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THAI INDUSTRIAL STANDARD

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**พลาสติก-การหาระดับการแตกเป็นส่วน
ของพลาสติกภายใต้สภาวะการหมักทางชีวภาพ
ที่กำหนดในการทดสอบระดับต้นแบบ**

PLASTICS-DETERMINATION OF THE DEGREE OF DISINTEGRATION
OF PLASTIC MATERIALS UNDER DEFINED COMPOSTING CONDITIONS
IN A PILOT-SCALE TEST

สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม

กระทรวงอุตสาหกรรม

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การหาระดับการแตกเป็นส่วนของพลาสติก เป็นคุณลักษณะหนึ่งของพลาสติกสลายตัวได้ทางชีวภาพ เพื่อให้การทดสอบดังกล่าวของหน่วยงานทดสอบ ผู้ทำ และผู้เกี่ยวข้อง เป็นมาตรฐานเดียวกัน จึงกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม พลาสติก-การหาระดับการแตกเป็นส่วนของพลาสติกภายใต้สภาวะการหมักทางชีวภาพที่กำหนดในการทดสอบระดับต้นแบบขึ้น

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ กำหนดขึ้นโดยรับ ISO 16929 : 2002 Plastics-Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test มาใช้ในระดับเหมือนกันทุกประการ (identical) โดยใช้ ISO ฉบับภาษาอังกฤษเป็นหลัก

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ กำหนดขึ้นเพื่อให้ทันกับความต้องการของผู้ใช้ และจักได้แปลเป็นภาษาไทยในโอกาสอันควร หากมีข้อสงสัยโปรดติดต่อสอบถามที่สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม

คณะกรรมการมาตรฐานผลิตภัณฑ์อุตสาหกรรมได้พิจารณามาตรฐานนี้แล้ว เห็นสมควรเสนอรัฐมนตรีประกาศตาม มาตรา 15 แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. 2511



ประกาศกระทรวงอุตสาหกรรม

ฉบับที่ 4193 (พ.ศ. 2553)

ออกตามความในพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม

พ.ศ. 2511

เรื่อง กำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม

พลาสติก-การหะระดับการแตกเป็นส่วนของพลาสติก

ภายใต้สภาวะการหมักทางชีวภาพที่กำหนดในการทดสอบระดับต้นแบบ

อาศัยอำนาจตามความในมาตรา 15 แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. 2511 รัฐมนตรีว่าการกระทรวงอุตสาหกรรมออกประกาศกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม พลาสติก-การหะระดับการแตกเป็นส่วนของพลาสติกภายใต้สภาวะการหมักทางชีวภาพที่กำหนดในการทดสอบระดับต้นแบบ มาตรฐานเลขที่ มอก.2511-2553 ไว้ ดังมีรายการละเอียดต่อท้ายประกาศนี้

ประกาศ ณ วันที่ 23 เมษายน พ.ศ. 2553

ชาญชัย ชัยรุ่งเรือง

รัฐมนตรีว่าการกระทรวงอุตสาหกรรม

มาตรฐานผลิตภัณฑ์อุตสาหกรรม พลาสติก-การหาระดับการแตกเป็นส่วน ของพลาสติกภายใต้สภาวะการหมักทางชีวภาพ ที่กำหนดในการทดสอบระดับต้นแบบ

บทนำ

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ กำหนดขึ้นโดยรับ ISO 16929 : 2002 Plastics–Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test มาใช้ในระดับเหมือนกันทุกประการ (identical) โดยใช้ ISO ฉบับภาษาอังกฤษเป็นหลัก

ขอบข่าย

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ กำหนดการหาระดับการแตกเป็นส่วนของพลาสติกแบบใช้ออกซิเจน ภายใต้สภาวะที่กำหนดในการทดสอบระดับต้นแบบ ซึ่งเป็นส่วนหนึ่งของการทดสอบพลาสติกสลายตัวได้ทางชีวภาพมาตรฐาน ISO 17088 การทดสอบที่กำหนดไว้ในมาตรฐานนี้ สามารถใช้หาอิทธิพลของกระบวนการหมักทางชีวภาพและคุณภาพของปุ๋ยหมักที่ได้ ทั้งนี้มาตรฐานนี้ไม่สามารถหาการแตกสลายได้ทางชีวภาพแบบใช้ออกซิเจน กรณีที่ต้องการหาค่าดังกล่าวให้ใช้ ISO 14851 ISO 14852 หรือ ISO 14855

เอกสารอ้างอิง

รายละเอียดให้เป็นไปตาม ISO 16929 : 2002 ข้อ 2

คำศัพท์และบทนิยาม

ความหมายของคำที่ใช้ในมาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ ให้เป็นไปตามที่ระบุไว้ใน ISO 16929 : 2002 ข้อ 3

หลักการ

รายละเอียดให้เป็นไปตาม ISO 16929 : 2002 ข้อ 4

เครื่องมือ

รายละเอียดให้เป็นไปตาม ISO 16929 : 2002 ข้อ 5

การทดสอบ

รายละเอียดให้เป็นไปตาม ISO 16929 : 2002 ข้อ 6

การคำนวณ

รายละเอียดให้เป็นไปตาม ISO 14855-1 : 2005 ข้อ 7

การใช้ได้ของผลลัพธ์

รายละเอียดให้เป็นไปตาม ISO 14855-1 : 2005 ข้อ 8

การรายงานผลทดสอบ

รายละเอียดให้เป็นไปตาม ISO 14855-1 : 2005 ข้อ 9

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 16929 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

Introduction

The biological treatment of biodegradable plastic materials includes aerobic composting in well operated, municipal or industrial biological waste treatment facilities. Determining the degree of disintegration of plastic materials in a pilot-scale plant is an important step within a test scheme to evaluate the compostability of such materials.

Plastics — Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test

WARNING — Compost may contain potentially pathogenic organisms. Therefore appropriate precautions should be taken when handling it.

1 Scope

This International Standard is used to determine the degree of disintegration of plastic materials in a pilot-scale aerobic composting test under defined conditions. It forms part of an overall scheme for the evaluation of the compostability of plastics as outlined in ISO 17088, *Plastics — Evaluation of compostability — Test scheme for final acceptance* (currently under preparation). The test method laid down in this International Standard can also be used to determine the influence of the test material on the composting process and the quality of the compost obtained. It cannot be used to determine the aerobic biodegradability of a test material. Other methods are available for this (see e.g. ISO 14851, ISO 14852 or ISO 14855).

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3310-2, *Test sieves — Technical requirements and testing — Part 2: Test sieves of perforated metal plate*

ISO 5663, *Water quality — Determination of Kjeldahl nitrogen — Method after mineralization with selenium*

ISO 7150-1, *Water quality — Determination of ammonium — Part 1: Manual spectrometric method*

ISO 10304-2, *Water quality — Determination of dissolved anions by liquid chromatography of ions — Part 2: Determination of bromide, chloride, nitrate, nitrite, orthophosphate and sulfate in waste water*

ISO 10390, *Soil quality — Determination of pH*

ISO 11465, *Soil quality — Determination of dry matter and water content on a mass basis — Gravimetric method*

ISO 14851, *Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium — Method by measuring the oxygen demand in a closed respirometer*

ISO 14852, *Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium — Method by analysis of evolved carbon dioxide*

ISO 14855, *Determination of the ultimate aerobic biodegradability and disintegration of plastic materials under controlled composting conditions — Method by analysis of evolved carbon dioxide*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1

biological treatability

the potential of a material to be aerobically composted or anaerobically biogasified

3.2

degradation

an irreversible process leading to a significant change in the structure of a material, typically characterized by a loss of properties (e.g. integrity, molecular mass or structure, mechanical strength) and/or by fragmentation, affected by environmental conditions, proceeding over a period of time and comprising one or more steps

3.3

biodegradation

degradation caused by biological activity especially by enzymatic action leading to a significant change in the chemical structure of a material

3.4

disintegration

the physical breakdown of a material into very small fragments

3.5

compost

organic soil conditioner obtained by biodegradation of a mixture principally consisting of various vegetable residues, occasionally with other organic material, and having a limited mineral content

3.6

composting

an aerobic process designed to produce compost

3.7

compostability

property of a material to be biodegraded in a composting process

NOTE To claim compostability, it must have been demonstrated that a material can be biodegraded and disintegrated in a composting system (as can be shown by standard test methods) and completes its biodegradation during the end-use of the compost. The compost must meet the relevant quality criteria. Quality criteria are e.g. low heavy-metal content, no ecotoxicity, no obviously distinguishable residues.

3.8

maturity of compost

assignment of the maturity of a compost based on the measurement of the maximum temperature in a self-heating test using Dewar vessels

NOTE It is expressed in terms of the so-called "Rottegrad" (see 6.2.3.1).

3.9

total dry solids

the amount of solids obtained by taking a known volume of test material or compost and drying at about 105 °C to constant mass

3.10

volatile solids

the amount of solids obtained by subtracting the residues of a known volume of test material or compost after incineration at about 550 °C from the total dry solids content of the same sample

NOTE The volatile solids content is an indication of the amount of organic matter present.

4 Principle

The disintegration test is performed under defined and standardized composting conditions on a pilot-scale level.

The test material is mixed with fresh biowaste in a precise concentration and introduced into a defined composting environment. A natural ubiquitous microbial population will start the composting process spontaneously and the temperature will increase. The composting mass is regularly turned over and mixed. Temperature, pH-value, moisture content and gas composition are regularly monitored. They have to fulfil certain requirements to ensure sufficient and appropriate microbial activity. The composting process is continued until a fully stabilized compost is obtained. This is usually the case after 12 weeks.

The compost is visually observed at regular time intervals to detect any adverse effect of the test material on the composting process. At the end of the test, the maturity of the compost is determined and the mixture of compost and test material is sieved through 2 mm and 10 mm mesh sieves. The disintegration of the test material is evaluated on the basis of the total dry solids by comparing the fraction of test material retained by the 2 mm sieve and the amount tested. The compost obtained at the end of the composting process can be used for further measurements such as chemical analyses and ecotoxicity tests.

5 Apparatus

5.1 Composting environment

5.1.1 General

The composting environment may be either a pilot-scale composting bin or nets buried in a pilot-scale composting bin. The volume of each bin shall be high enough for natural self-heating to occur. Sufficient and even aeration shall be provided by an appropriate air supply system.

NOTE 1 To standardize conditions for the test, the composting trials can be run in bins which are placed in a climatic chamber with a constant chamber temperature or in insulated bins.

NOTE 2 If during the spontaneous thermophilic phase the compost reaches temperatures higher than 65 °C, the diversity of microbial species may be reduced. To restore a full array of thermophilic bacteria, it is recommended that the compost be re-inoculated with mature compost (about 1 % of the total initial biowaste mass) of recent origin (maximum 3 months old).

5.1.2 Composting bins

5.1.2.1 Volume and material

The bins shall

- have a minimum volume of 140 l;
- consist of a sturdy, heat-resistant and non-biodegradable material;
- not affect the composting process or the quality of the compost.

5.1.2.2 Drainage

The drainage shall consist of a layer of drains with a thickness of at least 5 cm at the bottom of the bins.

5.1.3 Sample nets

The sample nets, if used, shall consist of mesh-like material with a mesh size of 1 mm made of non-degradable plastic which is resistant to temperatures up to 120 °C. The minimum volume shall be 20 l.

5.2 Apparatus for temperature measurement

5.3 pH-meter

5.4 Apparatus for oxygen measurement

5.5 Sieves

Use sieves of suitable shape with screens of 2 mm and 10 mm mesh (see e.g. ISO 3310-2).

6 Test procedure

6.1 Actions before and during incubation

6.1.1 Start-up of the test

6.1.1.1 Preparation of biowaste

As a carrier matrix, use biowaste, if possible from the input material of a composting plant treating predominantly municipal waste, or, less satisfactorily, biowaste directly from households or e.g. grocery stores.

NOTE Alternatively, a representative artificial biowaste with e.g. the following ingredients may be used:

- freshly mixed fruit and vegetable waste;
- rabbit feed (seeds and extruded dried-vegetable pellets);
- mature compost;
- sufficient water to attain a good moisture content;
- a bulking agent (e.g. wood chips or bark).

It is important that for all test series a homogeneous biowaste of the same age and origin is used. Reduce the biowaste to particle sizes of maximum 50 mm, e.g. by shredding or sieving. Depending on the type of waste, add about 10 % to 60 % of bulking agent (structurally stable components such as wood chips or bark with a particle size between 10 mm and 50 mm).

To ensure a good composting process, the biowaste shall meet the following criteria:

- the C:N ratio of the fresh biowaste/bulking agent mixture shall be between 20 and 30;
- the moisture content shall be above 50 % by mass, with no free water present;
- the volatile solids content of the total dry solids shall be above 50 % by mass;
- the pH shall be above 5.

Adjust the C:N ratio with urea, if required.

6.1.1.2 Preparation of the test material

- a) If the purpose of the test is to measure the degree of disintegration of the test material and to determine the effects on the composting process and the compost quality, use the test material in an identical form (e.g. shape, thickness) as for the intended final use. Reduce large materials in size to 10 cm × 10 cm for films and 5 cm × 5 cm for other products.

NOTE 1 As an option, a colouring agent (e.g. TiO₂ or Fe₂O₃) may be added to the test material for easier re-isolation.

- b) If the (optional) purpose of the test includes production of compost for ecotoxicity tests, use in addition to a) the test material in the form of fine powder or granules. The fine form is intended to prevent the mixture of biowaste and test material from getting too bulky.

NOTE 2 It is recommended that the test material be used as a powder with a particle size < 500 µm.

6.1.1.3 Number of test series

Provide a sufficient number of composting test series, at least:

- a) two series for the biowaste control;
- b) two series for the test material for the purpose of 6.1.1.2 a);
- c) an optional two series for the test material for the purpose of 6.1.1.2 b).

6.1.1.4 Mixing ratio of biowaste and test material

Conduct each composting test series with roughly the same amount of biowaste (wet mass minimum 60 kg). The amount of test material to be added shall be as follows:

- a) For measurement of the degree of disintegration and compost analysis [see 6.1.1.2 a)]:
 - 1 % on wet mass basis of test material in its final form.
- b) For measurement of the degree disintegration, compost analysis and ecotoxicity tests in one test series [see 6.1.1.2 a) and b)]:
 - 1 % on wet mass basis of test material in its final form plus;
 - 9 % on wet mass basis of test material as powder or granules.
- c) For the optional ecotoxicity tests in separate test series [see 6.1.1.2 b)]:
 - either 1 % on wet mass basis of test material in its final form plus 9 % on wet mass basis of test material as powder or granules;
 - or 10 % on wet mass basis as powder or granulate.

6.1.1.5 Preparation of samples

The biowaste used shall be a randomly taken homogeneous and representative sample.

Prepare each test series separately. For all series with test material, weigh biowaste and test material precisely and mix well before introducing into the bin.

If sample nets are used in the composting bins, put the input of biowaste from each sample into a container, weigh and subsequently mix thoroughly with the test material which shall be added in the ratios specified in 6.1.1.4. Place the mixture of biowaste and test material in the nets, tie the nets up tightly with non-biodegradable and heat-resistant plastic string and mark them appropriately.

6.1.2 Turning

Turn the biowaste mixture regularly to break down lumps and to remix water, micro-organisms and substrate. Do this weekly during the first 4 weeks and then every 2 weeks until the end of the test. If sample nets are used, open the nets and mix the contents.

6.1.3 Termination of the test

6.1.3.1 Duration

The duration of the incubation shall be 12 weeks.

6.1.3.2 Sieving procedure

Screen the compost obtained from each composting test series for residual particles of the test material, as follows:

When using bins for the test, take from each bin a homogeneous sample, preferably the whole content of the bin but at least 50 %. When using nets in bins, use the whole content of the net.

Sieve each of the samples through a standard 10 mm sieve, searching the overflow carefully for large lumps of the test material and breaking these up. Separate the sieved material further by sieving through a standard 2 mm sieve. From the 2 mm to 10 mm fraction thus obtained, pick out all particles of the test material, place them on a separate 2 mm sieve and clean carefully, if possible by washing under a running tap. Dry the cleaned particles at 105 °C (or at 40 °C for test materials with melting temperatures below 105 °C) until constant mass is reached. From the mass of total dry solids thus obtained, calculate the degree of disintegration as indicated in clause 7. In addition, measure the amount of organic matter present by determining the volatile-matter content.

NOTE Picking out the particles of test material can be facilitated by dividing the 2 mm to 10 mm fraction into fractions with a narrower particle-size distribution (e.g. 2 mm to 5 mm and 5 mm to 10 mm). Losses of particles of test material during the cleaning process can be avoided by using an additional 1 mm sieve under the 2 mm sieve. All particles < 2 mm in size are, however, usually neglected. It is recommended that samples be taken from the compost left after picking out the test material for compost quality analyses and ecotoxicity tests.

6.1.3.3 Visual observations (optional)

Carry out a visual assessment at least at the beginning and the end of the test and, if possible, whenever the test material is turned. Estimate the particle size distribution of the test material and record signs of microbial colonization (e.g. fungal hyphae, bacterial growth) on the test material particles.

For this, select at least 10 particles providing an impression of all visible degradation phenomena, ranging from little decomposition to extensive degradation of the test material. Clean the selected particles carefully with water and evaluate visually with regard to the following:

- consistency and compactness of the material;
- decolorization;
- signs of local disintegration (e.g. the presence of holes);
- how easy (or difficult) it was to pick out the test material.

Return the selected particles to the composting mixture. Note and document the results of each assessment in writing and by means of photographs.

NOTE A visual assessment is strongly recommended if the test material does not disintegrate completely after 12 weeks.

6.2 Analysis and process control

6.2.1 Start-up of the test

a) Biowaste

At the start of the test, analyse the biowaste and, separately, the bulking agent (see 6.1.1.1). Characterize and document the composition of the waste (e.g. the proportions of garden and kitchen waste).

b) Test material

Describe the test material (see 6.1.1.2) by reporting e.g. the type of material, the volume to surface area ratio or thickness, the ratio of carbon to total nitrogen (C:N), the moisture content, the total dry solids and the content of volatile solids.

6.2.2 During the test

6.2.2.1 Aeration

Control the aeration in such a way that the composting process can proceed smoothly. Measure regularly the oxygen concentration in the composting material or in the exhaust air, at least every working day during the first month of the test and once a week afterwards. The oxygen concentration inside the composting material shall be above 10 %. If the oxygen concentration decreases to below 10 %, aerate the biowaste, using air flow rates of no more than 15 l per kilogram of total dry solids and per hour.

NOTE The air flow can be used to control the temperature and the moisture level of the composting bins. The air flow used to ventilate the bins should preferably be in line with that used in a real composting plant. If, for practical reasons, a higher flow is used, the ammonia removed by the air flow can be estimated. This amount can be restored by the addition of e.g. urea.

6.2.2.2 Moisture content and pH

After turning, take a sample of each test series to measure the pH and moisture content. If the moisture content is too low for a good composting process to occur (< 40 % by mass), add water.

6.2.2.3 Temperature

Measure the temperature in the middle of the composting material at least once per working day.

6.2.2.4 Visual observations (optional)

Inspect visually the mixture and the test material during turning with regard to structure, moisture, fungal development and general appearance (see 6.1.3.3).

6.2.3 Termination of the test

6.2.3.1 Compost

Determine the wet mass of the total compost before sieving.

NOTE 1 It is recommended that the contents of the composting bins be cooled to ambient temperature before weighing and sieving, otherwise too much moisture may evaporate between weighing and sampling for the determination of the moisture content.

Analyse a homogeneous sample of the < 10 mm fraction for total dry solids, volatile solids (see e.g. ISO 11465), pH (see e.g. ISO 10390), ammonium nitrogen (see e.g. ISO 7150-1), nitrite and nitrate nitrogen (see e.g. ISO 10304-2) and total nitrogen (see e.g. ISO 5663). Use for the determination of the maturity of the compost a suitable method such as determination of volatile fatty acids (e.g. by ion chromatography of an aqueous extract) and/or the "Rottegrad".

NOTE 2 The assignment of a maturity level to compost using the "Rottegrad" scale takes place on the basis of the determination of the temperature maximum (T_{\max}) in a self-heating test using Dewar vessels. The measured maximum temperature after about 2 to 5 days is used to classify the compost as follows:

- Rottegrad I: $T_{\max} > 60\text{ }^{\circ}\text{C}$ (fresh biowaste)
- Rottegrad II: $T_{\max} 50,1\text{ }^{\circ}\text{C}$ to $60\text{ }^{\circ}\text{C}$
- Rottegrad III: $T_{\max} 40,1\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$
- Rottegrad IV: $T_{\max} 30,1\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$
- Rottegrad V: $T_{\max} \leq 30\text{ }^{\circ}\text{C}$ (mature compost)

For details of the method, see reference [1] in the Bibliography.

Use the results of these analyses to describe the quality of the compost produced. The results may be compared to a known compost of good quality.

If required, use the < 10 mm fraction for further ecotoxicity testing.

6.2.3.2 Test material

Determine the total dry solids of the complete > 2 mm fraction.

7 Calculation

Add up the mass of the retrieved test material particles of all selected > 2 mm fractions (see 6.1.3.2) and compare it to the mass of the initial test material input (see 6.1.1.2). Calculate the degree of disintegration of the test material on the basis of the respective total dry solids from the following equation:

$$D_i = \frac{m_1 - m_2}{m_1} \times 100$$

where

D_i is the degree of disintegration of the test material, expressed in %;

m_1 is the amount of total dry solids in the test material input, expressed in grams;

m_2 is the amount of total dry solids in the retrieved test material, expressed in grams.

8 Validity of the test

The test is valid if, for all bins, or nets in bins, with biowaste and the mixture of biowaste and test material

- a) the maximum temperature during composting remains below + 75 °C during the first week and below + 65 °C thereafter;
- b) the temperature remains above + 60 °C for at least 1 week;
- c) the temperature remains above + 40 °C for at least 4 consecutive weeks;
- d) the pH increases to a value above 7 during the test and does not fall below 5;
- e) the biowaste compost of the blank control has a maturity (Rottegrad) of IV to V after 12 weeks and/or the volatile fatty acid content is < 500 mg/kg or some other suitable parameter is used to ensure completion of the normal composting process.

9 Test report

The test report shall provide all relevant information, particularly the following:

- a) a reference to this International Standard, i.e. ISO 16929;
- b) all information necessary to identify and describe the test material, such as total dry or volatile solids content, organic carbon content, shape and visual appearance;
- c) the source of biowaste and the results of any analyses carried out at the start-up of the test;
- d) a precise description of the composting set-up (bins, nets in bins);
- e) the volume of the composting test series and the amounts of biowaste and test material;
- f) the test results, i.e. the amount of test material remaining and the degree of disintegration after composting and sieving;

- g) the values of the parameters characterizing the composting process, such as the temperature profile, pH, moisture content and oxygen concentration;
- h) the results of the analyses carried out at the end of composting;
- i) (optional) the results of the observations of the biowaste compost and the test material during and at the end of the test, such as fungal development, structure, colour and smell, documented in writing and by means of photographs;
- j) the reasons for rejection of any test results.

Bibliography

- [1] *Methods Book for the Analysis of Compost*; available from Bundesgütegemeinschaft Kompost e.V., Hauptstraße 305, D-51143 Cologne, Germany