

## The Test Items and Methods for Cosmetic Packaging

**Abstract:** Flexible plastic packaging is gradually taking the place of traditional glassware packaging in cosmetic industry. However the in some aspects the performance of flexible plastic is not as good as glassware. How to ensure the quality of cosmetic packaging? This paper will introduce cosmetic packaging, and the factors influencing the preservation and marketing of cosmetics. Respectively advices will be given.

**Key Words:** cosmetics, barrier, headspace, sealing, pressure-sensitive adhesive

Equal-pressure method was gradually developed in the 1970s to determine oxygen permeability of packaging materials. Although equal-pressure method has limitation in its actual application and still needs improvement to challenge the fundamental position of differential-pressure method in gas permeability testing, it possesses test advantages of its own, which expand the application fields of equal-pressure method.

### 1. Factors Influencing the Preservation of Cosmetics and Relevant Tests

Apparently the most significant function of cosmetic packaging is to preserve the content. There are lots of ingredients agreeable to the propagation of microorganism in cosmetics, such as glycerin and protein. When cosmetics have already been contaminated by microorganism (smelly, deteriorated and mildewed), water and oxygen became the factors influencing the growth of microorganism. Most cosmetics contain lipid, and the unsaturated bond in lipid can very easily go bad and rancid. Moreover this is a chain reaction, if one small part goes bad the whole entity will soon completely be rancid. Peroxide, acid and aldehyde will be generated, which release strong odor. Oxygen is the most important external cause; there won't be any rancidification if there is no oxygen. The increase of water will also cause hydrolyzation and accelerate the autoxidation. Water also provides the living environment for microorganism, and weakens the vitality of some antioxidant. The preservation of fragrant odor is the significance of cosmetic packaging. To some cosmetics, the fragrant odor is the 'product'. If the fragrance is gone, the product will be gone as well. Thus to keep the fragrance is the most important task to some cosmetics.

It can be seen that antiseptic, antioxidant treatment and the preservation of fragrance is the key point of cosmetic packaging. Following tests should be done: air permeation test, package internal air volume test, package entity test. These test can also be seen as the barrier property test of package materials, the head space analysis and the sealing test of packages.

#### 1.1 Barrier Property

Barrier property refers to the barrier performance of materials against penetrant air or liquid. The strength of barrier property can directly influence the quality of product during its guarantee period. It is also an important index to assess the guarantee period. The barrier property of cosmetic packages is one of the most important tests. It includes the oxygen permeation rate, vapor permeation rate and organic gas permeation rate.

Oxygen permeation rate is mainly applied to the tests of cosmetic package use film, multilayer film, package bags or bottles. At the moment there are only two methods to test the oxygen permeation rate—differential pressure method and equal pressure method. They are both able to test the permeation rate of film and whole packages, though they share different advantages. Differential pressure method has no requirement for test gas. It can be used to test the permeation rate of any gas. However it is still at the primary stage of package container test.

Equal pressure method is maturely used in film test and containers test, such as Labthink PERMETMOX2/230 Oxygen Permeation Rate Tester. The test method has requirement for test gas.

Vapor permeation rate test is mainly used in cosmetic package film, bottle, bag and other containers. By testing the vapor permeation rate, production technique index can be controlled and adjusted to satisfy the requirement of different products. Weighing method and sensor method can both test the vapor permeation rate of films and packages. But considering the test efficiency, sensor method is more developed in packaging test, such as the Labthink PERMETM W3/330 Vapor Permeation Test System.

Actually preservation of fragrance test is just the organic gas permeation rate test. This test is very important to cosmetic packages because fragrance is the point of most products. Losing the fragrance means losing the products' market share. In a global view the test of fragrance preservation is still in the development stage. The new tester made by Labthink, PERMETM OR2/410 Organic Gas Permeation Test, can test organic gas permeation rate by creating an organic gas concentration difference on the two sides of test material. The test can be done in room temperature. It is based on the permeation volume of organic gas to calculate the rate.

## 1.2 Sealing Performance

Sealing performance refers to the test of whether there is a leakage point on packages or not. Leakage can be leaking into the package or out of the package. It appears by small crack on materials, small holes or the joining place between two pieces of materials. The hot sealing and the bottle mouth are the two most likely places to have leakage. Strict production technique and tests are necessary to solve leakage. Usually there are two methods to test: positive pressure method and negative pressure method. Positive pressure method occupied wide attention because it is not only able to test the sealing performance of ordinary packages, but also able to test additional samples by using add-ons. Such as Labthink PARAMTM LSSD-01 Leakage and Sealing Performance Strength Tester, it can test flexible tubes, blow head, bottle cap, bags' sealing and so on.

## 1.3 Head Space Air Analysis

There is always a small volume of air in packages when cosmetics packaging is finished. That air is very difficult to control or change since it was packed until the product is opened. Barrier packaging material can only obstruct the air permeation, rather than remove the air inside the bags such as oxygen (excluding the deoxidization technology). If the remaining air volume exceeded the maximum allowance of product reservation, the guarantee period will not be reached no matter how good is the barrier material or how well the container is packaged. Thus the remaining air in cosmetic products should be tested and adjusting should be made.

Labthink PARAMTM HGA-01 Head Space Air Analyzer is capable to conduct the remaining air test. It can be used to test the oxygen and carbon dioxide volume and proportion in airtight packages, bottles and cans. It's able to test the air composition quickly and accurately in production line, storage, labs and so forth places, and therefore guarantee the production and product safety.

## 2. The Marketing Factors and the Appearance Test of Cosmetics Packaging

The appearance of cosmetic packages may directly influence consumers' recognition to the brand and its product quality. Usually first class cosmetics have first class packaging; every cosmetic brand puts lots of effort into its product packaging to ensure the product quality, its beauty and convenience as well. From the consumer perspective, the printing, easiness of opening, the touch of package surface and exterior design are all important factors to be considered when they are choosing a product. Except exterior design, all the other factors are closely related with the performance test of packaging materials.

### 2.1 Printing Quality

Cosmetic packages are usually delicately printed for visual enjoyment; therefore to test the quality of printings is fairly important. The routine tests for current cosmetic packaging are ink abrasion performance (anti-scratching), ink fastness performance and color differentiation. Among above tests, the fastness test and color differentiation can be tested by conventional methods. The abrasion test in China shares a different method with the international society. Chinese standard requires loaded block straight line test, but international standard requires loaded block curve line test such as ASTM D5264 (Labthink PARAMTM RT-01 Abrasion Tester). Testers should consider importer's need and acquire designated test method.

## 2.2 Adhesive Tag Test

Adhesive is widely applied in cosmetic packaging. The test items aim at the performance of pressure sensitive adhesive, which mainly are first attachment adhesive performance, the continuity of adhesive and the peeling strength.

The first attachment test adopts the tilt iron ball rolling test. The method utilizes the adhesiveness between iron ball and pressure sensitive adhesive tap when they reach each other by small pressure and time period. The test uses the biggest iron ball (which can be stuck on the tap) to symbolize the first attachment adhesive performance. The adhesive continuity test is conducted by a hanging test board attached with the sample tap. Some weights are put at the end of the board. The time period of displacement of the sample tap can indicate the adhesive continuity. The peeling strength is an important index to evaluate the adhesiveness. Usually this test can be done by electronic pulling tester or peeling tester.

## 2.3 Easiness of Opening

Bottle containers are the most common containers in cosmetic packaging. The strength of bottle caps and the torque length are important indexes in production techniques. These indexes have significant influence on transportation and final consumers. The opening and fastening of bottles can be tested by torque tester. This test should be related with sealing performance.

Packages also have wide application in cosmetics, especially in small volume packages. Its easiness of opening is usually decided by the tearing performance, hot sealing performance and the friction index of the material surface. It should be noted that the clamping strength should be strong enough to avoid slipping in tests. However when consumers are opening the packages, if packages' friction does not go well with the tearing strength (consumer does not provide more strength to tear), slipping can still happen. Comprehensive consideration should be given to both of these indexes when packages are being designed. Simulations should also be done in all kinds of gripping conditions.

## 3. Summary

Generally speaking, according to the preservation requirements of cosmetics, performance tests include the content preservation and the product appearance tests. Of course basic dynamics requirements should be satisfied. Antisepsis, antioxidant treatment and fragrance preservation are the key point of cosmetic preservation. They are related with the barrier property of materials, headspace air analysis and sealing performance tests. And the appearance of packages can directly affect marketing. Main factors are printings, easiness of opening, the touch of package material surface, and the adhesive test of tags. Knowing the index of packages and their materials, we can avoid some mistakes when we are designing cosmetic packages. The usability, the protection and appearance of package design will also be improved.