An introduction to...

GC-MS in the food sector

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Food safety requires scientific monitoring to ensure the safe handling, preparation and storage of food. Quality and consistency are also primary outcomes in food production, which have driven the development of scientific food analysis methods and instrumentation to highly sophisticated levels.

Scientific methods of food analysis first emerged in the mid-19th century, when chemical and microscopal knowledge had advanced to a point where food substances could be analysed and the subject of food adulteration began to be studied from the standpoint of the rights and welfare of the consumer. The father of modern day food science was Louis Pasteur, a French chemist and microbiologist who made remarkable breakthroughs in the causes and preventions of disease. He is best known to the general public for inventing a process now known as pasteurisation.

There are a variety of different analytical techniques available today to determine a particular property of a food material. The analytical technique selected depends on the property to be measured, the type of food to be analysed, and the reason for carrying out the analysis. For example, targeted analysis is used when the particular compound is already known and needs to be quantified whereas screening and identification techniques are used when the compound is unknown.

A chemistry technique called gas chromatography-mass spectrometry (GC-MS) is emerging as the perfect analytical tool for forensic food analysis. In fact, its simplicity, sensitivity and effectiveness in separating and identifying food components has made GC-MS one of the most important tools in analytical chemistry today. Twinned with this is a growing demand for specialty gases.

"Food analysis represents a very important market and the demand for specialty gases that can facilitate the detection of ever lower levels of chemicals in food is on the increase," says Linde's Katrin Åkerlindh, Global Product Manager, Specialty Gases.

"...gas chromatography-mass spectrometry is emerging as the perfect tool for food analysis"

Advantage

The key attribute of GC-MS is that it can qualitatively identify the actual nature of the chemicals in a food sample – therefore answering the question, 'what molecules are present?' rather than just the quantitative aspects that some other techniques identify from analysis.

The GC principle is that molecules in a sample separate in the chromatography column because of differences in their chemical properties. The MS breaks components into ionised species and separates these based on their mass-to-charge ratio. This is the great advantage of the combination of GC as the first separation step and the MS as the qualitative detector.

On the same standing with GC-MS, liquid chromatography-mass spectrometry (LC-MS) is also a qualitative analytical chemistry technique that combines the physical separation capabilities of high performance liquid chromatography with the qualitative analysis capabilities of mass spectrometry. Both techniques involve using a mass spectrometry detector, but GC-MS is used to screen a sample using a gaseous phase component separation process in the gas chromatography column, while LC-MS is able to detect and identify chemicals using a liquid phase component separation process in the liquid chromatography column.

The medium in which the sample exists and is most effectively separated in the chromatography column – gaseous or liquid – determines which technique is more appropriate. While many samples can be vaporized for GC-MS, others are better dissolved in a suitable solvent and examined using LC-MS. However, GC-MS is thought to be preferred when quick screening is required because the column separation is generally faster in the gaseous phase. gw

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