / ppm | Loop | Electrochemical | air /N2 |
| energyMEDOR | Sulfurs / H2S / Mercaptans / THT | Monitoring / odorization control | ppb / ppm | Loop | Electrochemical | air / N2 |
| THT MEDOR | THT | Monitoring / odorization control | ppb / ppm | Loop | Electrochemical | air / N2 |
| H2S TOS TS MEDOR | H2S / TOS / TS | Monitoring / process / safety | ppb / ppm | Loop | Electrochemical | air / N2 |
| Trap GC MS | Hydrocarbons / toxic compounds | Ambient / General / Clean room | ppt / ppb / ppm | Trap | Mass / FID | H2 |

Thank you for your attention !