

# **Packaging — Requirements for packaging recoverable through composting and biodegradation — Test scheme and evaluation criteria for the final acceptance of packaging**

The European Standard EN 13432:2000 has the status of a  
British Standard

ICS 13.030.50; 55.040

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## National foreword

This British Standard is the official English language version of EN 13432:2000.

The UK participation in its preparation was entrusted to Technical Committee PKW/4, Packaging and the environment, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

### Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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### Summary of pages

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**Packaging - Requirements for packaging recoverable through  
composting and biodegradation - Test scheme and evaluation  
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Emballage - Exigences relatives aux emballages  
valorisables par compostage et biodégradation -  
Programme d'essai et critères d'évaluation de l'acceptation  
finale des emballages

Verpackung - Anforderungen an die Verwertung von  
Verpackungen durch Kompostierung und biologischen  
Abbau - Prüfschema und Bewertungskriterien für die  
Einstufung von Verpackungen

This European Standard was approved by CEN on 4 June 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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## Contents

Foreword.....	3
Introduction .....	4
1 Scope .....	5
2 Normative references .....	5
3 Terms and definitions.....	5
4 Requirements .....	6
4.1 Control of constituents .....	6
4.2 Assessment.....	7
4.2.1 General.....	7
4.2.2 Characterization.....	7
4.2.3 Biodegradability.....	7
4.2.4 Disintegration.....	7
4.2.5 Compost quality.....	7
4.2.6 Recognizability.....	7
4.3 Exemptions.....	7
4.3.1 Equivalent form.....	7
4.3.2 Materials of natural origin .....	8
4.4 Recording of assessment outcome .....	8
4.4.1 Check list .....	8
4.4.2 Supporting documentation.....	8
4.5 Application.....	8
5 Organization of a test scheme.....	8
6 Laboratory tests on biodegradability .....	9
7 Determination of disintegration.....	9
8 Quality of the final compost.....	10
8.1 Rationale.....	10
8.2 Determination of negative effect .....	10
Annex A (normative) Evaluation criteria.....	11
Annex B (informative) Flow chart of evaluation of organic recoverability of packaging.....	13
Annex C (informative) Recommended format for a conformity assessment checklist .....	18
Annex D (informative) Prerequisites and quality of compost for evaluating composting of packaging .....	19
Annex E (normative) Determination of ecotoxic effects to higher plants .....	20
Annex Z (informative) Clauses of this European Standard addressing essential requirements or other provisions .....	21
Bibliography .....	22

## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 261 "Packaging", the secretariat of which is held by AFNOR.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex Z, which is an integral part of this standard.

This standard forms one of a series of standards and reports prepared under Mandate M 200 rev.3 given to CEN by the European Commission and the European Free Trade Association to support the European Council and Parliament Directive on Packaging and Packaging Waste [94/62/EC]. The procedure for applying this standard in conjunction with the other mandated standards and reports is specified in EN 13427.

This standard contains Annexes A and E which are normative and Annexes B, C, D and Z which are informative

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2001, and conflicting national standards shall be withdrawn at the latest by March 2001.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## Introduction

The Directive on Packaging and Packaging Waste (94/62/EC) defines requirements for packaging to be considered recoverable. This standard amplifies these requirements with respect to organic recovery. The European Standard EN 13427:2000 provides a framework within which this and four other standards may be used together to support a claim that a packaging is in compliance with the essential requirements for packaging to be placed on the market as required by the Directive.

The purpose of packaging is the containment, protection, handling, delivery and presentation of products. Organic recovery of used packaging is one of several recovery options within the overall life cycle of packaging. In order to save resources and minimise waste, the whole system in which the packaging takes part should be optimised. This includes prevention as well as reuse and recovery of packaging waste.

This European Standard presents a framework for self-assessment to determine whether the requirements of this standard have been met. Its approach is similar to that of systems standards such as the EN ISO 9000 and EN ISO 14000 series.

Organic recovery of packaging and packaging materials, which includes aerobic composting and anaerobic biogasification of packaging in municipal or industrial biological waste treatment facilities is an option for reducing and recycling packaging waste. Using these biological technologies, the aims of the Directive 94/62/EC of the European Parliament and of the Council on Packaging and Packaging Waste (Brussels 5 December 1994) in this respect can be met.

## 1 Scope

This European Standard specifies requirements and procedures to determine the compostability and anaerobic treatability of packaging and packaging materials by addressing four characteristics :

- 1) biodegradability,
- 2) disintegration during biological treatment,
- 3) effect on the biological treatment process and
- 4) effect on the quality of the resulting compost.

In case of a packaging formed by different components, some of which are compostable and some other not, the packaging itself, as a whole is not compostable. However, if the components can be easily separated by hand before disposal, the compostable components can be effectively considered and treated as such, once separated from the non compostable components.

This European Standard covers the compostability of packaging itself but does not address regulations that may exist regarding the compostability of any residual contents.

This European Standard makes provision for obtaining information on the processing of packaging in controlled waste treatment plants but does not take into account packaging waste which may end up in the environment, through uncontrolled means, i.e. as litter.

The essential relationship between this European Standard and the four other (mandated) European Packaging Standards and one (mandated) CEN Report is specified in EN 13427:2000.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 13193:2000, *Packaging - Packaging and the environment - Terminology.*

EN 13427:2000, *Packaging and the environment - Requirements for the use of European standards in the field of packaging and packaging waste.*

ISO 14851 : 1999, *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 : 1999, *Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium - Method by analysis of evolved carbon dioxide.*

ISO 14855 : 1999, *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 standard, the following terms and definitions and those given in EN 13193:2000 and EN 13427:2000 apply :

### 3.1

#### **constituent of a packaging material**

all pure chemical materials and substances of which a packaging material is composed

### 3.2

#### **packaging component**

part of packaging that can be separated by hand or by using simple physical means

### 3.3

#### **disintegration**

the physical falling apart into very small fragments of packaging and packaging materials

### 3.4

#### **ultimate biodegradability**

breakdown of an organic chemical compound by micro-organisms in the presence of oxygen to carbon dioxide, water and mineral salts of any other elements present (mineralization) and new biomass or in the absence of oxygen to carbon dioxide, methane, mineral salts and new biomass

### 3.5

#### **total dry solids**

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

### 3.6

#### **volatile solids**

amount of solids obtained by subtracting the residues of a known amount of test material or compost after incineration at about 550 °C from the total dry solids content of the same sample. The volatile solids content is an indication of the amount of organic matter.

## **4 Requirements**

### **4.1 Control of constituents**

Constituents known to be, or expected to become, harmful to the environment during the biological treatment process (see clause 8), in excess of the limits given in Annex A.1, shall not be deliberately introduced into packaging or packaging materials intended to be designated as suitable for organic recovery.



## 4.2 Assessment

### 4.2.1 General

Except as identified in clause 4.3, assessment of the biological treatability of packagings and packaging components shall include the following 5 assessment procedures as a minimum :

- characterization (see 4.2.2) ;
- biodegradability (see 4.2.3) ;
- disintegration including effects on the biological treatment process (see 4.2.4) ;
- compost quality (see 4.2.5) ;
- recognizability (see 4.2.6).

### 4.2.2 Characterization

Each packaging material under investigation shall be identified and characterized prior to testing including at least :

- information on, and identification of, the constituents of the packaging materials ;
- determination of the presence of hazardous substances, e.g. heavy metals ;
- determination of the organic carbon content, total dry solids and volatile solids of the packaging material used for biodegradation and disintegration tests.

NOTE In addition to the chemical characteristics for volatile solids, pass levels for heavy metals are also provided as their total absence is not possible.

### 4.2.3 Biodegradability

To be designated as organically recoverable, each packaging, packaging material or packaging component shall be inherently and ultimately biodegradable as demonstrated in laboratory tests (clause 6) and to the criteria and pass levels given in Annex A.2.

### 4.2.4 Disintegration

To be designated as organically recoverable, each packaging, packaging material or packaging component shall disintegrate in a biological waste treatment process (see clause 7) to the criteria and pass levels given in Annex A.3, without any observable negative effect on the process.

### 4.2.5 Compost quality

To be designated as organically recoverable, no packaging or packaging component thereof, submitted to a biological waste treatment process, shall be recorded as having a negative effect on the quality of the resulting compost (see clause 8).

### 4.2.6 Recognizability

The packaging or packaging component which is intended for entering the biowaste stream must be recognizable as compostable or biodegradable by the end user by appropriate means.

## 4.3 Exemptions

### 4.3.1 Equivalent form

A packaging material demonstrated to be organically recoverable in a particular form, shall be accepted as being organically recoverable in any other form having the same or a smaller mass to surface ratio or wall thickness.

#### 4.3.2 Materials of natural origin

Chemically unmodified packaging materials and constituents of natural origin, such as wood, wood fibre, cotton fibre, starch, paper pulp or jute shall be accepted as being biodegradable without testing (see clause 6) but shall be chemically characterized (see 4.2) and fulfil the criteria for disintegration (see clause 7) and compost quality (see clause 8).

#### 4.4 Recording of assessment outcome

##### 4.4.1 Check list

For each packaging the result of each assessment or test undertaken (as required in 4.2.1), shall be recorded on an assessment check list and their combined outcome used to determine whether a packaging material or a packaging is biologically treatable and therefore suitable for organic recovery. The check list shall provide for the identification of any supplementary information (see Annex C).

##### 4.4.2 Supporting documentation

The check list together with any other information( including externally sourced technical data) necessary to support the conclusions reached in the assessments shall be retained and made available for inspection if required.

#### 4.5 Application

The application of this standard to any particular packaging shall be as specified in EN 13427:2000.

### 5 Organization of a test scheme

In view of the relative complexity of some of the procedures involved, it is essential that assessment and testing be undertaken in a formal and organized way. Whilst this standard does not attempt to specify such organization, a flowchart of a recommended scheme is provided in Annex B.

Where required the disintegration test may also be used to obtain information on any negative effects that the packaging material or packaging could have on the composting process.

Compost is not only the final product of the aerobic composting process but also the aerobically stabilized product of the anaerobic biogasification process. Where appropriate an anaerobic disintegration test may be performed additionally.

**NOTE** It is important to recognise that it is not necessary that biodegradation of packaging material or packaging be fully completed by the end of biological treatment in technical plants but that it can subsequently be completed during the use of the compost produced.

## 6 Laboratory tests on biodegradability

Only biodegradation tests that provide unequivocal information on the inherent and ultimate biodegradability of a packaging material or its significant organic constituents shall be used.

The controlled aerobic composting test, which is technically identical with ISO 14855:1999 shall be used unless inappropriate to the type and properties of the material under test.

In the event that alternative methods are necessary an internationally standardized biodegradability test method (see ISO/TR 15462) shall be used, in particular ISO 14851:1999 and ISO 14852:1999 which are designed for polymeric materials.

**NOTE 1** Information on how to handle materials having poor water solubility for use in aquatic biodegradation tests may be obtained from ISO 10634.

**NOTE 2** For the purpose of this standard it is sufficient to determine biodegradability under aerobic conditions. If in a special case additional information on biogasification is required, a method with a high-solids test environment such as ISO 15985 should preferably be used. For screening anaerobic biodegradability for example ISO 14853:1999 or ISO 11734 may be used.

## 7 Determination of disintegration

Unless technically impossible the packaging, packaging material or packaging component shall be tested for disintegration in the form in which it will ultimately be used. The controlled pilot-scale test shall be used as the reference test method. A test in a full-scale treatment facility, may, however, be accepted as equivalent. The pilot-scale test simulates, as closely as possible, the real conditions of a high-level aerobic composting facility whereas a full-scale facility (technical composting plant) has always by definition real conditions and treatment periods.

In practice packaging materials are tested and from this it is concluded that a complete packaging will be disintegrated if all of its materials are capable of disintegration. A complete packaging should, however, be tested in cases where a direct conclusion is not possible e.g. if two or more packaging materials are firmly joined together forming a fixed multi-layer structure.

Due to the nature and analytical conditions of the disintegration test the test results cannot differentiate between biodegradation and abiotic disintegration but they are required to demonstrate that a sufficient disintegration of the test material is achieved within the specified treatment time of biowaste. By combining these observations with the information obtained from the laboratory tests it can be concluded whether a test material is sufficiently biodegradable under the known conditions of biological waste treatment and whether biodegradability can be brought to a conclusion with the use of the compost.

Pilot-scale composting tests are also suitable instruments for investigating any negative effects of the test material on the composting process if sufficient test material is introduced. This can be achieved by direct comparison of process parameters in reactors with and without test material.

The compost obtained at the end of the disintegration test may be used for analytical and biological quality control testing. When tests on ecotoxicity are performed it is important to use compost from disintegration tests which have been run with and without the test material to compare the test results directly and to find out any relative ecotoxic effects (see clause 8).

**NOTE 1** For the purpose of this standard it is sufficient to determine disintegration under aerobic composting conditions. If in a special case information on anaerobic treatability is required an anaerobic pilot-scale test or a full-scale facility for solid waste treatment should be used.

**NOTE 2** Special attention should be given to the visual aspects of compost. Visual contamination of compost, as evidenced by reduction of aesthetic acceptability, should not be significantly increased by any post composting residues of the packaging material introduced.

## 8 Quality of the final compost

### 8.1 Rationale

As the quality of compost may be influenced by any packaging, packaging material or packaging constituent added, it is preferable that evaluation of any possible environmental risk attaching to such compost to be based upon the best criteria on compost quality available. This may be achieved, for example, by determination of the ecotoxicological effects of the biodegradation products of packaging materials or by performing ecotoxicological tests with compost produced with and without packaging material and comparison of the test results. Other methods for the same purpose and the pass levels required for the evaluation of the test results are, however, not yet established and need to be elaborated before they can be specified as reference methods for the purpose of this standard. Test methods and limit values based on such tests may be introduced into future revisions of this standard as more experience is gained.

The final compost has to fulfil European or in absence national requirements for compost quality which include analytical and biological tests.

### 8.2 Determination of negative effect

The supplier of packaging, packaging material or packaging components, designated as organically recoverable, on the market shall as a minimum establish by a process of direct comparison that the quality of compost produced by a given "controlled waste treatment" process, as defined by the criteria listed below, is not negatively affected by the addition of that packaging material or packaging component.

Physical-chemical parameters by which the compost quality shall be defined are :

- volumetric weight (density),
- total dry solids,
- volatile solids,
- salt content,
- pH,
- the presence of total nitrogen, ammonium nitrogen, phosphorus, magnesium and potassium.

Ecotoxic effects on 2 higher plants shall be determined by comparing compost produced with and without addition of packaging material. The plant growth test OECD 208 shall be used, with the modifications described in Annex E.

**Annex A**  
**(normative)****Evaluation criteria****A.1 Chemical characteristics****A.1.1 Volatile solids**

Packaging, packaging materials and packaging components shall contain a minimum of 50 % of volatile solids which exclude largely inert materials.

**A.1.2 Heavy metals and other toxic and hazardous substances**

The concentration of any substance listed in Table A.1, present in packaging materials and whole packaging, shall not exceed the value given in that table.

**Table A.1 - Maximum element content of packaging material and whole packaging**

Element	mg/kg on dry substance	Element	mg/kg on dry substance
Zn	150	Cr	50
Cu	50	Mo	1
Ni	25,0	Se	0,75
Cd	0,5	As	5
Pb	50	F	100
Hg	0,5		

**NOTE** It is assumed that 50 % of the original weight of the packaging or packaging material will remain in compost after biological treatment together with the complete original amount of hazardous substances. The limit values are based on ecological criteria for the award of the Community eco-label to soil improvers (EC OJL, 219, 7.8.98, p. 39) and are set at 50 % of the maximum concentration of those requirements.

**A.2 Biodegradability****A.2.1 Significant organic constituents**

**A.2.1.1** Given that biodegradability shall be determined for each packaging material or each significant organic constituent of the packaging material, significant shall mean any organic constituent present in more than 1 % of dry weight of that material.

**A.2.1.2** The total proportion of organic constituents without determined biodegradability shall not exceed 5 %.

**A.2.2 Aerobic biodegradation tests**

**A.2.2.1** The period of application for the test specified in the test methods shall be a maximum of 6 months.

**A.2.2.2** For the test material the percentage of biodegradation shall be at least 90 % in total or 90 % of the maximum degradation of a suitable reference substance after a plateau has been reached for both test material and reference substance.

**NOTE** The limit value for biodegradation is based on conversion of the carbon of the test material into carbon dioxide and biomass. The details of calculation depend on the test and analytical methods used. The reference substance, a micro-crystalline cellulose powder, for example "Avicel", has to be degraded according to the validity criteria stated in the respective test methods.

### **A.2.3 Anaerobic biodegradation tests**

**A.2.3.1** Where required, the period of application for the test specified in the test methods shall be a maximum of 2 months.

**A.2.3.2** The percentage of biodegradation based on biogas production shall be 50 % or more of the theoretical value for the test material.

**NOTE** The lower percentage of biodegradation is justified because in all commercially available biogasification plants the process scheme provides a short second aerobic stabilization phase in which the biodegradation can further continue.

## **A.3 Disintegration**

### **A.3.1 Aerobic composting**

Following submission to the composting process for a maximum of twelve weeks, not more than 10 % of the original dry weight of test material shall fail to pass through a > 2 mm fraction sieve.

### **A.3.2 Anaerobic biogasification**

**A.3.2.1** Where required, the test duration shall be a maximum of 5 weeks as a combination of anaerobic digestion and aerobic stabilization.

**A.3.2.2** Following submission to the composting process as specified in A.3.2.1, not more than 10 % of the original dry weight of a test material shall fail to pass through a > 2 mm fraction sieve.

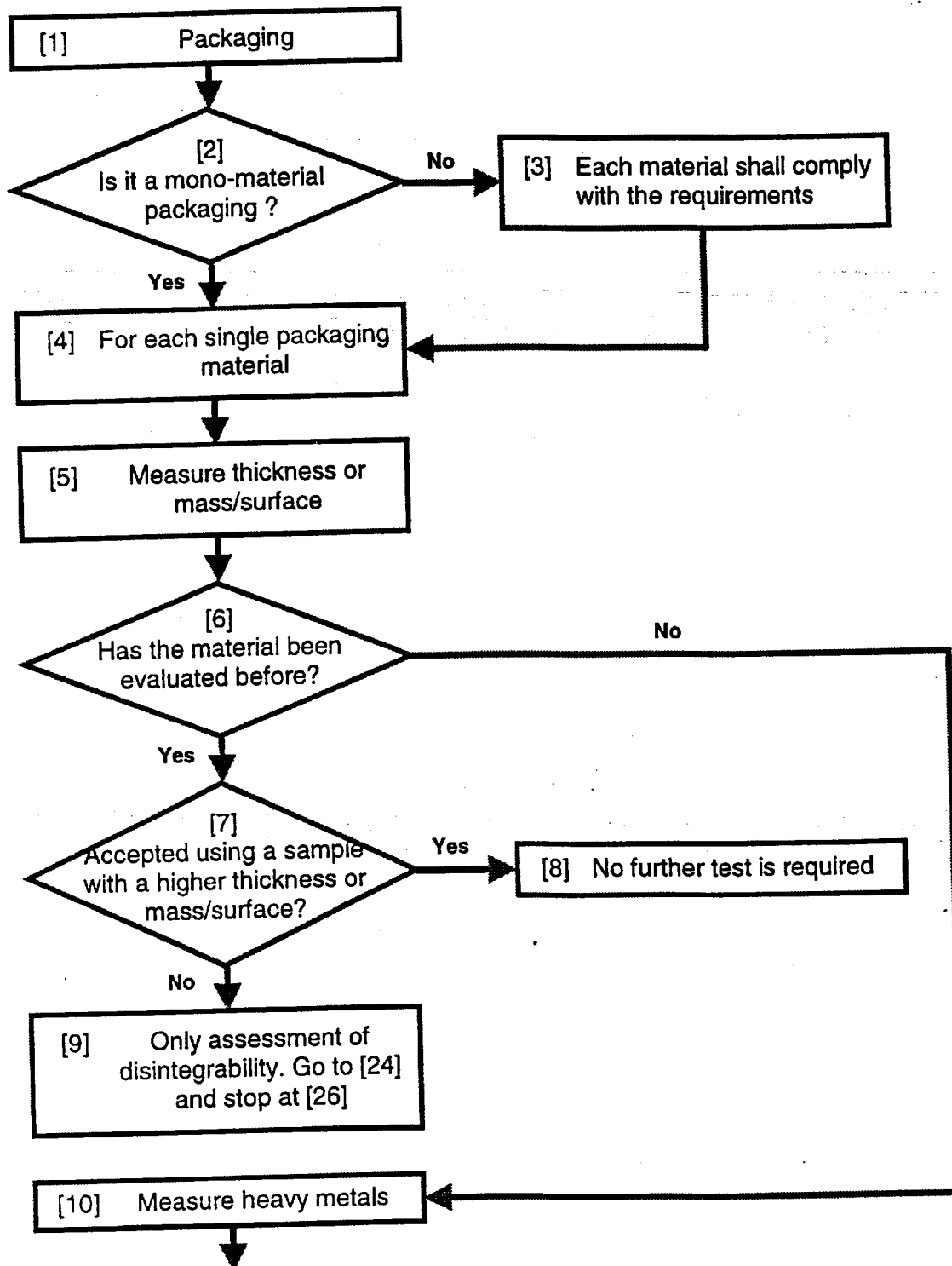
**NOTE** The limit values for disintegration and the test duration are based on present experience. It is anticipated that these may be confirmed or modified as necessary as a result of testing currently being carried out.

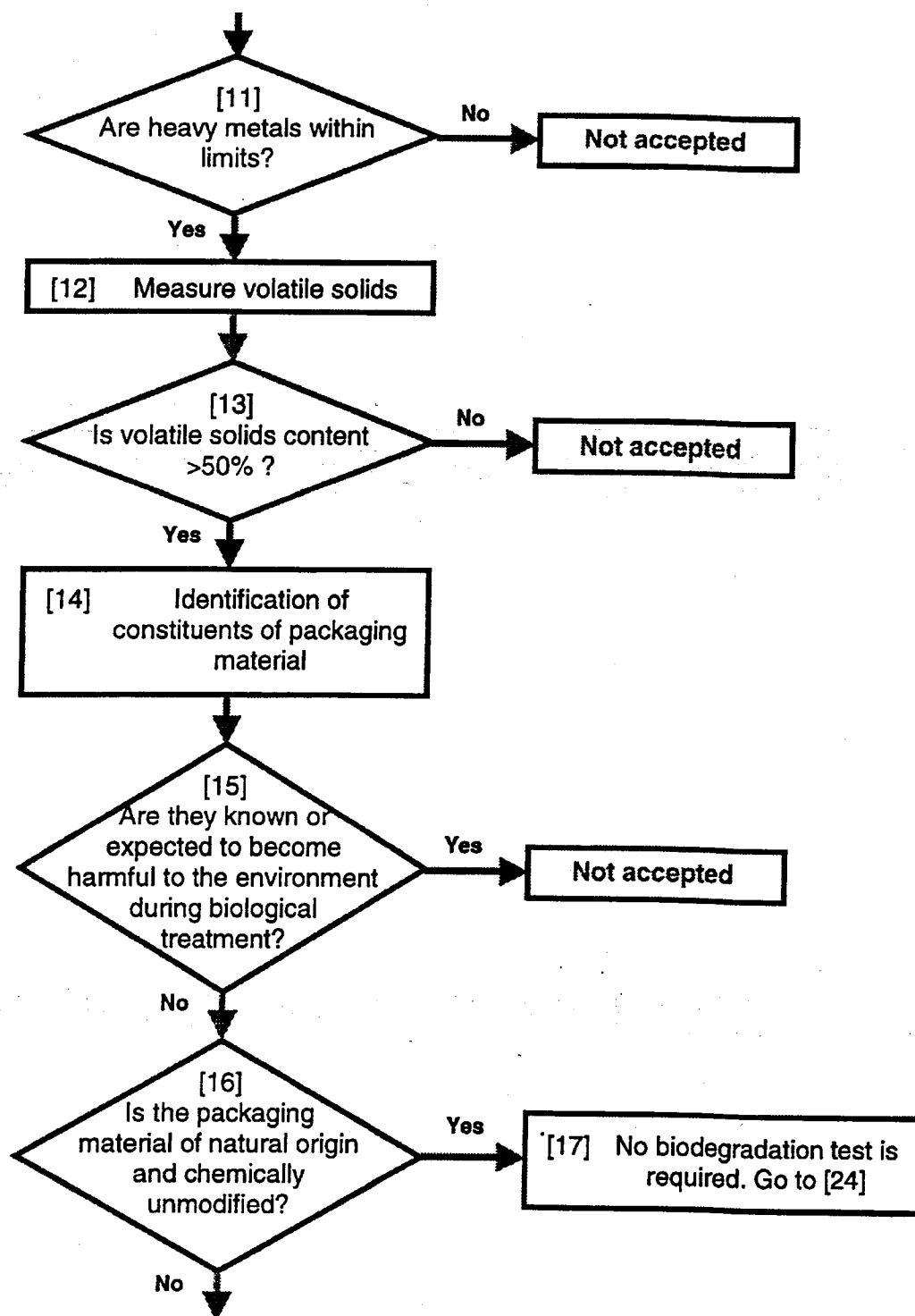
## **A.4 Ecotoxicity**

The germination rate and the plant biomass of the sample composts of both plant species should be more than 90 % of those from the corresponding blank compost (see Annex E).

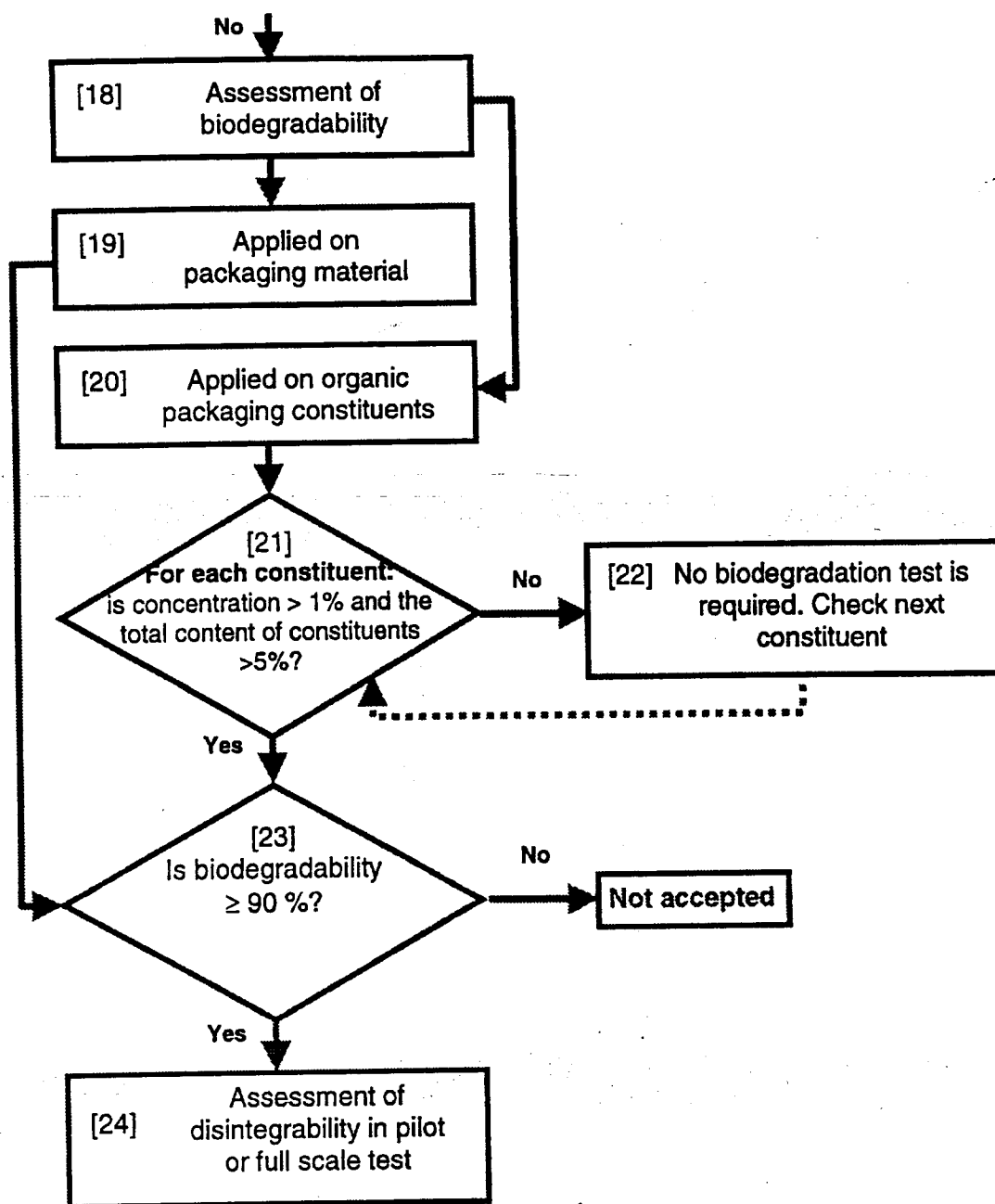
## Annex B (informative)

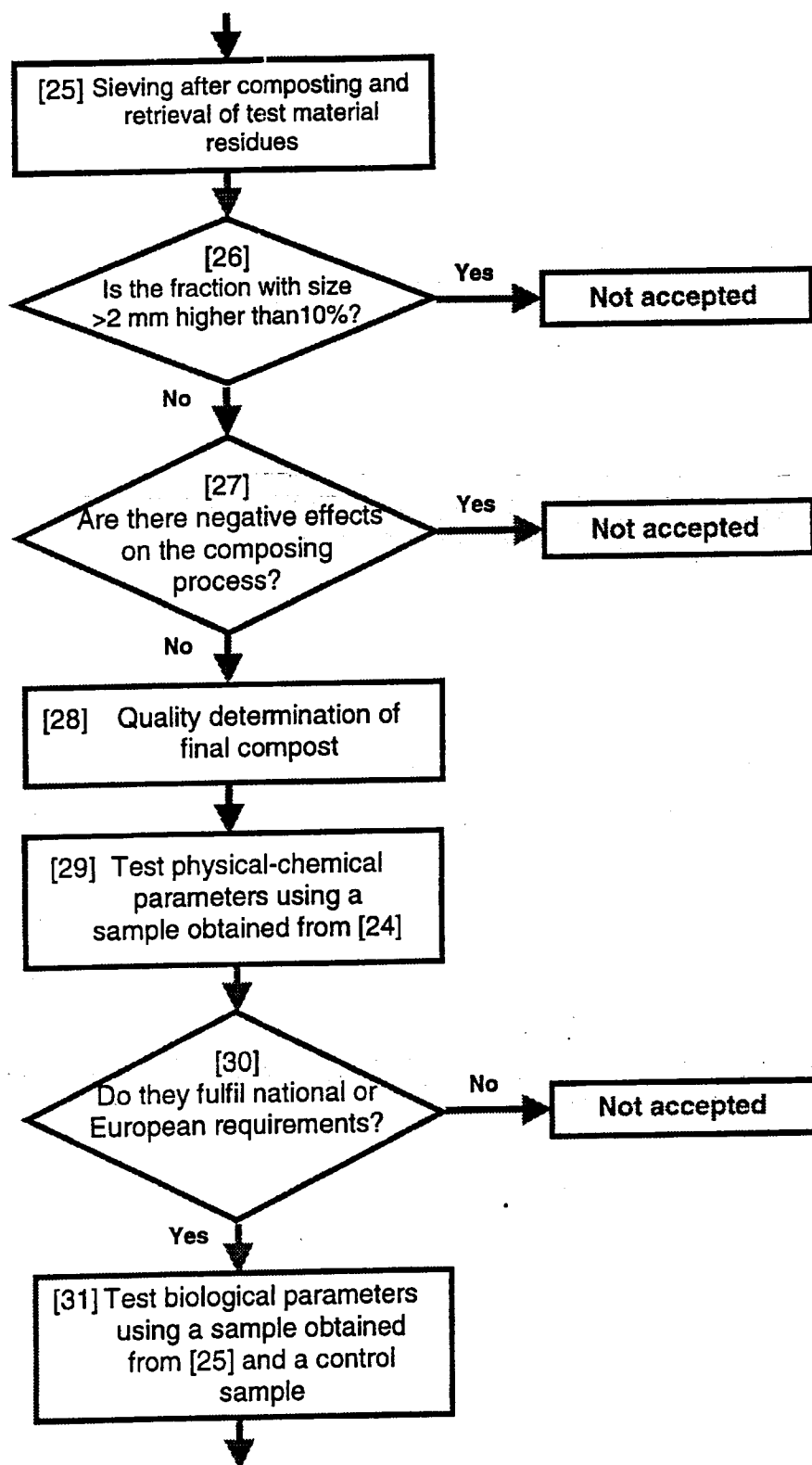
### Flow chart of evaluation of organic recoverability of packaging

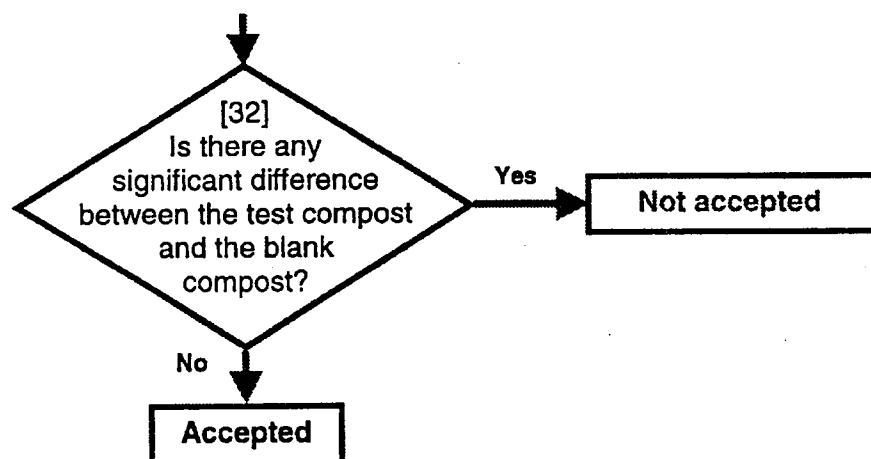












## Annex C (informative)

### Recommended format for a conformity assessment checklist

Identification of supplier :	Date :
Identification of packaging material/packaging :	

Overall result of  
assessment

Assessment file  
reference

Accept

Reject

	Character- ization	Biodegra- dability	Disintegra- tion	Compost quality	Comment Reference	Supporting docs. Ref.
Packaging material A						
Packaging material B						
Packaging material C						
Organic constituent A						
Organic constituent B						
Organic constituent C						
Other component A						
Other component B						
Other component C						
Complete packaging						

NOTE Comment should include reference to the packaging/packaging material consisting of natural material such that no biodegradation test is required.

The packaging/packaging material has previously been tested with higher mass to surface ratio – see assessment file reference .....	
Minor changes have been made which do not influence the fulfilment of the standard.	
Nature of changes	
Comment (if any)	
Signature and status of person responsible for this assessment	
Signature .....	
Status .....	

## **Annex D** **(informative)**

### **Prerequisites and quality of compost for evaluating composting of packaging**

This annex describes prerequisites for packaging, from use to collection, prerequisites of compost and composting plants for the biological treatment of organically recoverable packaging. These prerequisites should be considered in advance of the market release of packaging intended for entering the biowaste stream even if they are not part of the analytical testing procedure.

#### **D.1 Prerequisites for composting of packaging**

##### **D.1.1 Composition**

All of the packaging materials should be biodegradable and the packaging or the packaging components in the final shape should be compostable, meeting the criteria in this standard.

**NOTE** The fulfilment of the quality criteria for compost input material alone will not necessarily lead into production of quality compost.

##### **D.1.2 Products and their residues**

If in any case the product filled into a compostable packaging could remain in parts or as a whole in the packaging after the normal use, the products should by themselves be compostable and neither toxic nor hazardous.

If the shape of the packaging is a hollow body it should not be closed tightly and should preferably be empty.

##### **D.1.3 Grinding/shredding**

The shredding of used packaging with machinery and procedures, commonly used in composting plants, shall not be disturbed and should lead to particle sizes of less than 10 cm in the longest dimension, suitable for the composting process.

## **Annex E** **(normative)**

### **Determination of ecotoxic effects to higher plants**

Basis for the determination is the OECD Guideline for testing of chemicals 208 "Terrestrial Plants, Growth Test". The principles of the standard test method have to be followed and modifications given in this annex which are required to meet the special needs for testing compost samples.

#### **E.1 Properties of the reference substrate**

Any reference substrate is suitable if it allows a normal seed germination and plant growth. It should preferably have a composition and structure similar to the compost samples. Fertilisers shall not have been added.

Suitable reference substrates are all those which are defined by European national standards for analysis of compost quality, for example: Standard soil EE0 (Bundesgütegemeinschaft Kompost e. V., Germany), mixtures of culture substrate with backed clay granules (ÖNORM S2023) or mixtures of peat and siliceous sand.

#### **E.2 Preparation of samples**

Prepare mixtures of the reference substrate with 25 % and 50 % (m/m or v/v, documented in the report) of compost. Use the compost obtained after disintegration of the test material (sample compost) and the blank compost, obtained from the parallel process without addition of test material.

#### **E.3 Selection of plant species**

Use at least 2 plant species from 2 of the 3 mentioned categories of OECD 208. Regard in addition summer barley (*Hordeum vulgare*) as 4th category.

#### **E.4 Performing the tests**

Fill each tray with a minimum of 200 g of the samples (E.2) and add as a minimum 100 seeds (E.3) on the top. Cover the seeds with a thin layer of inert material, such as siliceous sand or perlite. Perform the tests in three parallels for each mixture. Add water until 70 % to 100 % of the water holding capacity is reached. Supply evaporated water periodically during the whole test duration as needed.

NOTE It is of advantage to keep the trays at a dark place or to cover them during the germination period.

#### **E.5 Evaluation of the results**

The germination numbers (number of grown plants) and the plant biomass of the sample compost and the blank compost are compared in all mixing rates. Both germination rate and biomass are calculated as per cent of the corresponding values obtained with the blank compost.

## Annex Z (informative)

### Clauses of this European Standard addressing essential requirements or other provisions

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of the EU Directive:

European Parliament and Council Directive 94/62/EC of 20 December 1994 on Packaging and Packaging Waste.

**WARNING** Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

The following clauses of this standard are likely to support requirements of Directive 94/62/EC of 20 December 1994 on Packaging and Packaging Waste:

Compliance with these clauses of this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

**Table Z.1 - Correspondence between this European Standard and Directive 94/62/EC on Packaging and Packaging Waste**

Essential requirements in Directive 94/62/EC	Corresponding clause in the standard
Article 9 and Annex II, para 1, indents 1 to 3	Clause 4.5
Article 9 and Annex II, para 3 (c) and (d)	Clause 4.1, 4.2, 4.3 and 4.4

## Bibliography

- [1] prEN 12578, *Soil improvers and growing media - Specifications - Product schedules.*
- [2] prEN 12880, *Characterization of sludges - Determination of dry residue and water content.*
- [3] ISO 11074-1: 1996, *Soil quality - Vocabulary - Part 1 : Terms and definitions relating to the protection and pollution of the soil.*
- [4] Official Journal of European Union, OJL, 219, 7.8.98, p. 39. Commission Decision of 7 April 1998 establishing the ecological criteria for the award of the Community eco-label to soil improvers.
- [5] CEN/TC 223, *Soil Amendment and Cultivation Substrates, Quality of Compost.*
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1) In preparation.



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