

Gas chromatography mass spectrometry in food analysis



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The food is a highly complex nature which consisted organic and inorganic components. It is undeniable that Gas Chromatography (GC) has many usage and application. It is also noted that gas chromatography has a wide range of applications especially in the food aspect analysis which includes composition of food, components of aroma and flavor, food additives, natural products etc. The aim of this section is to provide an overview of gas chromatography mass spectrometry in food analysis due to the arising of awareness on nutrition and health concern.

Review in Journal of Food Science:

Comparison of the Flavor Chemistry and Flavor Stability of Mozzarella and Cheddar Wheys

The stability of flavor of fresh and stored liquid Cheddar and Mozzarella wheys are being compared. The flavors profiling is being run by sensory analysis whereas extraction of volatile components are followed by characterization by solvent extraction. This is continued with gas chromatography-mass spectroscopy. The application of this research is for further understanding of the flavor of the raw materials which will greatly help manufacturers to have optimization of quality by identifying the methods.

Application

Gas chromatography modeled 690N Agilent was used with 5973 inert mass detector (MSD) for the analysis of the extraction of solvents. Fused silica capillary column as sued for the separation which is Rtx-5ms 30-m length x

0. 25-mm inner dia × 0. 25- μ m df . 1ml/min of a constant flow rate of helium is used. Besides, the temperature of the oven was set beginning at 40°C for 3min, increased of 10°C /min until 90°C, then 5°C/min to 200°C and holding time of 10 min, continued with an increase of 20°C/min, finally with 250°C and a holding time with 10min. The inert mass selector detector held for 3 min for the solvent delay and parameters was scanned by inert mass selector detection which was set from 35 to 300 m/z. 2 μ L of each extract was injected in the splitless mode. The samples were duplicated for duplication analyses for further accuracy.

The 2 main whey types of Cheddar and Mozzarella differences were the intensity of the compounds which based on an increased or decreased after storage by fat separation. Based on the results, it is known that the fat separation resulted in decreased concentration of lipid oxidation products by Gas chromatography mass spectroscopy.

It is concluded that flavor profiles of the 2 types of samples were different from each other and gas chromatography mass spectroscopy volatile recorded the differences between the selected volatile compounds in each whey sample. The objective was fulfilled as it is proven that Cheddar whey is more easily to undergo oxidation than Mozzarella whey.

Review in Journal of Food Science:

[Sensory and Physiochemical Characterization of Juices Made with Pomegranate and Blueberries, Blackberries or Raspberries](https://assignbuster.com/gas-chromatography-mass-spectrometry-in-food-analysis/)

The study of quality parameters of 1 commercial pomegranate juice mixed with different 5 concentration of blueberry, blackberry or raspberry juices. Solid phase microextraction - gas chromatography mass spectroscopy was used for the determination of volatile components which present in the mixtures in order to perceive the differences of aroma of the juices. The relationship between consumers and instrumental data was studied for the determination of innovation of designed juices by conducting a consumer study. This application of this research is to help juice industry to further understand the consumer's preferences for the blended juices of pomegranate.

Application

Gas chromatography mass spectrometry modeled GC CP3800 Varian was used for the separation, identification, and qualification of the volatile components of the mixtures. The analytes was injected to the injection port of the gas chromatography at 250° C during splitless mode of 5 min. The gas chromatography mass spectroscopy used RTX-5MS column , 30 m × 0.25mm × 0.25µm film thickness which composed of 5% dephenil/ 95% dimethyl polisiloxane. Then, the temperature of the column was set beginning at 40° C and was increased 280° C at 8°C/ min with a holding time of 10 min. The components identified in the mixtures used Kovats indices and mass spectra analytical methods.

There are 40 volatile compounds found in the juices. The most common compounds in the 3 berry juices were ethyl acetate, 3-methylbutanal,

hexanal and linalool. In the nutshell, it is found out that blueberry juice is preferred by consumers with the mixtures of pomegranate juice.

Review in Journal of Food Science

Iron-Lactoferrin Complex Reduces Iron -Catalyzed Off -flavour Formation in Powdered Milk with Added Fish Oil

Iron-lactoferrin complex is beneficial for dietary iron supplement but the effect has not been reported that iron-catalyzed off flavors in food products contained lipids. Therefore, the effects of iron-lactoferrin on off flavors were studied with the additional of fish oil. Compounds which have undergone oxidation such as pentanal, hexanal, heptanal etc were less developed in the powdered milk that contained iron-lactoferrin rather in iron(II) sulphate. The application of this research results proves and shows that iron-lactoferrin complex is beneficial for continuous fortification of foods with iron and fish oils. This is because there is a reduction of the formation of iron catalyzed off flavors in powdered milk fortified with fish oil.

Application

Gas Chromatography modeled 6890 Agilent with a mass selective detector of 5973 Agilent were used to performed analysis of volatile headspace compounds from the sample. The separations of volatiles were separated on DB-5 capillary column with measurement of 0. 32mm i. d. × 60m, 0. 52µm of film thickness in the operations with a constant flow of 2. 4mL/min. As for the temperature, it was set initially at 37° C was increased to 190° C, at rate of 4° C/min and then to 280° C at 40° C/min which the holding time is 8 min.

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In conclusion, iron-lactoferrin was proven by the measurements of headspace gas chromatography mass spectroscopy reduce the oxidation of flavor and metallic taste of powder milk enriched with fish oil during storage and processing.

Review in Journal of Food Science

Comprehensive Assessment of Antioxidant Activity of Essential Oils

It had been known the unique ability of essential oils was studied due to their special properties that act as antioxidants. The 20 samples with oil that have EC_{50} , which is less than $300\mu\text{g/mL}$ were analyzed by gas spectrometry mass spectrometry and many more. The application of the founded results will enhance the understanding of spices which contains essential oil may inhibit the oxidative damage, lipid oxidation and increase the level of antioxidant activity of the product.

Application

Gas chromatography modeled 580A Hewlett Packard Series II were used to analyze the essential oil with mass selective detector and autosampler. The column used with a measurement of 30m, 0.25mmID with 0.5 μm film thickness at the constant flow rate of 1.0mL/min and pressure of 20.0 psi. The temperature injector is 250 $^{\circ}\text{C}$, the beginning of oven temperature was 120 $^{\circ}\text{C}$ and was increased to 10.0 $^{\circ}\text{C}/\text{min}$ to 180 $^{\circ}\text{C}$. Once the temperature reached 180 $^{\circ}\text{C}$ and rate was changed to 3.0 $^{\circ}\text{C}/\text{min}$ till the temperature reached 240 $^{\circ}\text{C}$ and holding time was 5 min. The total run time was 31.0 min.

After running gas chromatography mass spectrometry, the chemical compounds in relation to antioxidant activities were known. It is based on the retention indices, co-chromatography with standards etc. The analysis of gas chromatography mass spectrometry also shows basil oils that are rich in linalool and geraniol. The confirmation of the indication of phenolic terpenes in antioxidant oil was also done.

It can be concluded that phenolic terpenes is the major contribution to the most effective oils. Furthermore, several sesquoterpens are shown to have the ability to scavage free radicals.

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Review in Journal of Food Science

Change of Volatile Compounds in Fresh Fish Meat during Ice Storage

This study is to determine the changes of volatile compound in fresh fish such as sardine, jack mackerel, bluefin tuna etc. during 3-4 d of ice storage by using headspace solid phase micro extraction gas chromatography mass spectrometry. Based on the result, it is revealed that there is an increased of aldehyde and alcohols in jack mackerel and chub mackerel followed by skipjack and red seabream during storage. The purpose of this research is to study the results to apply in inhibiting fishy off-flavor products. It is the lipid oxidation that change the fresh fish flavor so it is crucial for the prevention of oxidation of lipid.

Application

Modeled Turbo Mass system Perkin Elmer was used to analyze the extracted volatile compounds. The column used for separation with a measurement of 60m × 0.25 mm i. d., 0.25 µm film thickness. Preheating the column to 40° C and it was increased to 260° C at 5° C /min. The carrier gas used was helium with a constant head pressure at 20 psi. Moreover, the temperature of the injector is 250° C and splitless mode is change to split mode (50: 1) at 0.3 min after the injection.

The gas chromatography mass spectrometry identified 32 compounds of the red and white flesh fish and shows no apparent peaks during storage. The detection of the volatile compounds dependent of the storage time.

Therefore, the various changes on the fish flavors might be depending on the content of lipids, lipoxygenase activity and fish's redox potential.

(Taiko Miyasaki, 2011)

(Hiroshi M. Ueno, 2012)

(I. W. Liaw, 2011)

(Laura Vazquez-Araujo, 2010)

(Kevin P. Anthony, 2012)

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