

GC-MS

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INTRODUCTION

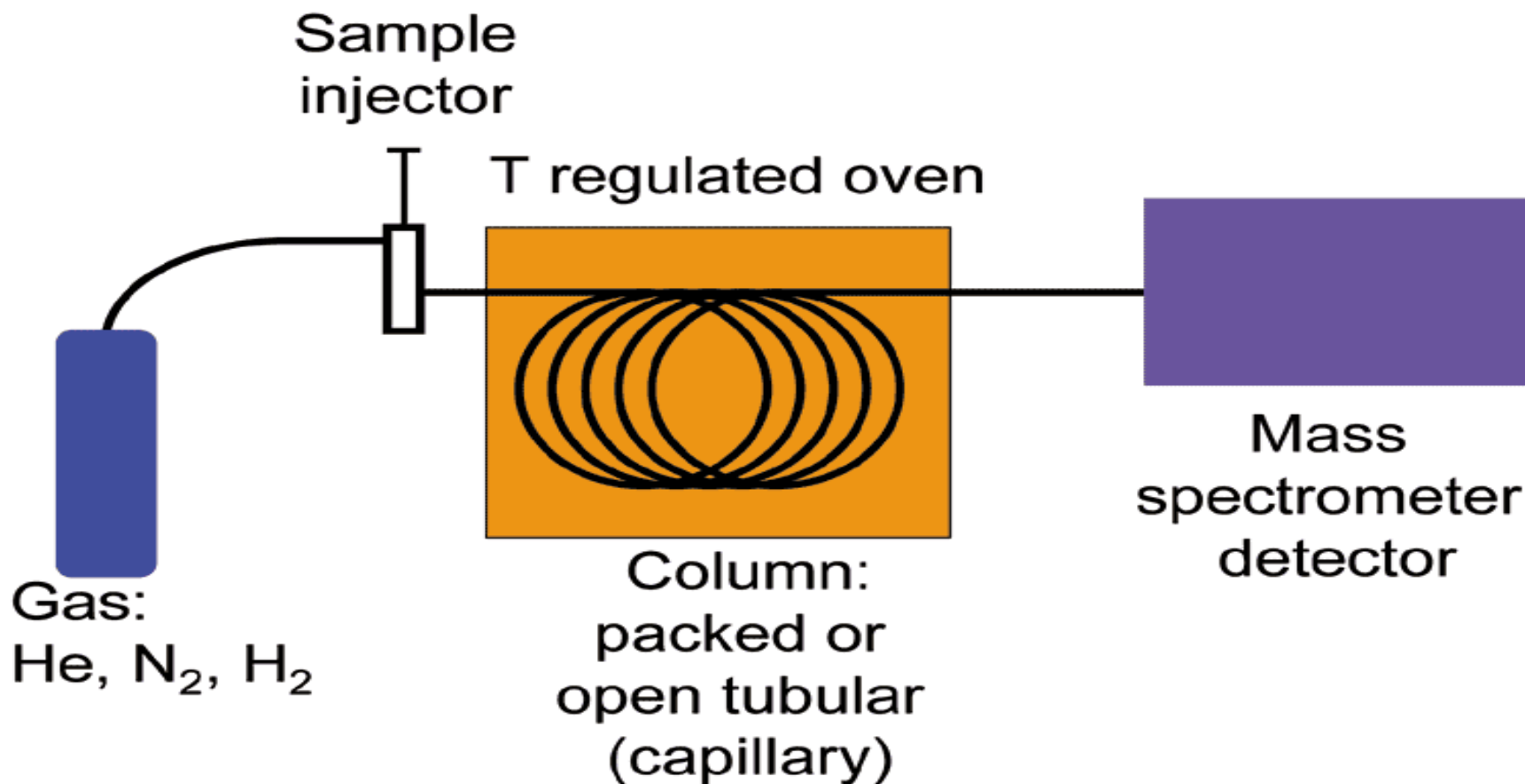
- **Gas chromatography-mass spectroscopy (GC-MS) is one of the so-called hyphenated analytical techniques.**
- **Gas chromatography separates the components of a mixture and mass spectroscopy characterizes each of the components individually.**

HISTORY

- **The use of a mass spectrometer as the detector in gas chromatography was developed during the 1950s by Roland Gohlke and Fred McLafferty.**
- **In 1996 the top-of-the-line high-speed GC-MS units completed analysis of fire accelerants in less than 90 seconds, whereas first-generation GC/MS would have required at least 16 minutes.**

INSTRUMENTATION





- **The GC-MS is composed of two major building blocks: the gas chromatography and the mass spectrometer.**

- **The molecules take different amounts of time (called the retention time) to come out of (elute from) the gas chromatograph, and this allows the mass spectrometer downstream to capture, ionize, accelerate, deflect, and detect the ionized molecules separately.**

GAS CHROMATOGRAPHY

- **In gas chromatography, the sample mixture is introduced (injected) into a mobile phase.**
- **The mobile phase carries the sample mixture run through the stationary phase.**
- **The mixture of compounds in the mobile phase interacts with the stationary phase.**
- **As the temperature increases, those compounds that have low boiling points elute from the column sooner than those that have higher boiling points**

MASS SPECTROSCOPY

- **As the individual compounds elute from the GC column, they enter the electron ionization (mass spec) detector.**
- **A group of 4 electromagnets (called a **quadrapole**) focuses each of the fragments through a slit and into the detector.**
- **The computer has the quadrapoles cycle through different M/Z's one at a time until a range of M/Z's are covered. This occurs many times per second. Each cycle of ranges is referred to as a scan.**

TYPE OF GC-MS DETECTORS





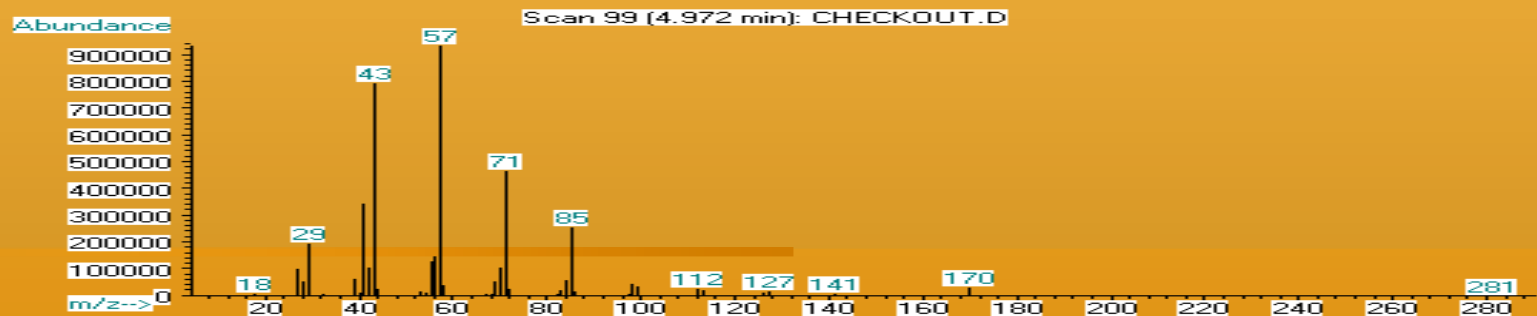
- **Quadrupole mass spectrometer, sometimes referred to by the Hewlett-Packard (now Agilent) trade name "Mass Selective Detector" (MSD).**
- **Another relatively common detector is the ion trap mass spectrometer.**
- **Magnetic sector mass spectrometer**
- **Other detectors may be encountered such as Time of flight (TOF), Tandem quadrupoles (MS-MS)**

ANALYSIS

- **Two kinds of analysis are possible, comparative and original.**
- **Comparative analysis essentially compares the given spectrum to a spectrum library to see if its characteristics are present for some sample in the library.**
- **This is best performed by a computer**
- **Another method of analysis measures the peaks in relation to one another.**



- A “full spectrum” analysis considers all the “peaks” within a spectrum.



- Conversely, selective ion monitoring (SIM) only monitors selected peaks associated with a specific substance.

APPLICATIONS

- **Environmental Monitoring and Cleanup**
- **Criminal Forensics**
- **Law Enforcement**
- **Security**
- **Food, Beverage and Perfume Analysis**
- **Astrochemistry**
- **Medicine**



**Thank
You!**