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Significance of Proficiency Testing of Plastic Packaging Material Barrier Property Testing

Abstract: At present, proficiency testing project has been fulfilled, Labthink realized the significant influence of this project to barrier property testing, made a review and summary of it.
Key words: barrier property, oxygen transmission rate, water vapor transmission rate, achievement, summary

At present, the development of material barrier property test in China is not balanced. The testing level is of various qualities, testing data is inconsistent. But, to improve the condition and promote testing proficiency, we must know the general condition objectively and accurately at first. We have investigated barrier property testing in China and gained tremendous achievement through laboratories proficiency testing “Barrier property test of plastic packaging material——Determination of oxygen and water vapor transmission rate”.

1. Evaluate barrier property testing level in China accurately

In the past, we realize and evaluate the barrier property testing level in China via indirect ways. Such as, analyzing the percentage of each testing method in China by market domination rate of testing instruments of each company, then estimate condition of general barrier property testing by analyzing and comparing each testing method and capability index of instruments, as a result the conclusions and evaluations do not process high accuracy. But, statistical data are often of little truthfulness due to indirect evaluation method and the lack of official authority.

The plastic packaging material barrier property testing is class A project of proficiency testing program of CNCA in 2007, production quality test centers nationwide, inspection institutes at provincial levels (including deputy provincial level city and city directly under state planning), government-controlled technical centers (labs) of Administrations for Entry-Exit Inspection and Quarantine, all laboratories process the barrier property testing items in relevant ministries and commissions and production quality inspection centers must participate the testing. Company laboratories and other laboratories can also participate the testing. 69 laboratories participated in oxygen transmission rate testing, 67 laboratories participated in water vapor transmission rate testing. It covers most of Quality testing institutes and relevant authoritative laboratories in China. This proficiency testing is unprecedented in barrier property testing level and authoritative of organizers, and we can evaluate barrier property testing level of China authoritatively, objectively and accurately. Statistical data affirmed the basic station of gravimetric method and differential-pressure method. Systematic error of gravimetric method and differential-pressure method are within the range of accreditation, none of the laboratories adopted them were considered to be outlying.

2. Regulate testing procedur

Barrier property testing is a new test field in China and many testing institutes and most laboratories began to study it in recent years, degree of familiarity of the testing method and understanding of the testing index of laboratory assistants are not exactly the same level. Laboratory assistants have different understandings on testing principal, specimen preparation, choosing of experimental environment, effects of temperature changes to the testing data, similarities and differences among testing standards, and notices of

kinds of testing instruments. Laboratory assistants would get deep understanding of many details in operating through the proficiency test testing, avoiding effect of many detailed problems in barrier property testing in the future, and the application of package material barrier property testing was extended and gained attentions at the same time.

3. Guidance to data comparison process

Comparison of data among laboratories and barrier property testing methods were not standard in the past, the specimen choosing for comparison and statistical processing of testing data are usually simple and not strict. Through the proficiency testing, we get a strict procedure of the whole proficiency testing, the consistency of comparison specimen and scientificity of data statistical analysis have a direct influence to the accuracy of proficiency testing, and relevant to success of the project. Therefore, organizers must test the homogeneity and stability of the proficiency testing specimen according to CNAS-GL03《Guidance on Evaluating the Homogeneity and Stability of Samples Used for Proficiency Testing》, to avoid the dissatisfied results from the inherent variability of specimen. Statistical testing result according to CNAS-GL02《Guidance on Statistic Treatment of Proficiency Testing Results and Performance Evaluation》, and evaluate testing capability of laboratories by statistical data. The evaluation method has been used for many years and have profound theoretical basis. It can act as theoretical basis for the comparison of kinds of data in future and be a guide to the comparison test.

4. Provide references to barrier property testing instrument choosing

There are many testing methods for each barrier property. In fact, other testing methods except gravimetric method and differential-pressure method, are also used in China (despite the lack of national standards supporting). Therefore the organizer National Package Product Quality Supervision & Testing Center (Jinan) suggested GB/T1037-1988《Test method for water vapor transmission of plastic film and sheet - Cup method》and GB/T1038-2000《Plastics - Film and sheeting – Determination of gas transmission - Differential-pressure method 》as experimental method, other experimental testing method are also allowed. Thus, this proficiency testing applied a scientific and equal platform for different testing methods.

The proficiency testing takes the automatization of instruments into account, which was not concerned in the past. In fact, the convenience of instrument operation affects artificial error in experimental data directly and is more seriously than effect of testing method itself, especially for indexes like barrier property. We acquired many valuable conclusions based on taking the automatization of instruments into account. For example, automatic gravimetric method instrument and non-automatic gravimetric method instrument performed differently in proficiency testing of water vapor transmission rate, data from 3 laboratories with automatic gravimetric method instrument were considered to be suspicious, but more than a half of laboratories with non-automatic gravimetric method instrument were considered to be suspicious or outlying. Experts are not surprised to the result, the shortages of non-automatic gravimetric method had been mentioned time after time, but some false sayings often confuse it with the errors arising by experimental methods.

Proficiency testing not only give us a clear understanding of advantages and disadvantages of different testing methods, but also supply tremendous information of instrument choosing for testing to institutes and laboratories.

5. Become the preparation for unifying data system of barrier property testing

From the proficiency testing, we can see that the inconsistency between different barrier property testing methods really exists. Thought data difference is small, it could lead to tremendous economic losses and even safety problems of products also, especially for foods and medicine packages. So, it has been focused on widely. The scale of data comparison is smaller and the procedure is not regular in the past, so it is hard to get an accurate and efficient analysis by data comparison, and unify testing data systems is impossibly. This proficiency testing is the largest barrier property testing in the world. Not only the testing environments and specimen are warrant, but also the reality of the testing is ensured by the status and strength of laboratories participating in the project. Therefore the statistical data of proficiency testing could be the preparation for unifying data system of barrier property testing.

6. Summary

In summary, the achievement of proficiency testing project is remarkable. We not only get the level of barrier property testing of China, but also accomplished the largest systematic comparison of different barrier property testing methods. We get a clear recognition of the problems existing in barrier property testing areas and find the way to unify data system of barrier property testing.