

**Ordinance**  
**on the Utilisation of Biowastes on**  
**Land used for Agricultural, Silvicultural and Horticultural Purposes**  
**(Ordinance on Biowastes - BioAbfV)**

Of 21 September 1998

(Federal Law Gazette BGBl. I p. 2955), as amended by Section 5 of the Ordinance on the Implementation of the European Waste Catalogue of 10 December 2001 (Federal Law Gazette BGBl. I p. 3379), by Section 3 of the Ordinance to amend Requirements of Proof under Waste Management Law of 25 April 2002 (Federal Law Gazette BGBl. I p. 1488), by Article 11 of the Fertiliser Ordinance of 26 November 2003 (Federal Law Gazette BGBl. I p. 2373) and by Section 5 of the Ordinance on Simplifying the Monitoring under Waste Management Law of 20 October 2006 (Federal Law Gazette BGBl. I p. 2298)

Pursuant to Article 8 (1) and (2) of the Closed Substance Cycle and Waste Management Act of 27 September 1994 (Federal Law Gazette BGBl. I p. 2705), the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, in agreement with the Federal Ministry of Food, Agriculture and Forestry and the Federal Ministry for Health and after hearing the parties concerned, hereby decrees as follows:

**Article 1**

**Scope**

(1) This Ordinance shall apply to

1. both treated and untreated biowastes and mixtures that are applied on land used for agricultural, silvicultural and horticultural purposes or handed over for the purpose of such application, as well as to
2. treatment and investigation of such biowastes and mixtures.

(2) This Ordinance shall apply to

1. public-law parties responsible for waste management and to any third parties, associations or self-regulatory commercial bodies (Selbstverwaltungskörperschaften) for which obligations to utilise biowastes have been established pursuant to Article 16 (2), Article 17 (3) or Article 18 (2) of the Closed Substance Cycle and Waste Management Act (parties responsible for waste management);

2. any producers or holders of biowastes and mixtures, in so far as they do not entrust this waste to a party responsible for waste management;
3. any party which treats biowastes (biowaste treatment entity);
4. any producers of mixtures using biowastes (mixture producers); as well as
5. any parties managing land used for agricultural, silvicultural and horticultural purposes on which any treated or untreated biowastes or mixtures are, or are intended to be, applied.

(3) This Ordinance shall not apply

1. to house and kitchen gardens as well as allotments;
2. to on-site utilisation of biowastes of vegetable origin in agricultural holdings or horticultural or landscape gardening businesses, in cases in which utilisation in accordance with Articles 6 and 7 is guaranteed on the site;
3. where the Sewage Sludge Ordinance is applicable; or
4. to any substances the management of which is subject to other legal provisions.

(4) The relevant provisions of legislation on fertilisers and plant protection products shall remain unaffected.

(5) The parties referred to in paragraph 2 above shall ensure that, wherever possible, they remain below the pollutant limit values for treated and untreated biowastes and mixtures referred to in this Ordinance. The fact that any soil values pursuant to Article 9 (2) have been reached or exceeded shall not in itself give rise to any general restrictions on cropping or any other restrictions not referred to in this Ordinance.

## **Article 2**

### **Definitions**

For the purposes of this Ordinance:

1. Biowastes shall mean  
any vegetable or animal waste destined for utilisation that can be degraded by micro-organisms, soil organisms or enzymes; these shall in particular include the types of waste referred to in Annex 1 No. 1; soil materials without a significant component of biowastes shall not be deemed to constitute biowastes; plant residues generated and remaining on

land used for silvicultural or agricultural purposes shall not be deemed to constitute biowastes;

2. Treatment shall mean

any controlled degradation of biowastes under aerobic conditions (composting) or anaerobic conditions (fermentation) or any other measures for sanitisation;

3. Untreated biowastes shall mean

biowastes that have not been consigned to any treatment;

4. Treated biowaste shall mean

a) biowaste consigned to an aerobic treatment process (compost);

b) biowaste consigned to an anaerobic treatment process (fermentation residues); or

c) biowaste sanitised by other methods;

including any mixing with materials during treatment in accordance with No. 5 below;

5. Mixtures shall mean

any mixing of treated bio-wastes with each other, with untreated bio-wastes, with farm manure, with licensed fertilisers referred to in paragraph 3, insofar as they are not subject to waste management legislation, and in paragraphs 1, 2 and 4 of Annex 1 of the Fertiliser Ordinance as last amended, with soil materials, with peat, with any mineral materials referred to in Annex 1 No. 2 or with any mixture produced using any of the aforementioned substances; the result of mixing during the process of treatment shall not be deemed to constitute a mixture;

6. On-site utilisation shall mean

application of the biowastes of vegetable origin produced on the site. On-site utilisation shall also include any biowastes of vegetable origin that are produced during provision of gardening services on land owned by other parties and applied, without treatment or after an aerobic treatment process, to soils used for agricultural or horticultural purposes by the business providing such services. On-site utilisation shall also include pro-rata reacceptance by the waste producer of untreated biowastes of vegetable origin from joint processing by agricultural or silvicultural producers' associations for the purpose of application on the site, in so far as the biowastes of vegetable origin were produced on soils managed by any member of the producers' association.

### **Article 3**

#### **Requirements concerning treatment**

(1) Prior to applying biowastes or producing mixtures, the parties responsible for waste management as well as the producers and the holders of the biowastes shall consign these wastes to treatment that guarantees safety for use in terms of human, animal and plant health. The first sentence of this paragraph shall also apply to food waste from restaurants and canteens, provided that this waste is not subject to the provisions on disposal laid down in the Act on the Disposal of Animal Carcasses.

(2) The requirements concerning human, animal and plant health pursuant to paragraph 1 above shall be deemed to be fulfilled when there is no reason to fear any threat to human or animal health from the release or transmission of pathogens, or any damage to plants, plant derivatives or soils from the spread of harmful organisms. The specific requirements concerning treatment and materials are laid down in Annex 2.

(3) The biowaste treatment entity shall treat the biowastes on the basis of the requirements laid down in Annex 2 and ensure that they meet requirements concerning human, animal and plant health after treatment and at the time of handover to the receiving party or at the time of application on the site. In the case of aerobic or anaerobic treatment, or of any other sanitisation of biowastes, the competent authority may, in agreement with the responsible agricultural and veterinary authorities, grant exemptions from the requirements laid down in Annex 2, if the nature and origin of the waste in question suggest that there is no threat from the point of view of human, animal or plant health.

(4) The biowaste treatment entity shall ensure that appropriate tests pursuant to Annex 2 No. 2.2 are carried out to determine

1. the efficiency of the treatment process by means of direct process validation;
2. compliance with the required treatment temperature by means of indirect process supervision; and
3. compliance with sanitisation requirements by means of a final analysis of the treated biowastes.

The tests shall be carried out in accordance with the methods laid down in No. 2.2 of Annex 2.

(5) Direct process validation shall be carried out within twelve months of the commissioning of a newly built treatment facility (commissioning test). This requirement shall apply mutatis mutandis to previously tested facilities if new processes are used or existing processes or process management procedures are significantly modified. In the case of existing facilities, direct process validation shall be carried out within 18 months of entry into force of this Ordinance, provided that no hygiene inspection based on the provisions concerning direct process validation, or on any comparable provisions, was carried out or commenced within the last five years prior to entry into force of this Ordinance.

(6) In the case of indirect process supervision, records shall be kept on temperature patterns, the times at which the compost is turned and the feeding intervals for anaerobic treatment facilities; such records shall be kept in the archives for at least five years.

(7) Tests of treated biowastes shall be conducted at intervals not exceeding six months for any treatment facilities with an annual capacity of up to 3000 tonnes, and at least every three months for treatment facilities with a higher annual capacity. If the result of a product analysis conducted for any treated biowastes falls short of requirements concerning human, animal and plant health pursuant to Annex 2 No. 2.2.3, the biowaste treatment entity shall inform the competent authority of the test results obtained as well as of any corrective action taken. If a second test reveals that the risk still exists, or if such risks are detected in various samples taken, the competent authority shall issue orders for these deficiencies to be eliminated.

(8) The tests pursuant to paragraph 4 above shall be carried out by independent bodies designated by the competent authority. The biowaste treatment entity shall submit the test results to the competent authority within four weeks of completion of the tests. Records proving the comparability of a test of sanitisation pursuant to paragraph 5 third sentence above as well as the results of this test of sanitisation shall be submitted to the competent authority within three months of entry into force of this Ordinance; if a test of sanitisation is already underway, records proving its comparability shall be submitted along with the test results within three months of completion of the test. Records of indirect process supervision pursuant to paragraph 6 above shall be submitted to the competent authority upon request. The results of the tests pursuant to paragraph 4 first sentence Nos. 1 and 3 shall be kept in the archives for ten years.

(9) The orders and prohibitions specified in Annex 1 No. 1 column 3 with regard to separate collection, treatment and application of biowastes shall be observed.

#### **Article 4**

##### **Requirements concerning pollutants and additional parameters**

(1) The biowaste treatment entity may use biowastes and soil materials, peat or any mineral materials referred to in Annex 1 No. 2 which, because of their nature, characteristics or origin, can be expected, in unmixed form, to meet the requirements of paragraph 3 below after being consigned to treatment and for which there is no indication of excessive concentrations of any other pollutants.

(2) The biowaste treatment entity may hand over biowastes or apply them on the site only in so far as this is in accordance with the provisions of paragraphs 3 to 5 below.

(3) The following heavy metal concentrations (expressed in milligrams per kilogram of dry matter of the applied material) shall not be exceeded in the case of application pursuant to Article 6 (1) first and second sentences:

|          |     |
|----------|-----|
| Lead     | 150 |
| Cadmium  | 1.5 |
| Chromium | 100 |
| Copper   | 100 |
| Nickel   | 50  |
| Mercury  | 1   |
| Zinc     | 400 |

In the case of application pursuant to Article 6 (1) third sentence, the following heavy metal concentrations (expressed in milligrams per kilogram of dry matter of the applied material) shall not be exceeded:

|          |     |
|----------|-----|
| Lead     | 100 |
| Cadmium  | 1   |
| Chromium | 70  |
| Copper   | 70  |

|         |      |
|---------|------|
| Nickel  | 35   |
| Mercury | 0.7  |
| Zinc    | 300. |

A limit value pursuant to the first and second sentences of this paragraph shall be deemed to be complied with if the value is not exceeded in the sliding average of the last four tests carried out in accordance with paragraph 5 below and if none of the results of an analysis exceed the limit value by more than 25 per cent. The competent authority may, in agreement with the agricultural authority responsible, permit individual heavy metal concentrations pursuant to the first sentence of this paragraph to be exceeded if this is not likely to be detrimental to the common good. In the case of regional utilisation concepts in areas with elevated heavy metal concentrations in the soil resulting from geological or site-specific factors, the competent authority may, in agreement with the agricultural authority responsible, permit individual heavy metal concentrations pursuant to the first sentence of this paragraph to be exceeded if this is not likely to be detrimental to the common good. The fourth and fifth sentences of this paragraph shall not be applicable to cadmium.

(4) The proportion of physical contaminants, in particular glass, plastics and metal, with a diameter of more than 2 millimetres, shall not exceed a maximum value of 0.5 per cent in relation to the dry matter. The proportion of stones with a diameter of more than 5 millimetres shall not exceed a maximum value of 5 per cent in relation to the dry matter.

(5) When treating biowastes destined for utilisation, the biowaste treatment entity shall ensure that, for every commenced quantity of 2000 tonnes (fresh mass), appropriate tests are conducted to determine

1. the concentrations of the heavy metals lead, cadmium, chromium, copper, nickel, mercury and zinc; as well as
2. the pH value, salt content, content of organic matter (loss on ignition), dry matter content and the proportion of physical contaminants.

If there are no, or only slight, changes to the composition of the biowastes used and if their origin remains the same, the competent authority may, in agreement with the agricultural authority responsible, require tests to be carried out only for quantities larger than 2000 tonnes. If there are significant changes to the composition or origin of the biowaste used, the competent authority may require tests to be conducted also for quantities of less than 2000 tonnes.

Notwithstanding the first to third sentences of this paragraph, tests shall be carried out at intervals not exceeding three months.

(6) Notwithstanding paragraph 5 first sentence above, biowaste treatment entities which treat more than 24,000 tonnes of biowastes a year (fresh mass) and which are specialised waste management companies and members of a body for quality testing at regular intervals (quality assurance association) and provide proof of continuous quality assurance activities shall ensure that tests of the treated biowastes are carried out once a month. The competent authority may, in agreement with the agricultural authority responsible, apply the provision of the first sentence of this paragraph *mutatis mutandis* to biowaste treatment entities which are members of a quality assurance association but not specialised waste management companies. Paragraph 5 second and third sentences above shall apply *mutatis mutandis*.

(7) The biowaste treatment entity shall ensure that additional tests are carried out for the unmixed input materials referred to in paragraph 1 above in order to determine their concentrations of the heavy metals referred to in paragraph 5 first sentence No. 1 if there is any indication that the requirements laid down in paragraph 3 first sentence above are not fulfilled. If the results show that the requirements laid down in paragraph 3 first sentence above have not been fulfilled, these results shall be submitted to the competent authority without undue delay. The competent authority shall decide on any further action. Treatment of the materials in question shall not be permissible until the competent authority has taken its decision. Paragraph 3 fourth to sixth sentences above shall apply *mutatis mutandis*.

(8) The biowaste treatment entity shall ensure that appropriate tests for other pollutants are carried out for the unmixed input materials referred to in paragraph 1 above or for the biowastes treated in accordance with paragraph 2 above if there is any indication of elevated concentrations of these pollutants on grounds of the nature, characteristics or origin of the unmixed individual materials. If elevated concentrations of these pollutants are detected, the relevant results shall be submitted to the competent authority without undue delay. The competent authority shall decide on any further action. Treatment, handover and application of the materials in question shall not be permissible until the competent authority has taken its decision.

(9) The tests pursuant to paragraphs 5 to 8 above shall be carried out by independent bodies designated by the competent authority. The sampling, sampling preparation and testing shall be conducted in accordance with Annex 3 of this Ordinance. The biowaste treatment entity shall collect the test results and submit them to the competent authority every six months. In the case of biowaste treatment entities which are specialised waste management companies and members of a recognised body for quality testing at regular intervals (quality assurance association), the test results may also be submitted to a body proposed by the quality assurance association and designated by the competent authority. The test results shall be kept in the archives for a period of ten years, and the relevant information shall be given prior to handover to the receiving party, subject to Article 11 (2), or after handover to the receiving party, subject to Article 11 (3).

## **Article 5**

### **Requirements concerning mixtures**

(1) The mixture producer may use treated biowastes, peat and any mineral materials referred to Annex 1 No. 2, as well as any mixture produced thereof, which, because of their nature, characteristics or origin, can be expected to meet the requirements of Article 4 (3) and (4) in their unmixed form and for which there is no indication of excessive concentrations of any other pollutants. Where soil materials are used for the production of mixtures, this shall be on condition that there is no indication, with respect to their nature, characteristics or origin, of excessive concentrations of any pollutants; untreated biowastes within the meaning of Article 10 (1) or (2) may be used for the production of mixtures.

(2) The mixture producer shall apply mixtures only to the extent specified in Article 4 (3) and (4) as well as in the second to fourth sentences of this paragraph. Article 4 (4) second sentence shall apply, provided that in the case of mixtures, the proportion of stones is expressed in relation to the treated organic component of the mixture. Article 4 (5) shall apply mutatis mutandis, provided that tests of the mixture produced must be carried out for every commenced quantity of 2000 tonnes. Article 4 (6) and (9) shall apply mutatis mutandis.

(3) The mixture producer shall ensure that additional tests are carried out for the unmixed materials referred to in paragraph 1 above in order to determine their concentrations of the

heavy metals referred to in Article 4 (5) first sentence No. 1 if there is any indication that the requirements laid down in Article 4 (3) first sentence are not fulfilled. Article 4 (7) second to fifth sentences and paragraph 9 shall apply mutatis mutandis.

(4) The mixture producer shall ensure that appropriate tests for other pollutants are carried out for the unmixed materials referred to in paragraph 1 above or for the mixtures pursuant to paragraph 2 above if there is any indication of elevated concentrations of these pollutants on grounds of the nature, characteristics or origin of these materials. Article 4 (8) second to fifth sentences and paragraph 9 shall apply mutatis mutandis.

## **Article 6**

### **Restrictions and prohibitions concerning application**

(1) Notwithstanding any provisions under fertiliser law, the total amount of biowastes (dry matter) applied per hectare within a period of three years shall not exceed 20 tonnes. The permissible quantity for application pursuant to the first sentence of this paragraph shall also apply to mixtures. The permissible quantity for application pursuant to the first and second sentences of this paragraph may be up to 30 tonnes per hectare within a period of three years if the heavy metal concentrations measured pursuant to Article 4 (5) and (6) or Article 5 (2) do not exceed the values laid down in Article 4 (3) second sentence. The competent authority may, in agreement with the agricultural authority responsible, permit further exemptions if the heavy metal concentrations are significantly lower than the values referred to in Article 4 (3) second sentence and if this is not likely to be detrimental to the common good.

(2) Application of biowastes and mixtures containing any biowastes other than the types referred to in Annex 1 No. 1 shall be subject to approval by the competent authority. Such approval shall only be given in agreement with the agricultural authority responsible. Before giving its approval in agreement with the agricultural authority responsible, the competent authority shall order the parties subject to the provisions of Article 4 (2) and Article 5 (2) to carry out tests for other pollutants within the meaning of Article 4 (8) first sentence, taking into account the nature, characteristics or origin of the biowastes, and to submit the results thereof.

(3) Application of biowastes and mixtures to soils used for silvicultural purposes shall only be permissible in justified exceptional cases, after obtaining prior permission from the competent authority in agreement with the forestry authority responsible.

#### **Article 7**

##### **Additional requirements for application on permanent grassland and on land used for field forage and field vegetable cropping**

(1) Application on permanent grassland shall be limited to those types of biowaste, in treated or untreated form, which are specifically listed in Annex 1 No. 1 column 3, as well as to any mixtures whose component of treated or untreated biowaste is entirely accounted for by those types of biowaste specifically listed in Annex 1 No. 1 column 3.

(2) Any treated biowastes and mixtures applied on field forage or field vegetable crops shall be worked into the surface prior to the commencement of cropping.

(3) Any treated biowastes and mixtures applied on permanent grassland or on land used for field forage cropping shall not contain any objects which could injure domestic or farm animals when ingested.

#### **Article 8**

##### **Coincidence of application of biowastes and sewage sludge**

Within the period of time specified in Article 6 (1), it shall only be permissible, on a given plot of land, to apply either biowastes and mixtures pursuant to this Ordinance or sewage sludge pursuant to the Sewage Sludge Ordinance.

## Article 9

### Soil analysis

(1) Within two weeks of the first application of biowastes and mixtures taking place after entry into force of this Ordinance, the party managing a given plot of land or any third party acting on its behalf shall specify to the competent authority the receiving plot of land. The competent authority shall notify the agricultural authority responsible of such plots of land.

(2) In the case of a first-time application of bio-wastes or mixtures, a soil analysis shall be carried out to detect heavy metals in accordance with Article 4 (5) first sentence No. 1 and to determine the pH value. The results of such a soil analysis shall be submitted to the competent authority within three months of application. If a valid test result in accordance with the Sewage Sludge Ordinance is available for the receiving plot of land, this result may be used. The first sentence of this paragraph shall not apply to the application of biowastes and mixtures handed over by biowaste treatment entities and mixture producers which are members of a body for quality testing at regular intervals (quality assurance association) and are exempted pursuant to Article 11 (3). If there is any indication that on a given receiving plot of land, any of the soil values (expressed in milligrams per kilogram of dry matter) are exceeded, the competent authority, in agreement with the agricultural authority responsible or at its request, should prohibit any further application of treated biowastes or mixtures if any of the following soil values are found to be exceeded:

| Type of soil | Cadmium | Lead | Chromium | Copper | Mercury | Nickel | Zinc |
|--------------|---------|------|----------|--------|---------|--------|------|
| Clayey       | 1.5     | 100  | 100      | 60     | 1       | 70     | 200  |
| Loamy        | 1       | 70   | 60       | 40     | 0.5     | 50     | 150  |
| Sandy        | 0.4     | 40   | 30       | 20     | 0.1     | 15     | 60   |

In the case of soils of the clayey type with a pH value of less than 6, cadmium and zinc shall be subject to the limit values for loamy soils. In the case of soils of the loamy type with a pH value of less than 6, cadmium and zinc shall be subject to the limit values for sandy soils. The sampling, sampling preparation and testing shall be carried out in accordance with Annex 1 of the Sewage Sludge Ordinance in the version as last amended by an independent body designated by the competent authority.

(3) Notwithstanding paragraph 2 above, a soil analysis shall not be required where any type of biowaste is used which is specifically listed in Annex 1 No. 1 column 3 for application on permanent grassland. In individual cases involving substances with similarly low pollutant concentrations, the competent authority may, in agreement with the agricultural authority responsible, authorise further exemptions from testing requirements.

(4) In the case of regional utilisation concepts in areas with elevated heavy metal concentrations in the soil resulting from geological factors, the competent authority may, in agreement with the agricultural authority responsible, also permit treated biowastes or mixtures to be applied to soils in which the values specified in paragraph 2 above are exceeded. The first sentence of this paragraph shall not apply to cadmium.

## **Article 10**

### **Exemptions from utilisation requirements for certain types of biowaste**

(1) The types of unmixed biowaste listed in Annex 1 No. 1 column 3 may be handed over, used for the production of mixtures or applied to soils without prior treatment, and, if treated, without prior tests pursuant to Articles 3 and 4.

(2) In the case of regional utilisation concepts, the competent authority may, in agreement with the agricultural authority responsible, permit not only the types of biowaste referred to in paragraph 1 above, but also unmixed biowastes of homogeneous composition to be handed over without undergoing prior treatment, and allow treated biowastes consisting of various types of unmixed biowaste of homogeneous composition to be handed over without prior tests pursuant to Articles 3 and 4, or to be used for production of mixtures or to be applied to soils. Exemption from treatment requirements may be granted if, because of their nature, characteristics or origin, the biowastes in question can be expected to meet the requirements regarding sanitisation as well as pollutants and physical contaminants which are laid down in Articles 3 and 4. Before granting such exemption, the competent authority may require the heavy metal concentrations to be determined through tests pursuant to Article 4 (5) and (9). Exemption from testing requirements may only be granted for those types of biowaste which, because of their nature, characteristics or origin, can be expected to meet the requirements regarding

sanitisation as well as pollutants and physical contaminants which are laid down in Articles 3 and 4. Such exemption may be revoked at any time.

(3) Article 6 (1) first sentence and paragraph (3) as well as Article 9 (1) and (2) shall be applied *mutatis mutandis*. Article 6 (1) third and fourth sentences shall be applied *mutatis mutandis*, subject to the proviso that the heavy metal concentrations are determined through tests pursuant to Article 4 (5) and (9).

## **Article 11**

### **Obligations to provide proof**

(1) The biowaste treatment entity and the mixture producer shall provide a list of the materials used during treatment or mixing processes and specify the nature, supplier and the quantity supplied thereof and break the list down into quarterly periods. The parties subject to the provisions of the first sentence of this paragraph shall keep these lists in the archives for a period of ten years. The lists shall be submitted to the competent authority upon request. The parties subject to the provisions of the first sentence of this paragraph shall comply with the requests pursuant to the third sentence of this paragraph.

(2) If any treated or untreated bio-wastes or mixtures are handed over for the purpose of application, the party handing over the waste shall each time hand over a delivery note to the receiving party and, if applicable, to the party managing the plot of land; the delivery note shall contain the following:

1. name and address of the party handing over the waste;
2. name and address of the receiving party and, if applicable, of the party managing the receiving plot of land;
3. quantity handed over and receiving plot of land;
4. handover to the receiving party in the form of treated or untreated biowaste or mixture, and a description of the treated or untreated biowaste or mixture based on the nature of the materials used in unmixed form;

5. assurance that the requirements are fulfilled with regard to
  - a) human, animal and plant health pursuant to Article 3 (2) and (3) and
  - b) heavy metal concentrations pursuant to Article 4 (3), also in conjunction with Article 5 (2) first sentence;
6. measurements of heavy metal concentrations and pH value, salt content, loss on ignition and proportion of physical contaminants pursuant to Article 4 (5) and (6), also in conjunction with Article 5 (2) third and fourth sentences; justification if, in the case of untreated biowastes, certain tests for determining the additional parameters referred to in Article 4 (5) first sentence No. 2 cannot be carried out;
7. bodies carrying out the testing and time of testing pursuant to Article 3 (4) first sentence No. 3 and paragraphs (7) and (8) as well as Article 4 (5), (6) and (9), also in conjunction with Article 5 (2) third and fourth sentences;
8. maximum permissible quantity for application pursuant to Article 6 (1) first, second or third sentence, in conjunction with Article 4 (3);
9. permissibility of application on permanent grassland pursuant to Article 7 (1);
10. soil analyses pursuant to Article 9 (2);
11. date of handover to the receiving party and signatures of the party handing over the waste and the party managing the plot of land.

The information pursuant to the first sentence Nos. 5 to 7 shall not be required where, in accordance with Article 10, the provisions of Articles 3 and 4 are not applicable. When handing over the waste, the party handing it over shall send an additional copy of the delivery note to the competent authority as well as to the agricultural authority responsible for the receiving plot of land. The party managing the plot of land shall enter in its copy of the delivery note the unequivocal designation of the plot for application (land register subdivision, plot number and size in hectares). The party handing over the waste and the party managing the plot of land shall keep their copies of the delivery note in the archives for a period of 30 years.

(3) The competent authority may exempt biowaste treatment entities or mixture producers which are members of a body for quality testing at regular intervals (quality assurance association) which provides proof of continuous quality assurance activities from the requirement to submit test results pursuant to Article 3 (4) and (8), Article 4 (5), (6) and (9) as well as from obligations to provide proof pursuant to paragraph 2 above. In this case, the quality-tested products shall be marked at the time of handover to the receiving party with the quality

assurance association's quality label. Instead, the parties handing over the waste shall submit to the competent authority every twelve months relevant records for the preceding period; these may be produced with the help of electronic data processing and shall contain the following:

1. name and address of the party handing over the waste;
2. name and address of the receiving party;
3. quantity handed over, expressed in tonnes of dry matter (t DM);
4. date of handover.

The records shall be kept in the archives for a period of ten years. In individual cases, the competent authority may require the biowaste treatment entity, the mixture producer or the body for quality testing at regular intervals to submit test results pursuant to Article 3 (4) and (8) and Article 4 (5), (6) and (9), as well as any other suitable proof, and may revoke exemption at any time.

(4) The provisions of the Ordinance on the Furnishing of Proof, with the exception of Article 2 para. (1) no. 2 and Article 23 no. 2 thereof, shall not apply to the utilisation of biowastes subject to the provisions of this Ordinance.

## **Article 12**

### **Exemptions for small plots of land**

Article 9 (1) and (2) and Article 11 (2) fourth sentence shall not apply if any treated or untreated biowastes or mixtures are to be applied on land belonging to any parties managing a surface of less than one hectare of land for agricultural or horticultural purposes. Article 11 (2) fifth sentence shall not apply to the managers of such plots of land.

## **Article 13**

### **Administrative offences**

An administrative offence within the meaning of Article 61 (1) No. 5 of the Closed Substance Cycle and Waste Management Act shall be deemed to have been committed by anyone who intentionally or through negligence

1. contravenes Article 3 (1) first sentence by not consigning biowastes to treatment at all or by failing to do so correctly or on time;
2. contravenes Article 3 (3) first sentence by not carrying out treatment at all or by not carrying it out correctly;
3. contravenes Article 3 (8) second sentence or Article 4 (9) third sentence, also in conjunction with Article 5 (2) fourth sentence, by not submitting a test result at all or by not submitting it completely or on time;
4. contravenes Article 4 (2) or Article 5 (2) first sentence by handing over or applying any biowastes;
5. contravenes Article 4 (7) first sentence, paragraph (8) first sentence, Article 5 (3) first sentence or paragraph (4) first sentence by failing to carry out the required tests;
6. contravenes Article 6 (1) first sentence, also in conjunction with Article 10 (3) first sentence, or Article 7 (1), by applying a biowaste or a mixture;
7. applies a biowaste or a mixture without approval pursuant to Article 6 (2) first sentence;
8. contravenes Article 8 by applying a biowaste or a mixture on the same plot of land as sewage sludge;
9. contravenes Article 9 (1) first sentence by not specifying to the competent authority the plots of land receiving treated biowastes or mixtures;
10. contravenes Article 11 (1) first and second sentences by not filling out a list at all, or by not filling it out correctly or completely or by not keeping it in the archives for the required period of time;
11. contravenes Article 11 (1) fourth sentence by not complying with an enforceable order;  
or
12. contravenes Article 11 (2) first, fourth or fifth sentence by not filling out a delivery note at all or by not filling it out correctly, completely or on time, or by not entering the designation of the plot for application in the delivery note at all or by not entering it correctly or by not keeping the delivery note in the archives for the required period of time.

#### **Article 14**

#### **Entry into force**

This Ordinance shall enter into force on the first day of the calendar month following its promulgation.

The *Bundesrat* has given its consent.

Bonn, 21 September 1998

The Federal Minister  
for the Environment, Nature Conservation and Nuclear Safety  
Angela Merkel

**Annex 1**

**List  
of the types of biowaste generally suitable for utilisation on land and  
of generally suitable mineral aggregates<sup>1)</sup>**

**1 Wastes with a high organic content**

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste)                                     | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1  | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)  |
|--|---|---|
| plant-tissue waste<br>(02 01 03)   | <ul style="list-style-type: none"> <li>– Husk, husk and cereal dust</li> <li>– Waste feedingstuffs</li> </ul>                                 | These materials may be applied on permanent grassland, including as a component of a mixture.   |
| animal faeces, urine and manure (including spoiled straw), effluent, collected separately and treated off-site<br>(02 01 06) | <ul style="list-style-type: none"> <li>– Poultry droppings</li> <li>– Pig and cattle slurry</li> <li>– Manure</li> <li>– Old straw</li> </ul> | These materials are subject to the provisions of this Ordinance only if they are not farm manure as defined by fertiliser law. Infectious manure (LAGA* code of waste No. 137 05) is generally excluded from utilisation. These materials may be applied on permanent grassland, including as a component of a mixture.                       |
| Waste from forestry exploitation<br>(02 01 07)   | <ul style="list-style-type: none"> <li>– Barks</li> <li>– Wood, wood residues</li> </ul>  | Natural barks and unmixed products for further processing made from barks are exempted from treatment and testing requirements pursuant to Articles 3 and 4. If shredded properly, natural bark, wood or wood residues may be added to materials for composting and also to those types of biowaste which are applied on permanent grassland. |
| Wastes not otherwise specified<br>(02 01 99)   | <ul style="list-style-type: none"> <li>– Fungus substrate residue</li> </ul>  | Spent substrates from commercial mushroom cultivation. Cultures killed off by steam pasteurisation.   |

\* Länderarbeitsgemeinschaft Abfall (Joint Länder Working Group on Waste).

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste) | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1 | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)  |
|--|--|---|
| animal-tissue waste<br>(02 02 02)  | – Bristle and horn wastes  | Including cattle hair from hair-preserving liming process.<br>To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> .   |
| Materials unsuitable for consumption or processing<br>(02 02 03)                         | – Waste fat  | (Processing of meat and fish)<br>To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> .<br>Waste fats may only be used in installations for anaerobic treatment.<br>These materials, even as a component of a mixture, may be applied on permanent grassland only after being pasteurised (70 °C; at least one hour).  |
| Sludges from on-site effluent treatment<br>(02 02 04)                                    | – Content of fat separators and flotation agents   | (Processing of meat and fish)<br>Possible sources: slaughterhouses and meat processing plants; unmixed with other effluents.<br>To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> .<br>The content of fat separators and flotation agents may only be used in installations for anaerobic treatment.<br>These materials, even as a component of a mixture, may be applied on permanent grassland only after being pasteurised (70 °C; at least one hour). |

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste) | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1  | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)   |
|--|---|--|
| Wastes not otherwise specified<br>(02 02 99)   | <ul style="list-style-type: none"> <li>– Sludges from gelatin production</li> <li>– Gelatin stampings</li> <li>– Feathers</li> <li>– Contents of stomach and intestines</li> </ul>  | To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> ; sludges may be utilised only if unmixed with effluents or sludges from other sources.  |
| sludges from washing, cleaning, peeling, centrifuging and separation<br>(02 03 01)       | <ul style="list-style-type: none"> <li>– Other sludge-like food waste</li> <li>– Starch sludge</li> </ul>   | (Food processing)<br>To be utilised only if unmixed with effluents or sludges from other sources.<br>These materials may be applied on permanent grassland, including as a component of a mixture.   |
| materials unsuitable for consumption or processing<br>(02 03 04)                         | <ul style="list-style-type: none"> <li>– Foodstuffs stored for too long</li> <li>– Residues from tinning processes</li> <li>– Semi-luxury foodstuffs stored for too long</li> <li>– Tobacco dust, veins and sludge</li> <li>– Defective cigarette batches</li> <li>– Residues from processing of coffee, tea and cocoa</li> <li>– Oilseed residues</li> </ul> | (Food processing)<br>To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> .   |
| Wastes not otherwise specified<br>(02 03 99)   | <ul style="list-style-type: none"> <li>– Sludge from production of edible fats</li> <li>– Sludge from production of edible oils</li> <li>– Bleaching earth, de-oiled</li> <li>– Seasonings residues</li> <li>– Molasses residues</li> <li>– Residues from production of potato, corn or rice starch</li> </ul>  | (Food processing)<br>Sludge from production of edible fats and oils, molasses residues, as well as residues from production of potato, corn or rice starch, may be applied on permanent grassland, including as a component of a mixture.<br>Sludges from production of edible fats and oils should only be used in installations for anaerobic treatment. |

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste) | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1 | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)   |
|--|--|--|
| Materials unsuitable for consumption or processing<br>(02 05 01)                         | – Foodstuffs stored for too long   | (Milk processing)<br>To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> . These materials may be applied on permanent grassland, including as a component of a mixture.             |
| Wastes not otherwise specified<br>(02 05 99)   | – Whey   | (Wastes from milk processing)<br>To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> . These materials may be applied on permanent grassland, including as a component of a mixture. |
| Materials unsuitable for consumption or processing<br>(02 06 01)                         | – Foodstuffs stored for too long<br>– Waste dough  | (Bakery and confectionery products)<br>To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> .   |
| wastes from washing, cleaning and mechanical reduction of raw materials<br>(02 07 01)    | – Spent filter and absorbing mass (diatomaceous earth), active earths, active carbon                 | (Production of alcoholic and non-alcoholic beverages)<br>Diatomaceous earths must not be applied when dried. They must be incorporated in the soil immediately after application.  |
| wastes from spirits distillation<br>(02 07 02)   | – Spent grains, fruit and potato pulp<br>– Sludge from distilleries (spirits distilleries)           | These materials may be applied on permanent grassland, including as a component of a mixture.  |
| Materials unsuitable for consumption or processing<br>(02 07 04)                         |  | (Drinks manufacturing)<br>e.g. fruit juice stored for too long.<br>These materials may be applied on permanent grassland, including as a component of a mixture.   |

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste)      | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1  | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)  |
|---|---|---|
| Sludges from on-site effluent treatment<br>(02 03 05, 02 04 03, 02 05 02, 02 06 03, 02 07 05) |   | (Production of foodstuffs and semi-luxury goods)<br>To be utilised only if there has been no mixing with effluents or sludges outside the specific production process and if the provisions of the Carcass Removal or Epizootic Disease Act <sup>3)</sup> are not violated. These materials may be applied on permanent grassland, including as a component of a mixture.   |
| Wastes not otherwise specified<br>(02 07 99)  | <ul style="list-style-type: none"> <li>– Malt husks, malt sprouts, malt dust</li> <li>– Spent hops</li> <li>– Lees and sludge from breweries</li> <li>– Sludge from wine making</li> <li>– Pomace and wine marc</li> <li>– Yeast and yeast-like residues</li> </ul> | (Production of alcoholic and non-alcoholic beverages)<br>These materials, with the exception of pomace, may be applied on permanent grassland, including as a component of a mixture.   |
| waste bark and cork<br>(03 01 01)<br><br>waste bark and wood<br>(03 03 01)                    | – Barks   | (Wood-working and wood processing)<br>Pursuant to Article 10, separately collected barks, with the exception of barks from roadside trees and shrubs are exempted from the treatment and testing requirements set out in Articles 3 and 4. Barks from roadside trees and shrubs may be utilised only if tests have shown that the heavy metal concentrations referred to in the Ordinance are not exceeded.<br>Natural, untreated materials may be applied on permanent grassland, including as a component of a mixture. |

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste)                          | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1   | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)   |
|---|--|--|
| sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04<br>(03 01 05) | <ul style="list-style-type: none"> <li>– Sawdust</li> <li>– Wood wool</li> </ul>   | (Wood-working and wood processing, pulp production and manufacture of furniture)<br>Only sawdust and wood wool from untreated wood. Sawdust from natural, untreated wood from the wood processing industry may, in a composting process, be added to those biowastes which are applied on permanent grassland. |
| wastes from unprocessed textile fibres<br>(04 02 21)  | <ul style="list-style-type: none"> <li>– Cellulose fibre wastes</li> <li>– Vegetable fibre wastes</li> <li>– Wool waste</li> </ul>                                 | (Textile industry)<br>Shoddy, short wool fibres: To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> .   |
| solid wastes other than those mentioned in 07 05 13<br>(07 05 14)   | <ul style="list-style-type: none"> <li>– Pomace from medicinal plants</li> <li>– Mycelium</li> <li>– Fungus substrate residue</li> <li>– Waste proteins</li> </ul> | Mycelium from the pharmaceutical industry may be utilised only after an individual examination and if it does not contain any residues of medicinal products.  |
| solid waste from primary filtration and screenings<br>(19 09 01)  | <ul style="list-style-type: none"> <li>– Waste catch, mowings and rakings</li> </ul>   | (Drinking water preparation, water management)<br>Only mowings are suitable for utilisation.   |
| Paper and cardboard<br>(20 01 01)   | <ul style="list-style-type: none"> <li>– Waste paper</li> </ul>  | Only small quantities (approx. 10 %) may be added to separately collected biowastes or for the composting thereof. High-gloss paper and waste wallpaper must not be added to separately collected biowastes or for the treatment thereof.  |

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste) | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1 | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)  |
|--|--|---|
| biodegradable kitchen and canteen waste<br>(20 01 08)                                    | – Kitchen waste from canteens and restaurants  | In the case of wastes from canteens and large-scale catering facilities, utilisation in accordance with the provisions of this Ordinance is only possible if it is compatible with the provisions of the Carcass Removal or Epizootic Disease Act <sup>3)</sup> .<br>These materials, even as a component of a mixture, may be applied on permanent grassland only after being pasteurised (70 °C; at least one hour).  |
| edible oil and fat<br>(20 01 25)   |  | In the case of wastes from canteens and large-scale catering facilities, utilisation in accordance with the provisions of this Ordinance is only possible if it is compatible with the provisions of the Carcass Removal or Epizootic Disease Act <sup>3)</sup> .<br>These materials may only be used in installations for anaerobic treatment.<br>These materials, even as a component of a mixture, may be applied on permanent grassland only after being pasteurised (70 °C; at least one hour).. |

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste) | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1                  | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)   |
|--|---|--|
| biodegradable waste<br>(20 02 01)  | – Garden and park wastes, landscape gardening wastes, residues from copse clearing, vegetable components of driftings | Pursuant to Article 10, materials collected separately, with the exception of tree and shrub prunings from the roadside (roadside greenery) or from industrial sites, are exempted from the treatment and testing requirements set out in Articles 3 and 4. Tree and shrub prunings from the roadside or from industrial sites as well as vegetable components of driftings may be utilised only if tests have proved that the heavy metal concentrations referred to in the Ordinance are not exceeded. These materials may be applied on permanent grassland, including as a component of a mixture. |
| Mixed municipal waste <sup>4)</sup><br>(20 03 01)  | – Waste from households <sup>4)</sup> (separately collected biowastes)  | (Municipal waste)<br>In particular, separately collected biowastes from private households and small businesses.   |
| Waste from markets<br>(20 03 02)   | – Waste from markets  | Only the separately collected, biodegradable fraction is suitable for utilisation. To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> . Materials of vegetable origin collected separately may be applied on permanent grassland, including as a component of a mixture.  |
| *  | – Mud and healing earths  | These materials may be applied on permanent grassland, including as a component of a mixture.  |

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste) | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1 | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)  |
|--|--|---|
| *  | – Biodegradable products from regenerative raw materials as well as wastes from their processing     | Degradability must be demonstrated in accordance with the provisions of a relevant technical standard.  |
| *  | – Egg-shells   | To be utilised only if compatible with the provisions of the Act on the Disposal of Animal Carcasses and the Animal Disease Act <sup>3)</sup> . |

## 2 Mineral aggregates (in case of wastes, specify EWC code of waste)

| Waste designated according to the Waste Catalogue Ordinance (in brackets: code of waste) | Types of waste suitable for utilisation <sup>2)</sup> from the waste designations listed in column 1 | Additional information (if necessary, the origin of the waste is specified in brackets at the beginning)                  |
|--|--|---|
| Off-specification calcium carbonate (02 04 02)   | – Carbonation sludge   | (Sugar beet processing)<br>These materials may also be added to biowastes which are to be applied on permanent grassland. |
| Sludges from decarbonation (19 09 03)  | – Sludge from water softening  | (Water treatment)<br>These materials may also be added to biowastes which are to be applied on permanent grassland.       |
| *  | – Lime<br>– Bentonite<br>– Stone dust, sand<br>– Clay  | These materials may also be added to biowastes which are to be applied on permanent grassland.                            |

<sup>1)</sup> Technical basis: Waste Catalogue Ordinance (Abfallverzeichnis-Verordnung - AVV) of 10 December 2001 (Federal Law Gazette BGBl. I p. 3379) in conjunction with the Waste Catalogue of the LAGA, as per 1990.

<sup>2)</sup> Types of waste in analogy to the Waste Catalogue of the LAGA.

<sup>3)</sup> as well as the Ordinances issued on the basis thereof

<sup>4)</sup> Classification under this waste designation is based on the lack of a specific waste designation for separately collected biowastes (bio-bin, etc.).

## **Annex 2**

### **Safety for use in terms of human, animal and plant health**

#### **1 General remarks**

This Annex contains the requirements for examining products that have undergone biological treatment (aerobic treatment / composting and anaerobic treatment / fermentation) for compliance with standards for safe use in terms of human, animal and plant health.

Compliance of products resulting from biological treatment of waste with requirements concerning human, animal and plant health is established by means of process and product analysis.

Tests to determine safety for use in terms of human, animal and plant health should be carried out simultaneously, if possible.

The principles of operational hygiene should be observed in any case, with a view to avoiding recontamination of products.

#### **2 Requirements for testing**

##### **2.1 Requirements concerning process management**

Processes at composting facilities should be managed in such a way that a thermophile temperature range and a high level of biological activity under favourable conditions with regard to humidity and nutrients, as well as an optimum structure and optimum air conduction, are guaranteed over a period of several weeks. Water content should be at least 40 per cent; the pH value should be approx. 7. In the course of the composting process, the entire quantity of materials being mixed must be exposed to a temperature of at least 55 °C over a period of two weeks, with no or minimum interruption, or alternatively to a temperature of 65 °C (or, in the case of enclosed composting facilities, 60 °C) over a period of one week.

In fermentation facilities, the waste matrix must be treated in such a way that a minimum temperature of 55 °C is maintained over a period of 24 hours without interruption and that the hydraulic dwell time in the reactor is at least 20 days. In the case of lower operating temperatures or shorter periods of exposure, either thermal pretreatment of input materials (70 °C for 1 hour) or adequate secondary treatment of the products (heating up to 70 °C for 1 hour), or anaerobic secondary decomposition of the separated fermentation residues (composting) is required; farm manure in agricultural co-fermentation facilities (individual and cooperative facilities) will remain unaffected, provided that this does not violate any provisions under animal disease law. Any input materials which have not yet undergone a sanitisation process should be stored in such a way that contact is avoided with any heated-up, composted or fermented materials.

If the treatment process is to be adequately monitored, the facilities for treatment of biodegradable waste must have openings for burying and removing samples.

## **2.2. Tests for compliance with requirements concerning human, animal and plant health**

Compliance of products resulting from the treatment of biological waste with sanitisation requirements is established by means of direct process validation (No. 2.2.1) and indirect process supervision (No. 2.2.2), as well as product analyses (No. 2.2.3). The products should not be classified as safe until all testing requirements have been fulfilled. Products having failed any of the tests must once again undergo the process for sanitisation.

### **2.2.1 Direct process validation**

In the case of direct process validation, test and indicator organisms are used to determine the efficiency of a process from a sanitisation point of view for all process stages.

Direct process validation should be carried out within twelve months of commissioning of a newly built biowaste treatment facility (commissioning test). This requirement applies mutatis

mutandis to previously tested facilities if new processes are used or existing processes or process management procedures are significantly modified.

In the case of existing facilities, direct process validation must be carried out within 18 months of entry into force of this Ordinance, provided that no hygiene inspection based on the provisions of direct process validation or on any comparable provisions (e.g. prototype test pursuant to specification sheet M 10 of the Joint Länder Working Group on Waste (LAGA), type test based on the hygiene-related type test system of the *Bundesgütegemeinschaft Kompost e.V.* [Federal Compost Quality Assurance Organisation] or any other comparable provisions) was carried out or commenced within the last five years prior to entry into force of this Ordinance.

Direct process validation is carried out in two test series separate in time; in the case of open-air facilities, one of them must take place in the winter months. At each stage of validation, tests are conducted on a total of 60 individual samples, of which 24 are tested for compliance with human and animal health requirements, and 36 for compliance with plant health requirements. The individual samples are used as follows:

- In the tests for **human and animal health requirements**, one test organism is buried, in double samples, in three different decomposition zones (upper, medium and lower range) as well as at four different points in the heap.
- In the tests for **plant health requirements**, three test organisms are buried in three different decomposition zones (upper, medium and lower range) as well as at four different points in the heap.

The scale of testing is reduced by half for smaller facilities with an annual capacity of up to 3000 tonnes (halving the number of individual samples to be tested). For the facilities concerned, this reduction means that test organisms are only buried in the heap at two different points.

In the case of fermentation facilities, instead of burying test organisms in three different treatment zones, tests should be carried out on three consecutive days.

The scale of testing is specified in Table 1.

The indicator organisms must be buried in representative decomposition zones or in the process stages responsible for thermal inactivation of test organisms, consigned to the common decomposition and fermentation processes and, after being removed, tested for surviving or infectious test organisms. If, in exceptional cases, introduction of indicator organisms into a component of a facility is not possible due to reasons related to the system, the efficacy of the process with regard to sanitisation must be demonstrated in other ways by suitable experts. Merely controlling the final product is not sufficient.

Before direct process validation is successfully concluded, products resulting from the biological treatment of waste may, in exceptional cases, be released for utilisation if their compliance with sanitisation requirements can be demonstrated by means of regular checks on the final products as well as indirect process supervision.

### **2.2.2 Indirect process supervision**

Temperatures must be recorded at regular intervals at biological waste treatment facilities. Where possible, these measurements should be continual. They must be taken at least once on every working day and should be automatically recorded. Temperature measurements should be taken in at least three representative zones in the process stages or components of a facility which are responsible for thermal inactivation. The verifiable records of temperature patterns, compost re-stacking times (composting) and feeding intervals (anaerobic treatment) must be kept in the archives for at least five years and presented to supervisory authorities upon request.

### **2.2.3 Product analysis**

Product analyses (final product controls) must be carried out by external supervisors, thus ensuring that the final product meets relevant standards for sanitisation.

Product analyses must be carried out at least every six months (facilities with a capacity of up to 3000 t/a), or every three months (facilities with a capacity of more than 3000 t/a), at every composting or fermentation facility.

The number of samples to be tested per year varies according to the capacity of the facility:

- for facilities with a capacity of up to 3000 t/a: six samples;
- for facilities with a capacity of more than 3000 t/a, up to 6500 t/a: six samples, as well as one additional sample for every commenced quantity of 1000 tonnes of throughput;
- for facilities with a capacity of more than 6500 t/a: 12 samples, as well as one additional sample for every commenced quantity of 3000 tonnes of throughput.

The number of samples to be tested is specified in Table 1.

These samples are mixed samples (approx. 3 kg); every such sample consists of at least five different individual sub-samples taken from different batches of finished compost or fermentation residue.

The test result is considered satisfactory if none of the samples taken contain *Salmonellae* (cf. No. 2.3.1.2) and if they all have a low content (less than 2 per litre of test substrate) of viable seeds or reproductive parts of plants (cf. No. 2.3.2.5).

If any of the products resulting from the biological treatment of waste are found to contain *Salmonellae* or if their content of viable seeds and reproductive parts of plants exceeds the guide value of 2 per litre of test substrate, this is considered to be evidence of inadequate sanitisation practices.

In such cases, the biowaste treatment entity is required to inform the competent authority of the result of the test as well as of any action taken in this regard. If a second check on the final product produces the same result, or if *Salmonellae* are found repeatedly in various samples taken, the competent authority, with the help of specialists if necessary, must issue an order to take action to correct these defects.

## **2.3 Methods**

### **2.3.1 Direct process validation and product analysis with regard to human and animal health requirements**

#### **2.3.1.1 Direct process validation**

Direct process validation involves using the indicator organism *Salmonella senftenberg* W775 (H<sub>2</sub>S negative). The indicator organism is incubated in standard-I-bouillon at 37 °C for 18 to 24 hours. The resulting suspension must have a micro-organism concentration of approx. 10<sup>7</sup> to 10<sup>8</sup> CFU/ml.

In composting processes, approx. 300 g of fresh, homogenised and ground biowaste material from the facility to be inspected is soaked in 25 ml of this suspension and subsequently packaged in sterile onion or plastic bags. The samples are buried in the composting feedstock, either in this form or in specific, coarsely perforated, stable sample containers suitable for the process. After being passed through the composting process, the sample containers are removed, and 50 g of the homogenised content of each sample sack are slowly shaken in 450 ml of buffered peptone water at 4 °C for over 30 minutes, followed by incubation at 37 °C for a period of more than 20 hours. The suspension solution thus gained is tested for the presence of Salmonellae.

In fermentation facilities, quantities of 1.5 ml of the suspension of *Salmonella senftenberg* W775 (H<sub>2</sub>S negative) are introduced into the process, either with the help of plastic ampoules (content: 2 ml) or on carriers with semi-permeable membranes according to RAPP (1995; modified according to FINK, 1997), depending on the method used at the facility. The carriers with semi-permeable membranes, which are filled with 2 ml of suspension as well as 15 ml of fermentation residue, must be placed into in the process stages or components of a facility which are responsible for thermal inactivation. After being passed through the process, each sample of 1 ml is briefly shaken in 9 ml of buffered peptone water (pre-enrichment) and incubated at 37 °C for over 20 hours. The suspension thus gained is tested for the presence of Salmonellae.

The presence of Salmonellae is determined using the suspension solutions produced according to the method described above. In this process, two samples, each 0.1 ml of the well-

mixed pre-enrichment, are incubated in 10 ml of enrichment bouillon according to Rappaport for a period of over 24 hours, one sample at a temperature of 37 °C, the other at 43 °C. Subsequently, parallel smears are applied on brilliant green-phenol red-saccharose-agar (BPLSA) and xylose-lysin-desoxycholate (XLD) and incubated at a temperature of 37 °C for over 24 hours. Any colonies suspected of being infected with Salmonellae are identified using biochemical and serological methods. If these tests are conducted in the laboratory, control samples must be kept available.

In order to control the tenacity of the test strain, four control samples are produced parallel to the process validation. These control samples are not placed inside the compost heaps, but stored in wet sand (e.g. bucket with glass sand, damping with deionised water) at room temperature (20 - 25 °C) and treated after ending process validation. The control samples should produce positive Salmonellae findings in at least three of the four samples; if this is not the case, the tenacity of the test strain must be considered inadequate.

The process is considered to be validated if no Salmonellae can be found in any of the samples in the process stage which is responsible for their thermal inactivation or after the buried samples have passed through the process stages.

### **2.3.1.2 Product analysis**

For each product analysis, a quantity of 50 g of material, taken from a well-mixed sample (approx. 3 kg) produced from five sub-samples of the finished compost or fermentation residue, is tested for Salmonellae according to the method described above (see No. 2.3.1.1). In the case of fermentation facilities putting out a liquid product, the samples must be taken either directly at the outlet of the reactor or from the intermediate storage facility.

The product analysis is considered to be have been successful if no Salmonellae can be found in any of the above-mentioned samples of 50 g.

## **2.3.2 Direct process validation and product analysis with regard to plant health requirements**

The tests needed to ascertain compliance with plant health requirements in the case of anaerobic treatment must be carried out using similar testing methods to those specified for composting.

### **2.3.2.1 Test organisms and guide values**

Out of the variety of plant pathogens and seeds that may be present in feedstocks for biological waste treatment facilities, the following indicator organisms are used in direct process validation:

- tobacco mosaic virus (TMV)  
guide value in the biotest:  $\leq 8$  lesions per plant;
- *Plasmodiophora brassicae* (clubroot)  
guide value in the biotest: infection index  $\leq 0.5$
- tomato seeds  
guide value in the biotest:  $\leq 2$  % of viable seeds per sample.

If, in the case of samples which have been passed through either the entire process or the process stage responsible for thermal inactivation, the guide values for tobacco mosaic virus or tomato seeds are exceeded by more than 30 per cent, direct process validation is considered to have failed. In the case of the parameter *Plasmodiophora brassicae*, the guide value must not be exceeded at all.

### **2.3.2.2 The tobacco mosaic testing method**

Testing is carried out on the basis of the method according to BRUNS et al. (1994), based on the method developed by KNOLL et al. (1980).

#### **2.3.2.2.1 Buried samples**

Every sample used in the process of biological treatment contains a quantity of 10 g of TMV-infected tobacco leaves (*Nicotiana tabacum Samsun*) as well as 100 g of the compost raw materials to be tested. The two components are mixed and packaged in 15 x 15 cm sacks made of non-decomposable gauze (mesh size 1 x 1 mm), and it must be ensured that no test organisms can transfer into the surrounding compost. In the case of fermentation facilities, 10 g of ground TMV-infected tobacco leaves are used in carriers with semi-permeable membranes mixed with substrate which are introduced into the process in stable, non-decomposable sample containers.

Propagation of the virus takes place in tobacco plants (*Nicotiana tabacum var. Samsun*), where it spreads systemically. The tobacco plants are grown under normal greenhouse conditions up to the five-leaf stage. For inoculation, two or three of the lower leaves are thinly powdered with carborundum, cellite or bentonite, and the TMV-infected suspension (pressed-out juice from TMV-infected tobacco plants in 0.05 mol/l of phosphate buffer; pH value: 7) is carefully applied to the powdered leaves with a brush, glass spatula or with a gauze wad. Two to three weeks after inoculation, leaves infected with the virus and showing mosaic-style discolourations can be used for the tests. The control samples are kept in the freezer at a temperature of approx. -18 °C.

#### **2.3.2.2.2 Proof of infectivity of TMV**

Immediately after removal of the sample carrier from the composting or fermentation facility, its content is removed, and any coarse components that are not decomposed (wood, stones, etc.) are screened. The sample is ground in a mixer, with 30 ml of phosphate buffer (0.05 mol/l; pH value: 7) being added. The sample homogenate should have a pulpy rather than liquid consistency. The pulp is returned to the gauze bag, and any surplus liquid is pressed out (extracted). The same is done with the control samples. To prove infection, the extracts from the samples and from the control samples are applied to the test plant *Nicotiana glutinosa*.

The detection method used here is the "half-leaf method" (WALKEY, 1991). The plants should be in the 6-8 leaf stage. The leaf tips and the lower leaves are removed, so that four fully grown leaves are left on the plant. The second and third leaves are inoculated with the extracts containing the virus, one half of each leaf being rubbed with the control extract, the other with the sample extract. The tobacco variety referred to above reacts to TMV by showing so-called local lesions; these are small round stains, the centres of which consist of dead, necrotic tissue. The local lesions are counted ten days after inoculation. Evaluation consists in adding up the number of lesions on the two leaf halves of each plant which are infected with the sample solution.

### **2.3.2.3 The *Plasmodiophora brassicae* testing method**

The testing is carried out on the basis of the method according to BRUNS et al. (1994), based on the method developed by KNOLL et al. (1980).

#### **2.3.2.3.1 Buried samples**

Every sample used in the process contains a quantity of 30 g of gall material with *Plasmodiophora brassicae* from affected cabbage plants, as well as 430 g of infectious soil and 200 g of the compost raw materials to be tested. In the case of fermentation facilities, 10 g of the ground gall material is mixed with substrate and introduced into the process using carriers with semi-permeable membranes. This corresponds to a ratio of 5 per cent gall material, 65 per cent soil and 30 per cent compost. The gall material is deep-frozen at -25 °C until the test start. The three components of the sample are thoroughly mixed and packaged in non-decomposable bags (maximum mesh size 1 x 1 mm). Here it is important to ensure that no test organisms can transfer into the surrounding compost. Instead of the compost raw material, the control samples consist of a mixture of gall material, infectious soil and sterile sand, with the ratio of components as described above. The control samples are stored in damp, sterilised sand at room temperature during the test period.

### 2.3.2.3.2 Proof of infectivity by means of biotests

After being recovered from the process, all pathogen samples are freed from coarse wood and thoroughly ground, and, in each case, 325 ml of sample are mixed with 275 ml of a sand/peat mixture (30 % : 70 % = V:V; sand steamed for five hours at 80 °C). The resulting total substance quantity is approx. 600 ml per sample, the pH value being > 6 (CaCl<sub>2</sub>). To determine the pH value, which has a strong influence on the infectivity of *Plasmodiophora brassicae*, a blank sample is used which does not contain any gall material but has been stored in the tested compost or fermentation residue during the entire test period. This blank sample is first used to produce the mixture, then to determine the pH value, which is corrected (by increasing or reducing the proportion of peat) if the value measured exceeds or is below 6 (CaCl<sub>2</sub>).

For each sample, a container with test plants is established in the biotest. The plant species used is *Brassica juncea* of the *Vittasso* variety. Four plants are pricked in each container and pathogen sample. The test plants in the control sample are fertilised with culture substrate to which 250 mg N, 100 mg P<sub>2</sub>O<sub>5</sub>, 300 mg K<sub>2</sub>O and 100 mg Mg are added per litre. Due to the normally very high P and K concentrations in the composts, there is usually no need to add these nutrients in the containers holding the samples. The biotest is carried out as a randomised split-plot design in light thermostats at 8000 Lux and at a temperature of 16 to 18 °C in the first week, and 22 °C from the second week onwards. The growing period for the biotest is five weeks.

After completion of the biotest, the number of affected plants is counted, and root galling is graded on a valuation scale from 0 to 3 according to BUCZACKI et al. (1975). Category 0: no swelling on lateral and/or tap roots; category 3: severe swelling on lateral and/or tap roots.

The scores are aggregated in the infection index according to the following formula:

$$\text{Infection index} = \frac{\sum(\text{Number of plants infected} \times \text{infection category})}{\text{Total number of plants}}$$

#### **2.3.2.4 Testing method for tomato seeds**

Testing is carried out on the basis of the method according to POLLMANN and STEINER (1994).

##### **2.3.2.4.1 Buried sample**

Approximately 1 g or 400 tomato seeds (*Lycopersicon lycopersicum* (L.) Karsten ex Farw. of the *St. Pierre* breed) are poured into a small bag made of non-decomposable gauze (mesh size 0.1 x 0.1 cm) and spread over the entire gauze surface before the bag is closed, thus keeping the layer of tomato seeds as thin as possible. The closed bag is put in a sample sack filled with at least 5 l of fresh biowaste from the batch to be investigated. In the case of fermentation facilities, a similar quantity of tomato seeds contained in a carrier with semi-permeable membranes is introduced into the process. The germinating capacity of the tomato seeds must be determined before testing starts. Seeds can be used only if they have a minimum germinating capacity of 90 per cent.

##### **2.3.2.4.2 Determining the germinating rate of the tomato seeds after removal of the buried samples**

During the transport between removal and processing, as well as during any intermediate storage, keep the removed buried sample cool in an air-tight container (cool box, refrigerator). Start germinating capacity test immediately after removing the samples from the compost.

Take tomato seeds out of the bag and count out 200 seeds. Dry the remaining seeds under room conditions (20 - 50 % relative humidity, approx. 20 °C), put them in an air-tight container and keep them in the refrigerator for any repeated germinating capacity tests that might become necessary at a later stage (reserve sample). Spread out the clean counted seeds - after washing them, if necessary - in order to determine the germinating capacity; for example, 4 x 50 seeds in covered Petri dishes with a diameter of 9 cm on four layers of damped filter paper at a temperature of 25 °C and exposed to light in a suitable room or conditioning cabinet (ANON., 1993).

Count out the number of germinated tomato seeds at intervals of seven days. This counting process is continued until no more seeds have germinated. A seed is considered to have germinated if its root and/or shoot has visibly come out. If no seeds have germinated after 21 days, the germinating capacity tests are concluded. Record the total number of germinated seeds and express it as a percentage of the seeds used in the tested aliquot (200 seeds).

### **2.3.2.5 Product analysis with regard to plant health requirements**

In the case of product analysis with regard to plant health requirements, the cultivation method is used to determine the content of viable seeds and reproductive parts of plants in the product to be used which comes from biological waste treatment facilities.

For this purpose, approx. 3 kg of the finished compost product is sieved down to a size < 10 mm and exposed to a temperature of 4 °C for a period of three days. After determination of the salt content (*Bundesgütegemeinschaft Kompost*, 1994, method 8), the test substrate thus produced is diluted with a suitable mixing component (KCl content = 0 g/l) so as to give the test mixture a salt content < 2 g KCl per litre. Since mixing components must be free of viable seeds and reproductive parts of plants, one suitable component is highmoor peat with approx. 4 g of aerated lime per litre. The test mixture is spread in test dishes (plastic dishes with perforated bottoms, or any equivalent containers lined with a water-absorbent mat, and a perforated foil to keep them clean) in an even layer of approx. 10 mm; the mixture is then slightly pressed down and watered such that its water capacity reaches maximum level. The test containers are then kept for a period of 15 days, at an illumination of at least 1000 Lux and a temperature of 18 to 20 °C, without direct exposure to sunlight. The loss of water is compensated by means of regular sprinkling. To prevent drying-out, the dishes can be covered with glass or plastic glass panes in such a way that an exchange of air remains possible.

A product analysis is considered to have been successful if, after this period, the content of viable seeds and reproductive parts of plants is less than 2 per litre of test substrate.

### 3 References

ANONYMOUS,

Internationale Vorschriften für die Prüfung von Saatgut. Seed Science and Technology 21, Supplement, Vorschriften, 1993

BRUNS, C., GOTTSCHALL, R., MARCHINISZYN, E., SCHÜLER, C., ZELLER, W., WOLF, G. und VOGTMANN, H.,

Phytohygiene der Kompostierung - Sachstand, Prüfmethode, F.- und E.-Vorhaben, Tagungsband "BMFT-Statusseminar Neue Techniken der Kompostierung", Hamburg, pp. 191 - 206, 1994

BUCZACKI, S. T., TOXOPEUS, H., MATTUSCH, P., JOHNSTON, T.D., DIXON, G.R. and HOBOLTH, L.A.,

Study of physiologic specialization in plasmodiophora brassicae; proposals for rationalization through an international approach, Transactions for the British Mycological Society, 65, pp. 295 - 303, 1975

BUNDESGÜTEGEMEINSCHAFT KOMPOST E.V.,

Methodenhandbuch zur Analyse von Kompost Nr. 222, Methode 8, Cologne, 1994

BUNDESGÜTEGEMEINSCHAFT KOMPOST E.V.,

Hygiene-Baumusterprüfsystem für Kompostierungsanlagen, Kompost-Information Nr. 225, Cologne, 1996

BÖHM, R., FINK, A., MARTENS, W., PHILIPP, W., WEBER, A. und WINTER, D.,

Abschlußbericht zum Forschungsvorhaben 02-WA 9257/5 "Veterinär- und seuchenhygienische Untersuchungen zur Überprüfung von Gülleaufbereitungsverfahren und der erzeugten Gülleaufbereitungsprodukte". Institut für Umwelt- und Tierhygiene der Universität Hohenheim, 1997

HERMANN, I., MEISSNER, S., BÄCHLE, E., RUPP, E., MENKE, G. und

GROSSMANN, F.,

Einfluß des Rotteprozesses von Bioabfall auf das Überleben von phytopathogenen Organismen und Tomatensamen, Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz, 101 (1), pp. 48 - 65, 1994

KNOLL, K.-H., STRAUCH, D. und HOLST, H.,  
Standardisierung von Hygieneuntersuchungen für Kompostierungsverfahren. Forschungsbericht 79-10302403, Umweltforschungsplan des BMI, Abfallwirtschaft, 1980

LÄNDERARBEITSGEMEINSCHAFT ABFALL (LAGA),  
LAGA-Merkblatt M 10: Qualitätskriterien und Anwendungsempfehlungen für Kompost, Stand 15.2.1995

POLLMANN, B. und STEINER, A.M.,  
A standardized method for testing the decay of plant diaspores in biowaste composts by using tomato seed, Agribiological Research, 47, 1, 24 - 31, 1994

RAPP, A.,  
Hygienisch-mikrobiologische Untersuchungen zum Verhalten von ausgewählten Bakterien und Viren während der längerfristigen Speicherung von Flüssigmist in Güllegemeinschaftsanlagen. Agrarwissenschaftliche Dissertation, Universität Hohenheim, 1995

WALKEY, D.G.A.,  
Applied plant virology, Second edition, Chapman and Hall, London, 1991

**Table 1: Testing requirements for demonstrating compliance with human, animal and plant health standards for composting and fermentation facilities**

| Quality parameter   |                         | Direct process validation  | Indirect process supervision   | Product analysis  |
|---|-------------------------|--|--|---|
| Safety for use in terms of human, animal and plant health |                         | Control of the efficiency of the process   | Regular temperature control  | Control of final product <sup>3)</sup> ,<br><sup>4)</sup>   |
| Human, animal and plant health                            |                         | <ul style="list-style-type: none"> <li>– Newly established composting and fermentation facility (within 12 months of commissioning)</li> <li>– Facilities already inspected, if new processes are used or existing processes or process management procedures are significantly modified (within 12 months of first use / modification)</li> <li>– Existing facilities where the facility itself or the process have not undergone hygiene inspection within the last five years prior to entry into force of this Ordinance (within 18 months of entry into force of this Ordinance)</li> </ul> | <ul style="list-style-type: none"> <li>– Continual temperature measurements at three representative points within the sanitisation process</li> <li>– Verifiable recording of data (including re-stacking times, relative humidity of air, feeding/ collection)</li> </ul> | <ul style="list-style-type: none"> <li>– Regular analysis of the finished compost or fermentation residue to determine compliance with sanitisation requirements</li> </ul>   |
| Number of test series                                     |                         | 2 test series; and at open-air facilities: one test series in winter   | Permanent, verifiable recording (to be kept in the archives for 5 years)   | Evenly distributed over the year, but at least <ul style="list-style-type: none"> <li>– every six months (facilities with a capacity ≤ 3000 t/a)</li> <li>– every three months (facilities with a capacity &gt; 3000 t/a)</li> </ul>            |
| Number of test organisms                                  | human and animal health | 1 test organism<br>( <i>Salmonella senftenberg</i> W775, H <sub>2</sub> S negative)  | --   | Salmonellae (not traceable in 50 g of compost or fermentation residues)   |
|   | plant health            | 3 test organisms<br>( <i>Plasmodiophora brassicae</i> , tobacco mosaic virus, tomato seeds)  | --   | Viable seeds and reproductive parts of plants; less than 2 per litre of test substrate  |
| Number of samples (per test series)                       |                         |  | --   | Facility throughput in t/a:<br>1. ≤ 3000 (6 samples/year)<br>2. > 3000 - 6500 (6 samples/year + one more sample for every commenced quantity of 1000 t)<br>3. > 6500 (12 samples/year + one more sample for every commenced quantity of 3000 t) |
| Human and animal health<br>Plant health                   |                         | 24 <sup>1)</sup> , <sup>2)</sup><br>36 <sup>1)</sup> , <sup>2)</sup>   |  |   |
| Total   |                         | 60   |  |   |

<sup>1)</sup> Half the number of samples for smaller facilities (throughput ≤ 3000 t/a)

<sup>2)</sup> Direct process validation at fermentation facilities can also be carried out in several consecutive stages. Thus, for example, the component of a facility which is responsible for thermal inactivation of pathogens may be inspected in three batches on three consecutive days.

<sup>3)</sup> The provisions relating to human and animal health standards for treated materials are only applicable if both the final product analyses and the process analyses have proved successful.

<sup>4)</sup> The samples are mixed samples (approx. 3 kg), each produced from five sub-samples of the final product.

## **Annex 3**

### **Requirements concerning analysis (sampling, preparation of samples and investigation of both treated and untreated biowastes)**

#### **1 Investigation of treated and untreated biowastes**

##### **1.1 Sampling**

Samples for the investigation of biowastes as required by Article 4 are taken from biowastes in the form in which they are put into circulation or applied to soils used for agricultural, silvicultural or horticultural purposes.

Samples of solid treated or untreated biowastes are taken according to the *Methodenbuch zur Analyse von Kompost*<sup>1)</sup> (Manual for Compost Analysis)

Samples of liquid, pasty and sludge-like biowastes are taken according to the Guidelines PN 2/78<sup>2)</sup> on the taking and preparation of samples from liquid, pasty and sludge-like wastes or PN 2/78 K<sup>3)</sup> on basic rules for the taking of samples from waste and landfilled materials, issued by the Joint Länder Working Group on Waste (LAGA).

From the thoroughly mixed, fresh sample, a certain quantity is taken which is at least sufficient to guarantee four parallel tests for all required test parameters.

This quantity is poured into a suitable, container that can be tightly sealed and is immediately taken to the testing laboratory.

##### **1.2 Preparation of samples**

The sample to be investigated is thoroughly mixed directly before the sub-sample is taken.

For the test parameters which are to be determined from the dry matter, one core sample is taken which is at least sufficient to guarantee four parallel tests. This core sample is dried according to the requirements of DIN 38414, Part 2 (November 1985)<sup>4)</sup> at a temperature of 105 °C until reaching a constant weight. To determine the loss on ignition and the heavy metal concentrations, solid biowastes are pulverised to particle sizes of < 0.25 mm in diameter.

With regard to the test parameters that are to be determined from the fresh mass, another subsample is taken which must at least be sufficient to guarantee four parallel tests. Solid subsamples for these four tests must be taken from the fraction that passes through a screen with mesh holes 10 mm in diameter.

### **1.3 Testing**

A minimum of two parallel measurements must be taken for each test parameter. Equivalent methods are admissible.

If, in the case of untreated biowastes, individual tests to determine any of the additional parameters referred to in Article 4 (5) first sentence No. 2 cannot be carried out, the reasons must be given in the delivery note.

#### **1.3.1 Determination of the dry matter content**

The dry matter content is determined from the unscreened sub-sample according to the requirements of DIN ISO 11465 (December 1996)<sup>4)</sup>.

The results are given in percentage by dry weight.

### **1.3.2 Determination of the content of organic matter (loss on ignition)**

Loss on ignition is determined from the dry matter according to the requirements of DIN 19684, Part 3 (February 1977)<sup>4)</sup>.

The results are given in percentage by dry weight.

### **1.3.3 Determination of the proportion of stones and physical contaminants**

The proportion of stones > 5 mm and physical contaminants > 2 mm (glass, plastics and metals) is determined from the dry matter of the unscreened sub-sample (105 °C) according to the *Methodenbuch zur Analyse von Kompost*<sup>1)</sup>.

The results are given in percentage by dry weight.

### **1.3.4 Determination of pH and salt content**

These values are determined from fresh mass.

The pH value is determined according to the *Methodenbuch Bd. 1, Die Untersuchung von Böden*<sup>5)</sup> (Instructions on Methods, Volume 1, Soil analysis).

The salt content is determined by extracting the sample with distilled water for conductivity measurements at a ratio of 1 + 10 (weight + volume). The salt content in the filtered extract is calculated and expressed as potassium chloride after conductivity has been measured.

The test is carried out according to the *Methodenbuch Bd. 1, Die Untersuchung von Böden*<sup>5)</sup>.

The results are given in milligrams per 100 grams of fresh mass.

### 1.3.5 Determination of heavy metals (lead, cadmium, chromium, copper, nickel, mercury and zinc)

Heavy metal concentrations are determined by digesting the dry matter with nitrohydrochloric acid according to DIN 38414, Part 7 (January 1983)<sup>4)</sup>, using one of the following methods:

| Heavy metal | Testing method(s) <sup>4)</sup>   |
|-------------|---|
| Lead        | DIN 38406, Part 6 (May 1981)<br>DIN 38406, Part 22 (March 1988)<br>DIN ISO 11047 (June 1995)        |
| Cadmium     | DIN-EN ISO 5961 (May 1995)<br>DIN 38406, Part 22 (March 1988)<br>DIN ISO 11047 (June 1995)          |
| Chromium    | DIN EN 1233 (August 1996)<br>DIN 38406, Part 22 (March 1988)<br>DIN ISO 11047 (June 1995)           |
| Copper      | DIN 38406, Part 7 (September 1991)<br>DIN 38406, Part 22 (March 1988)<br>DIN ISO 11047 (June 1995)  |
| Nickel      | DIN 38406, Part 11 (September 1991)<br>DIN 38406, Part 22 (March 1988)<br>DIN ISO 11047 (June 1995) |
| Mercury     | DIN 38406, Part 12 (June 1980) <sup>*)</sup>  |
| Zinc        | DIN 38406, Part 8 (October 1980)<br>DIN 38406, Part 22 (March 1988)<br>DIN ISO 11047 (June 1995)    |

\*) To be replaced by European standard:  
DIN EN 1483 (currently draft standard; status: September 1995);  
DIN EN 12338 (currently draft standard; status: May 1996).

The results are given in milligrams per kilogram of dry matter.

**Note:**

If, in the case of untreated biowastes, digestion with nitrohydrochloric acid is not possible, the samples must be mineralised before digestion and without loss of heavy metals at a temperature of 450 °C; alternatively, an equivalent method may be used.

## **2 Indication and calculation of results**

Unless it is otherwise specified for the individual test parameters in this Annex, the results of each of the two parallel measurements and their arithmetical mean must be indicated. Determining the mean value is only admissible if the difference between the two individual results is within the common range of precision of the method applied<sup>6)</sup>. If it is not within this range of precision, examination of the possible causes of such an excessive difference as well as a third measurement are required. Where examination of this excessive difference fails to identify any clear cause, the median of the three individual values must be given as a final result.

## **3 Exceeding of limit values**

If the measured concentration for a heavy metal is more than 10 per cent higher than the corresponding maximum specified in Article 4 (3), it is considered to have exceeded the limit.

## **4 Quality assurance and control**

The testing bodies are required to ensure the accuracy of the results of analyses by means of appropriate measures for quality assurance and control<sup>7)</sup>. This involves providing proof of regular and successful participation in multiple-laboratory test series.

## **5 Announcements by competent bodies**

The announcements by competent bodies referred to under No. 1 are filed in the archives of the German Patent Office for safe custody.

Publications:

- The DIN standards are published by Beuth-Verlag GmbH, Berlin and Cologne.
- LAGA Directive PN 2/78 K is published in the *Müll-Handbuch* (Waste Management Manual) by Erich Schmidt Verlag, Berlin.
- The *Methodenbuch Bd. 1, Die Untersuchung von Böden*<sup>5)</sup> is published by VDLUFA-Verlag, Darmstadt.
- The *Methodenbuch zur Analyse von Kompost*<sup>1)</sup> is published by Verlag Abfall Now, Stuttgart.

---

<sup>1)</sup> Methodenbuch zur Analyse von Kompost, published by Bundesgütegemeinschaft Kompost e.V., Abfall Now Verlag, third edition, Stuttgart 1994.

<sup>2)</sup> Published in: Physikalische und chemische Untersuchungen im Zusammenhang mit Abfällen - Teil II, Schriftenreihe chemische Analytik und Umwelttechnologie, Heft 2; published by the Bayerisches Landesamt für Umweltschutz, R. Oldenbourg Verlag, Munich 1979.

<sup>3)</sup> Länderarbeitsgemeinschaft Abfall, PN 2/78 K - Grundregeln für die Entnahme von Proben aus Abfällen und abgelagerten Stoffen (12/83), Müll-Handbuch, Kennzahl 1859, Lieferung 2/84, Erich Schmidt Verlag, Berlin.

<sup>4)</sup> Available from same source as <sup>5)</sup>.

<sup>5)</sup> Methodenbuch Band I, Die Untersuchung von Böden, VDLUFA-Verlag, fourth edition, Darmstadt 1991.

<sup>6)</sup> For details with regard to the range of precision of the method applied, see, for example, ISO 5725, Accuracy (trueness and precision) of measurement methods and results. First edition, 15 December 1994.

<sup>7)</sup> See one of the following:

- AQS - analytische Qualitätssicherung. Rahmenempfehlungen der Länderarbeitsgemeinschaft Wasser für Wasser-, Abwasser- und Schlammuntersuchungen; published by LAWA, Erich Schmidt Verlag, Berlin 1989.

- Richtlinie zur analytischen Qualitätssicherung in der Wasseranalytik, DIN ENV 13530, 1997<sup>4)</sup>.