

Headspace Gas Analysis and Quality Control

Abstract: This paper introduces the relationship between packaging headspace gas analysis and product shelf-life. It also introduced a number of issues concerning purchasing the headspace gas analyzer.

Keywords: Headspace gas analysis , packaging , shelf life period

Oxygen and water vapor is the main factors influencing the product shelf-life. Some study found that, by controlling the composition ratio of the gas inside the packaging, products shelf-life can be extended or at least the quality of products can be improved. This has become the impetus of the rapid development and applications of barrier films. However, it is worth noting that the leak of gas filling inside the packaging (MAP and CAP packaging barely use oxygen to fill) will cause the increase in the proportion of oxygen. Furthermore, when filling in is completed, there will be a small amount of air remaining. Therefore the actual composition of the gas will be different from what expected. What would this problem cause? How to solve these problems? This article will analyze the relationship between the headspace gas analysis and the quality control of product packaging. The purchase tips of headspace gas analyzer will also be touched on.

1 The Purpose of Headspace Gas Analysis

There is also gas inside of the packaging, such as style snacks, baked goods, meat products, dairy products, coffee, fruit juice, carbonated drinks, pills, injections, per os medical liquid, perfumes, toiletries and so on. Even the so-called 'Vacuum-packed', it is just to reduce the gas content in packaging as much as possible. Gas can not be completely ruled out. It is very difficult to use techniques to control and change the gas composition since the end of the filling until the open of package. Use of packaging materials can only be the barrier to the infiltration of gas. Packaging cannot eliminate the in-house gases such as oxygen (excluding the oxygen elimination packaging technology). Therefore, if oxygen or other products-sensitive gas still exists inside of the package, it will impact the quality of products and gradually changes the in-house gas composition. In order to minimize the specific content of the gas, MAP and CAP packaging is widely used. The inert gas is also critical to extend shelf-life of products. It is mainly carbon dioxide and nitrogen. But as the extension of storage time, gas will constitute a gradual change. We can see that, regardless of what is the form of packaging, it is always difficult to control the internal components of the gas. So that it became difficult to analyze product quality, expected durability, and the reasonableness of the packaging design. Headspace gas analysis - testing the composition of accumulated gas, which is in the headspace inside of the packaging, can be an effective solution to this problem. It has become a test of the packaging design quality, as well as an important means to verify product shelf-life.

2 Keys to Headspace Gas Analysis

Oxygen and carbon dioxide is the key point to headspace gas analysis.

Oxygen can not only damage the nutritional content of food (for example oxygen can oxidize oils and fats, it smells bad. Sometimes it is toxic). Under most circumstances, it is the conditions for the growth of bacteria (bacteria

growth in food is the main reason for deterioration). But when the oxygen content is less than 2%, carbon dioxide levels in more than 7%, food and bacteria are in a state of hibernation, which can effectively extend the shelf life of food. Many drugs, such as low-cost iron salt, iodide, nitrite, unsaturated carbon chain and other types of organic drugs, can be slowly oxidized. Discoloration, smell, decomposition and deterioration will occur. Sometimes it is also toxic. Most of cosmetics contain fat ingredients. Non-saturated fat can easily cause oxidation and deterioration (rancidity), and oxygen is the most important external cause to rancidity.

Carbon dioxide gas is an important component to CAP packaging and MAP packaging. Its content is closely related to product shelf life length, and carbon dioxide content of the package is directly influencing carbonated drinks taste and quality. Drugs packaging also needs attention to the impact of carbon dioxide, because some drugs can combine with carbon dioxide in the air, resulting in deterioration. Examples are some hydroxide, oxide and the class of calcium drugs. They can absorb carbon dioxide and produce carbonate.

3 Factors to be Noted when Choosing Devices

At present there is a large variety of headspace gas analyzer .but the following factors should be taken into account to choose practical and reliable equipment:

1. The type of gas to be analyzed. All of the current headspace gas analyzer can analyze oxygen content, but not all of the equipment can analyze carbon dioxide content. By analyzing the oxygen content, current product quality can be checked but what unable to determine is the product's shelf-life reservation quality. As a result, to expand the types of gases as far as possible can improve the accuracy of the shelf-life expectation.
2. Sample gas size. It is known that, packaging trend is to be smaller, more and more independent small package came into being one after another. Accordingly the volume of gas in the package has been greatly reduced. However, headspace gas analyzer probe body must absorb a sufficient volume of test gas in order to carry out gas analysis. And if sampling probe is being used, probe and hose contents also need to be taken into account. Great test gas demand is one of the main shortcomings of traditional hand-held headspace gas analyzer. Desktop device can solve the problem by direct sampling.
3. System response time. All of the headspace gas analyzers use the same method to collect gas, which is to use probe to penetrate seal. But in fact when the probe penetrated the packaging, the packaging around the probe began leaking. The leak would 'contaminate' the packaging test gas. Therefore the system response time will influence the test result.
4. Sensor life. In general, the headspace gas analyzer sensor is always surrounded by test gas. Influenced by the principle of testing as well as gas content, the sensor has life span which can not be extended. It could only be replaced. So when making choice of equipment, attention should also be paid to the life of the sensor.
5. Portability of the equipment and the convenience of data transfer. In order to better analyze the actual quality of the product, it is likely that test process is not completed in the laboratory. Thus the portability of the products is needed. A good portable device can be carried by the staff to warehouse, stores, transportation, and even before the use of the product. The equipment with poor portability can only be used in the laboratory. Consequently testing efficiency will be lower. Nevertheless, current portable headspace gas analyzers do not have more real-time test results printing function. Although the test data can be stored in the device, it could easily cause confusion

if a large amount of data stores in the device.

4 The Advantages of HGA-01 Headspace Gas Analyzer

The latest HGA-01-Headspace Gas Analyzer from Labthink, it draws the advantages from desktop and portable devices, with many exclusive features. First of all, it is able to analyze two kinds of gas- oxygen and carbon dioxide. Its accuracy and range excel to be the first class around the globe. Secondly, the automatic sampling and manual sampling, two sampling methods are exclusive. It can analyze oxygen and carbon dioxide content at the same time. Its minimum amount of manual injection has reached the highest level internationally, making the analysis of small-scale packaging possible. Third, the equipment of special probes, airproof gasket and filter, improve the response and sampling time, which is the guarantee of valid and reliable test data. Fourth, with the gas sensors of the longest life expectancy around the world, it meets at least 6 years of normal use. Fifth, although the HGA-01-headspace gas analyzer is larger than the average size of portable devices, but it has printing function which average portable devices do not have. Labthink equipped it with professional, portable tool box so that it can be easily used in various environments and conduct quick analysis.

5 Summary

Headspace gas analysis will enable us of more convenient, accurate and rapid control of the gas components changes inside packaging. It is a significant means to help us analyze the quality of products, the validity of durability and the reasonability of packaging design. It is an essential method to improve product quality control. Practical and reliable equipment is the assurance to quality control and analysis.