



**NATIONAL STANDARD OF THE  
PEOPLE'S REPUBLIC OF CHINA**

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**Plastics - Assessment of the intrinsic biodegradability of  
materials exposed to marine inocula under mesophilic aerobic  
laboratory conditions - Test methods and requirements**

塑料 在实验室中温条件下暴露于海洋接种物的材料固有需氧生物分解能力评估  
试验方法与要求

**(English Translation)**

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### 1 Scope

This document describes test methods for assessing the inherent biodegradability of plastic raw materials and polymers in marine environments without any environmental exposure or pretreatment.

The test methods in this document are carried out under aerobic, mesophilic conditions and are aimed to obtain the ultimate biodegradability of materials, i.e. conversion into carbon dioxide, water, and biomass.

This document is only used to evaluate the inherent biodegradability of materials. It is not used to evaluate the environmental hazards of possible constituents such as heavy metals and other substances, nor is it used to evaluate its potential ecotoxicity. This document is suitable for assessing the overall environmental impact of plastics released intentionally or unintentionally into the marine environment.

This document is not used to evaluate the performance of products processed from biodegradable plastic raw materials and biodegradable polymers. The lifetime and biodegradation rate of biodegradable plastic products in the ocean are often affected by specific environmental conditions as well as the thickness and shape of the product.

The test results of biodegradability obtained under the test conditions specified in this document cannot be directly extrapolated to the actual marine environment.

This document does not apply to "marine biodegradable" claims for biodegradable plastic raw materials. If necessary, refer to the relevant product standard.

The test methods specified in this document cannot be used to determine the specific biodegradation rate (i.e. rate per available surface area) of the test material. If necessary, refer to the relevant standards about biodegradation rates.

### 4.3 Negative control material

The negative control material shall be tested in parallel with the test material. The negative control material is virgin polyethylene.

### 4.4 Biodegradation test methods

Plastic raw materials, polymers or each organic constituent shall be subjected to marine biodegradation tests together with reference materials and negative control materials, respectively. The tests shall be carried out in accordance with any of the following 6 documents: ISO 18830, ISO 19679, ISO 22404, ASTM D6691-17, ISO 23977-1, and ISO 23977-2.

The test ends when the test reaches a plateau phase. When the average biodegradation rate of at least 3 test materials is less than 3 % within 2 months, the test can be considered to have reached a plateau phase. After 1 year of testing, the test conditions shall be carefully monitored following the corresponding standard test methods to ensure long-term reliability of the test conditions. The results are only valid if the test method meets the corresponding standards.

### 4.5 Requirements

For whole test material or each individual constituent, organic carbon shall mineralize into carbon dioxide within 2 years for a degree of mineralization of at least 90 %, or for the extent of the reference material. In this document, this requirement is met if the mineralization relative to the reference material is  $\geq 90$  %. Both the reference material and the test material shall be tested within the same period, and the results shall be compared at the same point after both tests have reached a plateau phase.

For organic constituents with a content between 1 % ~ 15 % (dry mass) in the material, the biodegradability shall be determined separately. It may refer to OECD 301 Methods

A ~ F to determine based on the existing biodegradation test results. This document recognizes the biodegradability under conditions described in OECD 310.

Alternatively, it may also use an artificial blend of the same material to determine the biodegradability of an organic constituent. The artificial blend shall contain  $\geq 15$  % of the corresponding organic constituent [by total organic carbon (TOC) content]. The chemical composition and the structure of the material shall remain the same, but the content of the organic constituent of concern shall be increased to  $\geq 15$  % [by total organic carbon (TOC) content]. The preparation of the artificial blend shall use the same process conditions (e.g. extrusion) as used for the raw materials, except that the content of each constituent in the raw materials may be less than 15 % (by dry mass). If the artificial blend meets the above requirements, the organic constituent is considered biodegradable. Therefore, when the

content of this constituent in a certain material is

$\leq 15\%$  (based on dry mass), the above results are also applicable.

**NOTE 1:** The purpose of testing an artificial blend is to verify a synergistic effect demonstrating that a constituent, which is suspected of being non-biodegradable when tested alone, may become biodegradable when combined with another biodegradable constituent of a material.

**NOTE 2:** The purpose of increasing the content of a certain constituent in the artificial blend to  $\geq 15\%$  is to avoid false-positive test results, because theoretically a material contains 10 % of a non-biodegradable constituent may still reach the pass level for biodegradation.

Natural materials and constituents that have not been chemically modified (such as wood, wood fiber, cotton fiber, starch, paper pulp, bagasse, jute) shall be considered to be biodegradable in nature without testing.

In principle, the biodegradation test results obtained using any of the test methods in

4.4 can prove whether the material is susceptible to biodegradation by marine microorganisms. However, some test materials that fail the test may be the consequence of being affected by the quality or quantity (or both) of the ineffective microbial population in an inoculum. Thus, when the test is repeated using different inoculum, the material may show signs of biodegradability.

The above laboratory test methods shall be carried out between 15 °C and 25 °C, but not exceeding 28 °C.

**NOTE 3:** When the test temperature is higher than 20 °C ~ 22 °C, the biodegradability of psychrophilic microbes may be inhibited.

## 5 Test report

The test report shall contain at least the following content:

- all identification information of the plastic material or polymer being tested;
- the test methods used in the test, the results, and whether the specified requirements have been satisfied;
- annexes with the specific test reports of the test method used.

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