SCIENTIFIC SUB-COMMITTEE
-
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Brussels, 30 May 1996.

CREATION OF A NEW HEADING FOR BIODEGRADABLE PLASTICS AND ARTICLES THEREOF

(Item II.4 on Agenda)

Reference documents :

39.982 (RSC/13)
40.180, Annex C/9 (RSC/13 - Report)

I. BACKGROUND

1. At its 13th Session, the Harmonized System Review Sub-Committee considered a proposal by the Japanese Administration to create a new heading in Chapter 39 for biodegradable plastics and articles thereof, in view of the potential growth of trade in these products.

2. The Japanese proposal (see Doc. 39.982) was to create a new heading 39.27 with the following structure :

"39.27 Biodegradable plastics and articles thereof

- Biodegradable plastics :

3927.11 -- Biosynthetic biodegradable plastics
3927.12 -- Chemical synthetic biodegradable plastics
3927.13 -- Biodegradable plastics using natural polymers
3927.19 -- Other

3927.20 - Articles of biodegradable plastics".

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3. As regards the nature of biodegradable plastics, the Japanese Administration explained that they "retain the same functions as existing plastics during use and finally can be degraded into water, carbon dioxide and other inorganic substances that do not have an adverse effect on the environment, by micro-organisms that commonly exist in nature".

4. With regard to the three subdivisions suggested for biodegradable plastics in primary form (3927.11 to 3927.13), the Japanese Administration had indicated that there were three manufacturing methods for biodegradable plastics, namely, biosynthesis, chemical synthesis and use of natural polymers, and had provided the following information :

4.1 Biosynthetic biodegradable plastics include copolymer of polyhydroxybutyrate and polyhydroxyvalelate, which would fall in HS subheading 3913.90.

4.2 Chemical synthetic biodegradable plastics include aliphatic polyesters, which would fall in HS subheading 3907.99.

4.3 Biodegradable plastics using natural polymers include a polymer alloy of starch and polyvinyl alcohols, which would fall in HS subheading 3905.20, 3905.90 or 3911.90.

5. In view of the technical nature of the question, the Review Sub-Committee (13th Session) agreed that the Japanese proposal should be referred to the Scientific Sub-Committee for advice on whether it was possible to define biodegradable plastics and, if so, what criteria were for distinguishing biodegradable plastics from other plastics. Administrations were requested to submit comments on these points to the Secretariat as soon as possible.

6. On 26 April 1996, Secretariat received the following Note from the Japanese Administration.

II. NOTE BY THE JAPANESE ADMINISTRATION

7. "The International Organization for Standardization (ISO) defines the degradable plastics as those in which the degradation process results in lower-molecular-weight fragments produced by the action of naturally occurring micro-organisms such as bacteria, fungi and algae. We think that Japan would be able to accept the above definition on a new heading of the HS for biodegradable plastics.

8. With respect to the criteria, we would be able to distinguish the biodegradable plastics from other plastics by adopting a biodegradability testing method using activated sludge, which is approved as Japanese Industrial Standard (JIS) by the Ministry of International Trade and Industry of Japan (MITI), which is annexed hereto. However, this method will take 28 days to obtain the result, which is longer than expected.

9. An alternative solution would be to specify biodegradable plastics by their chemical names instead of using the term "biodegradable plastics" in the legal text.

10. According to the MITI, international trade figures for the years 1992, 1993 and 1994 were 450 million yen (4.5 million US dollars; 1067 tons), 1030 million yens (10.3 US million US dollars; 1454 tons) and 1250 million yens (12.5 million US dollars; 1986 tons), respectively, and the figure is expected to increase in the future."

11. The biodegradability testing method (Japanese Industrial Standard), referred to in paragraph 8 above, is reproduced in the Annex hereto (available only in English version).

III. SECRETARIAT COMMENTS

12. The following explanation concerning biodegradation of plastics is given in Kirk-Othmer Encyclopedia of Chemical Technology (Third Edition, Supplement Volume, page 626-627) :

> "Biodegradation is the degradation and assimilation of organic polymers and other compounds by the action of living organisms. For samples exposed to the environment, the principal organisms are fungi and bacteria. Microbiological degradation often is facilitated by hydrolytic and oxidative breakdown of the polymer owing to environmental exposure. For polymers implanted in an animal body, bio-degradation involves some or all of the body's catabolic processes, including hydrolysis and oxidation processes which usually involve enzyme mediation. Synthetic polymers are usually more difficult to degrade by either animals or microbes than natural polymers."

13. The same literature indicates that several general methods have been developed for measuring biodegradation and "these measurements provide such information as rate of polymer weight loss, loss of polymer physical properties such as tensile strength, or rate of increase in colony size of the microbial culture in contact with the polymer." The following methods have been described (see pages 627-631, Supplement Volume) :

(a) **Growth Ratings (ASTM G 21-70 and ASTM G 22-76)**: The specimens are placed in a solid agar growth medium, that is deficient in available carbon. After exposure up to three weeks, the samples are examined for evidence of colony growth on the polymer sample surface.

(b)**Petri Dish Method, Quantitative**: A weighed polymer sample is deposited on the inside of a Petri dish. Nutrient agar is poured over the polymer and after the test period (3 to 4 weeks), the agar and culture are washed off and the sample is reweighed to determine weight loss.

(c)**Clear Zone Method**: The polymer in finely powdered form is suspended in a nutrient-agar medium in Petri dishes and growth of colonies of cells are observed. A clear zone may occur in the medium surrounding the colony if the polymer in the vicinity has been degraded.

(d)**Soil Burial and Retrieval**: Samples are buried in a mixture of sand, garden soil and peat moss, or in a given soil type. After retrieval from soil burial, the samples are tested for weight loss or deterioration of mechanical properties or examined by scanning electron microscope for evidence of attack.

(e)**Plate Count Method**: Finely ground polymer sample is suspended in a shaker flask in nutrient broth which has been inoculated with the bacteria of choice. Plate counts are performed on aliquots removed at intervals in a procedure similar to that performed in blood analysis.

(f)**Radioactive ^{14}C Tracer Studies**: The ^{14}C-labelled plastics is finely ground and mixed with fresh garden soil. Water-saturated air, free from carbon dioxide, is passed through the pot containing the sample and then through a KOH solution to absorb the CO_2 and $^{14}CO_2$ generated on degradation of plastics.

14. It has also been indicated that biodegradability of additives (e.g., plasticisers, fillers, stabilizers) greatly influence the test results. In many situations, however, the possible ambiguity can be resolved by removal of additives from the plastics by solvent extraction, followed by testing of the purified polymers.

15. It appears that most of plastics are biodegradable to varying degrees depending on their susceptibility to micro-organisms. For example, condensation polymers are generally more easily biodegraded than carbon chain polymers. The test methods referred to above and the one adopted by the Japanese Administration (see Annex) measure the extent of biodegradability of plastics. As a matter of course, appropriate criteria would have to be found to distinguish biodegradable plastics from other plastics.

16. It should be noted that most of these methods require a testing time of 3-4 weeks. However, this need not prevent the Sub-Committee from adopting one of these methods for the purposes of HS classification, since such tests could be carried out either in advance at the pre-entry stage or at the stage of entry processing by releasing the goods on a provisional basis subject to finalizing the classification (and duty, etc. adjustment) at a later stage depending on the result of the test.

III. CONCLUSIONS

17. The Sub-Committee is invited to give its views on the following questions, taking account of the Secretariat comments :

(a) Definition of biodegradable plastics (see paragraphs 7 and 12 above);

(b) Methods and criteria for distinguishing biodegradable plastics from other plastics (see paragraphs 13 to 16 above).

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