The Electronics:

By 1970, Hewlett Packard had established itself as one of the premier brands for electronic equipment used in metrology, signal generation, recording and power supplies. The QMF, a mass analyzer whose performance already stood on electronic components was a natural step for Hewlett Packard to pursue. HP had successfully entered the analytical instrument market with the purchase of the F & M Scientific Corporation in 1969, a gas chromatograph supplier[5]. Development and marketing of the QMF for GCMS applications was a natural move for the company.

Acceptance:

In the late 50s, magnetic sector instruments dominated the field and were in a horsepower race to produce the mass spectrometer with the highest resolving power. The QMF was seen as an analog mass analyzer for analytical mass spectrometry and, despite being endorsed by the Environmental Protection Agency, it was not readily accepted. Further, Eichberger and co-workers[6] pointed out that the intensity of ions above mass 100 In spectra from the QMF were not as intense as those in the spectra from magnetic sector instruments. Since mass spectrometry identified by comparison of sample spectra with standard libraries of spectra taken on sector instruments was a primary analytical objective of GCMS/Data Systems, this shortcoming required attention.

Eichberger and co-workers chose deaerated triphenylphosgene (DPPPP) as a calibration compound and showed that the variation in the mass spectra of DPPPP among 11 laboratories using the same model QMF instrument was far greater than that among 4 laboratories using sector instruments from different manufacturers. The mass differences were traced to the manner in which the QMF was "tuned" by the operator. By selecting tuning parameters that produced a DPPPP spectrum similar to that obtained with sector instruments, standardization of tuning could be achieved for GCMS instruments collecting spectra against a database of magnetic sector spectra.

Applications:

The acceptance of the QMF as an instrumentation tool grew as additional instruments were developed after tuning issues were resolved. These instruments were generally smaller and less expensive than their magnetic sector counterparts and were able to scan even more rapidly to meet the challenges of continually improving chromatographic resolution and sharper GC peaks. Applications in environmental analysis, forensic science, analysis of drugs of abuse, and other small molecule analysis are common. Within a decade of introduction, the QMF was accepted as a legitimate analytical mass spectrometer. Subsequent developments, such as the triple-quadrupole MMS instrument in the late 70s, sealed the reputation of the quadrupole mass filter as a viable mass analyzer in the analytical mass spectrometer market.

The Hewlett Packard HP5930A Mass Spectrometer

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The quadrupole mass filter (QMF) was originally employed in analytical settings with limited mass range and resolving power. It had been used for specialty applications in vacuum technology[1], upper atmosphere exploration[2], and physics (especially nuclear) in the 1940s.[4] All of these applications required an instrument with unit mass resolution over a limited mass range, typically 3 to 100 Da.

By the late 50s, combined gas chromatography/mass spectrometry (GCMS) had been in the laboratories of early adopters to the point that instrument companies saw a lucrative market and embarked on the design of custom-built units for GCMS applications. At the time, magnetic sector instruments were the standard for analytical mass spectrometry, but were not particularly well suited for GCMS due to the relatively slow scan speeds imposed by the magnet. The Bendix Corporation had introduced the time-of-flight (TOF) mass analyzer in 1958[3] and it was well suited for the GCMS application since it had higher scan speeds. However, the resolving power of the instrument degraded above 300 Dalton and it had a non-linear energy scale.

A number of companies turned to the quadrupole mass filter as the mass analyzer for an inexpensive analytical mass spectrometer for the GCMS market. The Flintridge Corporation (1958) a venture capital company, Ofifs (1970)[8] and Hewlett Packard (1971) were among the earliest. In this presentation, we focus on the Hewlett Packard entry into this market, the HP5930A, which was first marketed in the summer of 1971.

SPECIFICATIONS:

- QMF: The quadrupole mass filter (QMF) is a mass analyzer for GCMS applications.
- Upper atmospheric physics
- 1940s
- 1950s
- 1960s
- 1970s
- 1980s
- 1990s
- 2000s
- 2010s

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