

## Test Overall Barrier Property of Package

**Abstract:** This article details on the test method of bottle body that has complete bottle-cap sealing.

**Keywords:** barrier property , transmission rate , permeance , permeability , packaging

### 1. Current Situation of Package Barrier Property Testing

Package is one of the main forms in liquid packing. Barrier property of the package has a direct influence on quality guarantee period of products. Generally speaking, the better the barrier property of package is, the longer the quality guarantee period will be. To products such as alcohol or perfume that possess special odor, the package should have better barrier property to elements that will easily cause product deterioration, such as oxygen and water vapor. Moreover, the package should ensure that special perfume of these products would not dissipate during storage.

Because package is directly used in liquid packing, its shape and specification is very difficult to unify. That is why package testing is difficult to carry out and develops more slowly than film barrier property testing. In barrier property testing of the package, test of common gases occupies a large demand. In the past, gas permeance is estimated by testing package sheet material. However, package wall is not uniform in thickness and material nature will be changed in the process of production, which will cause certain disparity existing between estimated and actual gas permeance of the package. Among various test technologies, package oxygen permeability enjoys the rapidest development. The introduction of ASTM F 1307 standard for package oxygen permeability test method not only accelerated the research and popularization of package oxygen permeability instruments, test results also becomes more scientific and accurate, which changed the former condition of chaotic test methods and lower credibility of test data.

Except for metal cans and packing box of pulp-molded aluminum, one complete package mainly consists of bottle body and bottle cap. At present, the test of package oxygen permeability mainly aims at bottle body or bottle cap. However, to one package, so long as its bottle body and bottle cap are not one integral part, leakage of the connecting place will greatly decrease overall barrier property of package, even if both bottle body and bottle cap can achieve high barrier property. Connecting place of the bottle is like heat-sealing place of flexible package, where leakage point will cause a failure of barrier property protection to inner content. Therefore, the connecting place of package (especially the detachable package except for metal cans and packing box of pulp-molded aluminum) is one weak point of package barrier property.

### 2. Integral Test of Package Barrier Property

At present, methods for overall barrier property test of sealed bottle are very rare. Based on the oxygen permeability test of common bottle body, Labthink made some improvements and has find a method for overall barrier property test of sealed bottle. Here we will take one actual test of Labthink lab as an example for explanation.

- Instrument: Labthink TOY-C1 film/package oxygen permeability instrument
- Specimen: glass bottle (metal cap)
- Test item: oxygen permeance of bottle cap and sealing place
- Test environment: standard lab environment
- In the following part, the test method is introduced step by step.

## 2.1 Specimen Preparation

First, prepare effective test specimen. The method of preparation is almost the same with that of bottle body oxygen permeability test, which include preparation of test instrument, specimen pretreatment and tools needed in the process of test. However, specimen placement is not the same.

When test barrier property of bottle body, the package should be laid upside down and fixed onto special bottle pedestal manufactured by Labthink. Then seal bottle neck by filling special glue into bottle pedestal in order to avoid the transmission of oxygen from connecting place of bottle pedestal and bottleneck into bottle body. Generally, the finished specimen is shown as figure 1.



Figure 1



Figure 2

In overall barrier property testing of bottle cap and bottle body, place the bottle upward on the center of tailor-made bottle pedestal (please refer to the article 'TOY-C1 Package Oxygen Permeability Test'). Then fill the sealing glue evenly into between bottle body and bottle pedestal. Make sure that the space between bottom recess and input and output pipes is also filled with sealing glue. The finished specimen is shown as figure 2.

It should be noted that unit mounting must be carried out after the complete solidification of sealing glue. Otherwise movement of specimen may cause failure of sealing glue, i.e., failure of package sealing.

## 2.2 Specimen Placement and Test

Similar to the method of bottle body test, install the prepared specimen and other accessories to lower chamber of instrument (please refer to the article 'TOY-C1 Package Oxygen Permeability Test'). Then the test can be started. The test method is completely the same with that of bottle body oxygen permeability.



Figure 3. Test condition

### 3. Conclusion

Oxygen permeability test method for sealed bottle introduced in this article is based on oxygen permeability test of common bottle body, among which preparation of specimen and specimen unit is the difficult points. This method can also be used for overall oxygen permeability test of metal cans and pulp-molded aluminum flexible package. Wide application of this method not only can offer great help to a comprehensive understanding of package barrier property, it can also provide data support to structure designing and cost saving of package.