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Application of Gas Chromatography in Food Safety Testing

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Abstract: Food safety is an important issue of people's livelihood, which is a matter of great concern to every country. With the increase of industrial pollution and the use of chemical pesticides in crop production, the safety of food is getting lower and lower. Gas chromatography can be used to detect the residues of additives and harmful substances in food, so as to improve the safety of food. In this paper, gas chromatography technology was analyzed, and its application in food safety testing was discussed.

Keywords: Gas chromatography technology; Food safety inspection; Application

1. Introduction

Food is the basic guarantee of all kinds of production and life, and it is a great event related to the life of our people. Food as an important basis to ensure national stability and social development, safety and nutrition has become the main concern of the society. Therefore, food detection plays a very important role. Through the food detection can effectively detect the substances harmful to the body in time, and avoid causing harm to the body. Among the many detection technologies, gas chromatography detection technology has outstanding advantages in food testing due to its easy operation and low detection cost.

2. Overview of gas chromatography

2.1 Basic concepts of gas chromatography technology

Gas chromatography is a type of chromatography method in which an inert gas is used as a mobile phase to analyze a sample. The so-called gas chromatography technique is the use of a gas chromatograph to analyze the composition of a gas or liquid sample. Gas chromatography is mainly used for the detection of gaseous mixtures, volatile liquids or solids, but it can also be used for the detection of more complex mixtures. Currently, gas chromatography is the most widely used analytical method of all chromatography.

2.2 Basic principles of gas chromatography

The mixture is driven by the fluidity of the gas and flows through a fixed liquid. Due to the different forces acting on each part of the solid, the duration of the components in the stationary phase varies. In this way, the mixtures are separated, and the separated isolates are converted into non-electric amounts in a certain order, and converted into corresponding signals for calculation.

3. Application of gas chromatography technology in food safety testing

3.1 Detection of pesticide residues in crops

In the current food industry, vegetables and fruits are basic food categories and are also an important source of major nutrients for people. However, during the planting of vegetables and fruits, growers may overspray pesticides such as abadazin, rice man, caixi, Ruijinte and avermectin to ensure the yield of vegetables and fruits. These pesticides have residues on the surface of vegetables and fruits, which usually cause some damage to the human body. Pesticides residues in vegetables and fruits generally contain endogenous phosphorus, thiophos, dimethoate, malathion and other components. These components can be detected by gas chromatography. Although most pesticide ingredients are not seriously toxic, if ingested in large amounts, they may cause severe vomiting and dizziness in the consumer, and affect the body's metabolic function. There are many types of gas chromatography techniques, and various types of techniques can be used to detect different kinds of crops. In the detection of organochlorine pesticide residues, it can be performed by gas chromatography-electron capture detector method (GC/ECD); For the detection of organic nitrogen and organophosphorus, capillary gas chromatography nitrogen and phosphorus detectors (GC/NPD) can be used. In conclusion, when testing pesticide residues for crops, it is necessary to test according to the type of pesticide residue components.

3.2 Detection of food additives

In the process of food production and processing, in order to make it colorful, flavorful, and beautiful, most manufacturers and/or businesses will add food additives. Although most food additives do not cause serious toxicity to humans and have no adverse effects. However, some illegal additions are more harmful, such as the plasticizer itself has a high harm, which can make human genes toxic and seriously damage human genes. If you eat food containing plasticizers for a long time, it may lead to diseases, such as cardiovascular disease, etc.; At the same time, it can also seriously hinder the normal functioning of the body's metabolic function. For example, in 2011, the incident of excessive plasticizer in a liquor in Taiwan became one of the major food safety incidents. In recent years, food safety supervision units have strengthened the supervision and management of food safety issues, and strictly stipulated the available types and amounts of food additives. According to the use, the types of food additives are divided into four categories, namely nutritional enhancers, food quality improvers, food preservatives, and food processing additives. For this, gas chromatography mainly detects acidic acids such as propionic acid and sorbic acid, as well as ester preservatives. It can segregate and classify the components of food additives, and detect the specific ingredients and addition amounts.

3.3 Food nutrient composition and freshness testing

Meat and meat products are an important source of nutrients for the human body, including amino acids, proteins and fatty acids. Among them, amino acids are one of the sources of nutrition and play an important role in taste, such as glycine, glutamic acid and serine, which are the basic substances for the formation of livestock and poultry meat flavor. The composition and content of intramuscular fat affect the flavor and freshness of meat, and also affect the palatability and juiciness, such as phospholipids can use chemical reactions to change volatile products, and then change the flavor of meat products and improve palatability. Gas chromatography is a common technique for fatty acid analysis. Compared to liquid chromatography, the sample preparation time is short and the operation is simple. Under the action of enzymes and microorganisms, the components of meat products are decomposed, which changes the protein and fat, resulting in its spoilage. The evaluation of the freshness of traditional meat products is relatively subjective. The application of gas chromatography can be used to quantitatively detect the degradation products and volatile components during the storage of meat products, and quantitatively judge the freshness of meat and related products. If aquatic products and pork are subjected to enzymes and microorganisms, the trimethylamine oxide contained in them will decompose to dimethylamine and trimethylamine, reducing the freshness of food and increasing the production of trimethylamine. However, the traditional detection method of trimethylamine content is not only complicated for sample processing, but also lacks sensitivity and precision. Some studies have detected trimethylamine contained in pork, giant river shrimp and hairtail fish by gas chromatography technology under the premise of sample processing. It is concluded that this detection method is not only simple to operate, but also has good sample reproducibility.

3.4 Detection of added ingredients in alcohol

With the progress and development of the times, in addition to the increasing variety of food products, the number and variety of beverages are also increasing. Whether it is beverages or alcohol, they have been comprehensively improved. Liquor contains methanol, a methyl ester decomposition substance in pectin, which can seriously damage the human body. If you drink too much alcohol, it may cause congestion of the human nervous system and even cause symptoms such as dizziness. Beverages and beers contain compounds, so detection with gas chromatography can reveal their quality status completely. For example, when testing the quality of liquor and its harmful substances such as alcohols and methanol, the detection is carried out by gas chromatography-hydrogen flame ionization detector (GC-FID). When testing the rationality of compounds in beverages, product quality needs to be strictly controlled. For various compounds, the corresponding gas chromatography detection technology is used for detection. For example, when testing fermented beverages such as wine and beer, the quality of organic substances such as carbon dioxide, sucrose and fat can be tested mainly by static headspace-gas chromatography (HS-GC). If it comes to harmful substances in beer, it can also be done by HS-GC technology to distinguish between volatile gases and harmful gases.

3.5 Detection of harmful substances in food plastic bags

In the production of processed food plastic bags, plasticizers are often added to make them more malleable and transparent, and to increase their toughness. Titanates (phthalates, PAEs) are the most widely used and ubiquitous plasticizers, with up to 50% content in the final product. However, because there is no chemical covalent bond between the plastic matrix and the titanate plasticizer. It will dissolve when it comes into contact with greases and moisture in packaged foods, especially when heated. And the higher the content of titanate plasticizers in plastics, the more they are dissolved. According to relevant studies, titanate has chronic toxic effects on human development and reproduction, and can cause cancer and mutagenesis. Therefore, the detection of titanate in food plastic bags by GC-FID technology mainly involves the detection of five components: dimethyl phthalate (DMP), diethyl phthalate (DEP), dibutyl phthalate (DBP), di-n-octyl phthalate (DOP), and

bis(2-ethyl)hexyl phthalate (DEHP).

4. Concluding remarks

There are many types of gas chromatography technology, which can be used to detect pesticide residues, food additives, edible oil fatty acid composition and solvent residues, and harmful substances in food plastic bags. The ingredients are detected and separated to improve the safety of food. In this way, food containing harmful substances can be avoided from entering the market, and the health of the human body is ultimately protected.

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