Composting and Quality Assurance in Germany

Dr. Stefanie Siebert and Dipl.-Ing. Agr. Maria Thelen Jüngling
German Quality Assurance Organisation for Compost - Bundesgütegemeinschaft Kompost e.V. (BGK)
Outline

Part 1
- Composting and Digestion Plants in Germany
- Legal Specifications

Part 2
- Quality Assurance and Production of Compost and Digestates in Germany

Part 3
- Sample Taking in Practice
Composting and Quality Assurance in Germany

Part 1: Composting and digestion plants in Germany

Dr. Stefanie Siebert

German Quality Assurance Organisation for Compost - Bundesgütegemeinschaft Kompost e.V. (BGK)
Bundesgütegemeinschaft Kompost e.V. (BGK) is a self-obligatory measurement of the industry and is recognised by the responsible legal authorities. BGK was founded in 1989.

The RAL quality assurance for compost was established in Germany in 1991.

RAL-quality labels identify a standardised and regularly checked product.
Examples for RAL Quality Labels

- RAL mark butter and cheese
- RAL-GZ 252 Growing media
- RAL-RG 180 Wine label
- RAL-RG 183 Wine cropping region
- RAL-GZ 164 Quality mark
- RAL-RG 163/1 Holiday on farms
State of Quality Assurance in Germany

- **RAL GZ 251**: 433 plants
- **RAL GZ 245**: 99 plants
- **RAL GZ 246**: 8 plants
- **RAL GZ 258**: 14 plants
Compost from Biodegradable Waste

Biowaste is defined as any vegetable or animal waste destined for utilisation that can be degraded by micro-organisms, soil organisms or enzymes.

Treated biowaste shall mean
- biowaste from an aerobic treatment process ⇒ compost
- biowaste from an anaerobic treatment process ⇒ digestate products
Management of Biodegradable Waste

- Biowaste is a source for organic fertilising (humus and nutrients).
- Biowaste can be used as raw material for biogas production combined with the production of organic fertiliser (power, heat and compost).
- The use of biowaste gives a good opportunity for CO$_2$ reduction.
- A separate way for biowastes recycling offers the reduction of landfill consumption.
Emissions of CO$_2$-Equivalents from Landfills

Mio. t CO$_2$-Equivalents

- 1995: BMW 100%
- 2006: BMW 75%
- 2009: BMW 50%
- 2016: BMW 35%

Content of biologically degradable material for landfilling (BMW)
Management of Biodegradable Waste in Germany and Europe

**Germany**
- Recycling: 64%
- Incineration: 33%
- Landfill: 3%

**Europe**
- Landfill: 72%
- Incineration: 22%
- Recycling: 6%

Legend:
- Yellow: Recycling
- Red: Incineration / MBT
- Gray: Landfilling (not treated)
Amount of Different Fractions of Household Waste in Germany 2005

Source: www.umweltministerkonferenz.de / > Umweltinfos der Bundesländer
Composition of Household Waste in Germany

- Biowaste: 30%
- Paper: 24%
- Others, bulk waste: 22%
- Packages: 13%
- Glass: 10%
The Ways of Biowaste

Biodegradable garden & park waste

- Separate collection
  - material recycling
  - and/or
  - energetic recycling
  - Compost
  - Fertiliser

Biodegradable waste from households

- MSW collection
  - Biogas
  - energy use
  - Incineration
  - landfill
  - material recycling
Development of Recovery of Recyclates in Germany

![Bar chart showing the development of recovery of recyclates in Germany from 1990 to 2004 for different categories: Packages, Glass, Paper, Biowaste, and Biowaste 2007. The chart indicates a significant increase in recovery for Biowaste and Biowaste 2007.]
Bio-bin Collection System in Germany

- Regions with bio-bin
- Regions without bio-bin

18 % of Germany‘s inhabitants

Participation rate in areas with bio-bin:
60 % inhabitants of these areas

Source: REMONDIS GmbH & Co.KG
Collection of Biodegradable Waste in Germany 2005

Source: www.umweltministerkonferenz.de / Umweltinfos der Bundesländer
Costs of separate Collection
- Rural disposal area -

€/E*a

Collection

Treatment

Total

-14%

HW collection
HW treatment
Resid/Bio treatment
HW collection & treatment
Resid/Bio collection & treatment

+12%

Household waste
Biowaste

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### Sustainable Targets with the Management of Biowastes

<table>
<thead>
<tr>
<th>Targets</th>
<th>Incineration 1)</th>
<th>Recovery 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of methane emissions 3)</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Use of plant nutrients</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Generation of humus fertilisers</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Substitution of peat</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Generation of energy and heat</td>
<td>-</td>
<td>(+)</td>
</tr>
</tbody>
</table>

1) Incineration as pre-treatment prior to landfilling  
2) Separate collection and material recycling of biowastes (composting and digestion, proportionate also energy recovery of biowastes rich in calorific values)  
3) Reduction of methane emissions, which would arise at the landfilling of not treated urban wastes with fractions of biowastes
## Benefit Value of Biowastes
- **Treatment Options** -

<table>
<thead>
<tr>
<th>Treatment Options</th>
<th>Compost</th>
<th>Digestion</th>
<th>Incineration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>material solid</td>
<td>energ./ material solid</td>
<td>energ./ material liquid</td>
</tr>
<tr>
<td></td>
<td>+ + +</td>
<td>+ +</td>
<td>+</td>
</tr>
<tr>
<td>Humus reproduction</td>
<td>+ + +</td>
<td>+ +</td>
<td>+</td>
</tr>
<tr>
<td>Peat substitution</td>
<td>+ +</td>
<td>+ +</td>
<td>-</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>+ +</td>
<td>+ +</td>
<td>++</td>
</tr>
<tr>
<td>Other nutrients</td>
<td>+ +</td>
<td>+ +</td>
<td>++</td>
</tr>
<tr>
<td>Energy, heat</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

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## Benefit of Material Recovery of Biowastes

### Soil nutrition
- Humus supply: Humus effective for reproduction
- Lime supply: Alkaline material as CaO

### Plant nutrition
- Basic fertilisation: P, K, Mg, S and trace nutrients
- Nitrogen: Soluble contents, follow-up supply

### Component in mixtures
- Growing Media and Substrates: Top soils, Culture substrate

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**Growing Media and Substrates**
- Top soils
- Culture substrate
Compost from Biodegradable Waste

Currently about 50% of German households are involved in the separate collection of biowaste (bio-bins/bio-containers).

Approximately 8 million tons of biowaste are treated in 800 composting plants to produce 5 million tons of compost.

70% of the produced compost is labelled with the quality label RAL-GZ 251.
Separate Collection of Biodegradable Waste

- Input Composting plants
- Input Digestion plants and Co-digestion plants
- Input total

Input in Mio. t

0 1 2 3 4 5 6 7 8

Compost and digestate products in 2009

Input amounts in 2009

| RAL-GZ 251 | Compost | 5,800,000 t/a |
| RAL-GZ 245 | Digestate product from biowaste | 2,070,000 t/a |
| RAL-GZ 246 | Digestate product from renewable energy plant | 330,000 t/a |
Composting and Digestion Plants 2009

Production plants in the Quality Assurance System

Composting plants 433

Digestion plants 99
Composting plants

Open windrow composting more or less for park and garden waste, smaller amount of input materials < 10,000 t

Closed composting systems for biowaste from households, often more than > 10,000 t of input materials

- tunnel systems
- box/container systems
- bricolare systems
- windrow systems
Input Amount of Composting plants

- 50,000 - 100,000 t: 3.8%
- >100,000 t: 0.2%
- <2,000 t: 12.5%
- 2,000 - 10,000 t: 48.3%
- 10,000 - 50,000 t: 35.1%
Composting process

Composting is a natural biological degradation process that is controlled and accelerated at a composting facility.

Composting is the transformation of biologically decomposable material through a controlled process of biooxidation, which results in the production of carbon dioxide, water, minerals and stabilised organic matter (compost or humus).
Composting process in three phases

The composting process can be divided into three phases:

- A degradation phase ⇒ important for sanitisation (weed seeds and pathogens, thermophilic bacteria, actinomycetes and fungi

- A conversion phase ⇒ temperature drops and other bacteria and fungi complete the decomposition

- A maturation phase ⇒ bacterial activity slows down, earthworms, springtails and mites
### Organisms involved in composting

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Number of organisms per gram of compost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria</td>
<td>100 000 000 to 1 000 000 000</td>
</tr>
<tr>
<td>Actinomycetes</td>
<td>100 000 to 100 000 000</td>
</tr>
<tr>
<td>Fungi</td>
<td>10 000 to 1 000 000</td>
</tr>
<tr>
<td>Algae</td>
<td>up to 10 000</td>
</tr>
<tr>
<td>Viruses</td>
<td>not known</td>
</tr>
<tr>
<td>Protozoae</td>
<td>10 000 to 100 000</td>
</tr>
<tr>
<td>Nematodes</td>
<td></td>
</tr>
<tr>
<td>Ants</td>
<td>Varies greatly, depending on the raw material and its state of decay.</td>
</tr>
<tr>
<td>Springtails (Collembola)</td>
<td></td>
</tr>
<tr>
<td>Mites</td>
<td></td>
</tr>
<tr>
<td>Earthworms</td>
<td></td>
</tr>
</tbody>
</table>

Number of organisms per gram of compost.
Composting process control

The composting process is regulated by

- **Aeration** to maintain optimum conditions for aerobic microbial activity, supply oxygen, immobilize ammonium, remove heat, carbon dioxide and moisture, strip volatile compounds and avoid anaerobic conditions.

- **Temperature control** to maximize the rate of decomposition and reduce pathogens.

- **Addition of make-up water** to maintain moisture content for aerobic conditions, and maximize organic decomposition.

- **Mechanical turning** to produce a uniform product.
Ideal moisture profile
Ideal temperature profile
Operation systems in Germany

Defined composting operations of various producers can be united into specific construction- and plant categories to a „modular construction“ on account of their similar construction and processing methods.

The differences between the single construction types are based on the geometry of the heaps: triangel or table heaps.
Construction categories

Classification of constructional conditions and basic system components in type categories:

Boxes/container systems
Bricolare systems
Tunnel systems
Windrow systems (open/enclosed)
End of presentation
Part 1a: Legal Specifications

Dr. Stefanie Siebert

German Quality Assurance Organisation for Compost - Bundesgütegemeinschaft Kompost e.V. (BGK)
Legal specifications in Germany

- **Ordinance on Biowastes – BioAbfV 1998**
  Ordinance on the Utilisation of Biowastes on Land used for Agricultural, Silvicultural and Horticultural purposes

- **Fertiliser regulations**
  Fertiliser regulation - DüV 2006
  Ordinance for the declaration of fertilisers, soil improving agents, growing media and plant protection agents - DüMV 2003

- **Soil Protection Act - BBodSchG 1998**
  Federal Soil Protection and Contaminated Sites Ordinance - BBodSchV 1999
Ordinance on Biowastes (BioAbfV 1998)

- on the utilisation of biowastes on land used for agricultural, silvicultural and horticultural purposes

- is defined for untreated biowastes, aerobically treated biowastes (composts) and anaerobically treated biowastes (digestate residues)
Ordinance on Biowastes (2)

The ordinance on biowastes regulates and includes:

- process requirements
- hygienic and precautionary environmental aspects of the material
- requirements for application
As a general rule the producers as well as the parties responsible for waste management have to treat the biodegradable material in such a way that the safety for use in terms of human, animal and plant health is guaranteed.

- Direct process validation (once)
- Indirect process supervision (continuous)
- Final product analysis (continuous)
Operation conditions for sanitization

Composting plants
- 55 °C for two weeks or
- 65°C (60°C in closed plants) for one week

Digestion plants
- 55 °C should be maintained over a period of 24 hours and
- 20 days hydraulic dwell time in the reactor or
- 70 °C for 1 hour
Direct Process Validation - BioAbfV

Procedure degree of efficiency on hygienic aspects

Dumping and retrieval of test and indicator organisms

- Human and veterinary hygienic aspects (salmonellae)
- Phyto hygienic aspects (tobacco mosaic virus (TMV), clubroot (plasmodiophora brassicae) and tomato seed
Indirect Process Supervision - BioAbfV

- Continous temperature management
  Every working day or automatically in three representatives zones

- Compliance with necessary treatment temperature
Final Product Analysis

Continous examinations of the final product

- Salmonellae
- Germinative seeds and reproducible plant parts
## Environmental Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Class Type 1</th>
<th>Class Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impurities (glass, metals, plastics) % dm</td>
<td>( \leq 0,5 )</td>
<td>( \leq 0,5 )</td>
</tr>
<tr>
<td>Lead (Pb) mg/kg dm</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>Cadmium (Cd) mg/kg dm</td>
<td>1,0</td>
<td>1,5</td>
</tr>
<tr>
<td>Chromium (Cr) mg/kg dm</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Copper (Cu) mg/kg dm</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Nickel (Ni) mg/kg dm</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>Mercury (Hg) mg/kg dm</td>
<td>0,7</td>
<td>1,0</td>
</tr>
<tr>
<td>Zinc (Zn) mg/kg dm</td>
<td>300</td>
<td>400</td>
</tr>
</tbody>
</table>
Application requirements

The total amount of biowastes (dry matter) applied per hectare within a period of three years shall not exceed

<table>
<thead>
<tr>
<th>Type</th>
<th>Amount (t dm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>30</td>
</tr>
<tr>
<td>Type 2</td>
<td>20</td>
</tr>
</tbody>
</table>

Further restrictions

Treated separately collected biowaste from households is not allowed for application on permanent grassland.
Fertiliser Regulation

Fertiliser regulation - relevant for agriculture and gardening

- Fertiliser regulation (DüV 2006)
- Ordinance for the declaration of fertilisers, soil improving agents, growing media and plant protection agents (DüMV 2003) ⇒ at this point composted waste turns into a labelled product and is declared as organic (N-P-K)-fertiliser or (P-K)-fertiliser.
Soil protection regulations

Soil protection act (BBodSchG 1998)
- relevant for landscaping

Federal Soil Protection and Contaminated Sites Ordinance (BBodSchV 1999)
- regulates the application amount for specific landscaping purposes
EU Regulations

EC Reg n° 834/2007 – Regulation on Organic Farming
Specific environmental criteria are described for compost from separate collected household wastes

EU ECO Label for soil improver - promotes the production and reuse of organic waste
(2006/799/EC 03.11.2006 L325/28)
## Environmental Criteria on EU-level

<table>
<thead>
<tr>
<th>Parameter</th>
<th>EC n° 834/2007</th>
<th>EU ECO label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impurities (glass, metals, plastics) % dm</td>
<td>-</td>
<td>≤ 0,5</td>
</tr>
<tr>
<td>Lead (Pb) mg/kg dm</td>
<td>45</td>
<td>100</td>
</tr>
<tr>
<td>Cadmium (Cd) mg/kg dm</td>
<td>0,7</td>
<td>1,0</td>
</tr>
<tr>
<td>Chromium (Cr) mg/kg dm</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Cupper (Cu) mg/kg dm</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Nickel (Ni) mg/kg dm</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>Mercury (Hg) mg/kg dm</td>
<td>0,4</td>
<td>1,0</td>
</tr>
<tr>
<td>Zinc (Zn) mg/kg dm</td>
<td>200</td>
<td>300</td>
</tr>
</tbody>
</table>
EU Reg nº 1774 – (ABPRnew 1069/2009)

Regulation on Animal-by-products

▪ Regulates specific requirements on the treatment of animal-by-products, if used as input materials in composting and digestion plants
## Animal-by-Product-Regulation

<table>
<thead>
<tr>
<th>ABPR</th>
<th>Diverting national regulation or full implementation of Annex VI ABPR</th>
<th>Time/temp. regime</th>
<th>Max. Particle size</th>
<th>Closed reactor or open windrows</th>
<th>Final product testing</th>
<th>Final product testing</th>
<th>Waiting period for grazing/ harvesting of feeding stuff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Catering waste from households</strong></td>
<td>National regulation (TierNebV)</td>
<td>Compost: 55°C/2 Weeks 65/60°C /1 week Fermentation: 55°C/24h 20 Days 70°/1h</td>
<td>-</td>
<td>Closed or Open windrow</td>
<td>Salmonella</td>
<td>Capital 本公司</td>
<td>Absent in 50g</td>
</tr>
<tr>
<td><strong>Catering waste from central kitchens</strong></td>
<td>National regulation (TierNebV)</td>
<td>Compost: 55°C/2 Weeks 65/60°C /1 week Fermentation: 55°C/24h and Fermentation &gt; 20 Days 70°/1h</td>
<td>-</td>
<td>Only closed reactor</td>
<td>Salmonella</td>
<td>Capital 本公司</td>
<td>Absent in 50g</td>
</tr>
<tr>
<td><strong>Former foodstuff</strong></td>
<td>ABPR</td>
<td>70°/1h</td>
<td>12 mm</td>
<td>Closed or Open windrow</td>
<td>Salmonella</td>
<td>Salmonella</td>
<td>Absent in 25g</td>
</tr>
<tr>
<td><strong>All other Cat. 3 material</strong></td>
<td>ABPR</td>
<td>70°/1h</td>
<td>12 mm</td>
<td>Closed or Open windrow</td>
<td>Salmonella E.coli</td>
<td>Capital 本公司</td>
<td>1000-5000 MPN / 1 of 5 samples</td>
</tr>
<tr>
<td><strong>Manure</strong></td>
<td>ABPR</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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Legal Specifications

End of presentation
Composting and Quality Assurance in Germany

Part 2: Quality Assurance for Compost and Digestate

Dr. Stefanie Siebert
Bundesgütegemeinschaft Kompost e.V.
Development of the QAS

The RAL quality assurance for compost was established in Germany in 1991.

The RAL quality assurance for digestate residuals was established in 2000. Revision in 2007.

The RAL quality assurance for sewage sludge compost was established in 2003.
RAL Quality Compost and Digestate Products in Germany

Compost products (RAL-GZ 251):
- fresh compost
- mature compost
- compost for potting soil

Digestate products from biowaste (RAL-GZ 245):
- solid and liquid digestates

Digestate products from renewable energy crops (RAL-GZ 246):
- solid and liquid digestates

Composted sludge products (RAL-GZ 258):
- sludge-based mature compost
- sludge-based fresh compost
State of Quality Assurance in Germany

- RAL GZ 245: 99 plants
- RAL GZ 246: 8 plants
- RAL GZ 251: 433 plants
- RAL GZ 258: 14 plants
Benefits of BGK

- Quality assurance system (QAS)
- Product standards
- Legal safety
- Information service
- Local consideration
## Benefits of participation in BGK QAS

<table>
<thead>
<tr>
<th>QAS</th>
<th>Produkt Standards</th>
<th>Legal safety</th>
<th>Information Service</th>
<th>Regional Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Conferring of quality labels</td>
<td>• Regulations for quality and examination</td>
<td>• Monitoring of legislation regulations</td>
<td>• Journal „Humus &amp; KomPost“</td>
<td>• Local considerations</td>
</tr>
<tr>
<td>• Organisation of QAS</td>
<td>• Product declaration (i.e. for fertilizer regulations)</td>
<td>• Assistance with the realisations</td>
<td>• Application recommendations and advertising material for members</td>
<td>• Authority contacts</td>
</tr>
<tr>
<td>• Documentation and certificates</td>
<td>• Influence on product standards</td>
<td>• Representation of the concerns of practice</td>
<td>• Consideration in individual cases</td>
<td>• Exchange of experience</td>
</tr>
<tr>
<td>• ZAS (central evaluation station)</td>
<td>• Coordination of market demands</td>
<td>• Questions of product liability</td>
<td>• Contact for institutes, administration etc.</td>
<td>• Special events</td>
</tr>
<tr>
<td>• HBPS (hygiene modular construction system)</td>
<td>• Continuing progression</td>
<td>• Qualification of raw materials</td>
<td>• Expert questions</td>
<td>• Representation of special local concerns</td>
</tr>
<tr>
<td>• Lab recognition, methods book</td>
<td>• Statistical examinations</td>
<td>• Certificates for authorities</td>
<td>• Internet presence</td>
<td></td>
</tr>
</tbody>
</table>

**Bundesgütegemeinschaft Kompost e.V.**
 Targets of Quality Assurance

- Specification of products with a guaranteed homogenous quality
- Enhancement of product quality and operation quality
- Guarantee for a successful use of the products
- Deregulation and recognition of certified products by legal authorities, in agricultural systems and by food processing industry
- Promotion of the re-use of waste "from waste to product"
Advantages of Quality Assurance

Without Quality Assurance

- Hygienic harmlessness § 3
- Amount of heavy metals § 4
- Application requirements §§ 6, 7, 8
- Soil investigations § 9
- Official control §§ 3, 4
- Documented evidence of utilization § 11

With Quality Assurance

- Hygienic harmlessness § 3
- Amount of heavy metals § 4
- Application requirements §§ 6, 7, 8

Bundesgütegemeinschaft
Kompost e.V.
Application Areas of BGK QAS

- Implementation of the RAL- quality assurance systems
- Information for operators and production plants
- On-site inspection and consultation by an independent quality manager
- Recognition of test laboratories (implementation of ring tests)
- Recognition of sample taker (courses for sample taking)
- Elaboration of application requirements for good practical use
Contents of Quality Assurance System

- Process requirements and suitable input materials
- Independent analysis and declaration of the product quality
- Documentation and application requirements
Quality Assurance Organisation
central data base

Composting / Digestion Plant
Member of Quality Assurance Organisation (BGK)

Quality Committee
control, sanctions, measures

Sample Taker

Acknowledged Laboratory

Bundesgütegemeinschaft
Kompost e.V.
Course of Quality Assurance System

2-Step Quality Assurance System

Recognition Procedure
single

Supervision Procedure
continuous
Contents of Quality Assurance System

**Input Materials**
- in accordance with the biowaste ordinance and fertiliser regulation
- operation control by plant visits of independent quality managers
- control by independent sample takers and by declaration in analysis report

**Independent analysis and declaration of the product quality**
- 4 -12 times a year, depends on the amount of input material
- control and sanctions by an independent quality committee
- certification with product declaration according to the fertiliser regulation

**Application requirements**
- application requirements based on the biowaste and fertiliser regulation
- application requirements due to good practical use

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Recognition of Laboratories

Qualification possibilities for laboratories

1. Inter-laboratory trial organised by BGK
2. Participation at another inter-laboratory trial which is accepted by BGK
3. Single qualification
Sample Taking and Analysis

- According to the methods book of BGK
- Accomplishment only by ordered and recognised lab
- Independancy and education of sample taker
- Samples have to supply a representative sample
- Samples must only be taken from goods ready for sale
Producer
Plant operator

Analyses results
monatly updated on
BGK Website

Evaluation by
BGA
half yearly

Certificate
annually

Application for RAL-
QAS

Sample taker

Approved Lab

Qualitity label
Certificate

BKG quality assurance
organisation and
BGA quality committee

ZAS-Lab
database

Contract for
Analysis

Appli-
cation for RAL-
QAS

Bundesgütegemeinschaft
Kompost e.V.
Central Data Evaluation (ZAS)

- Approved Sample taker
  - Sample
  - Protocol

- Approved lab
  - ZASLab Lab software

- BGK office
  - Email-Versand
  - ZAS Central database
    - Result reports
    - Control certificate
    - Annual certificate
    - Analyses survey
    - Sampling plan
    - Survey of all results

- Plant manager
  - Application of QAS
  - Annual date (online)
Documentation and Record System

- Analysis records
  Analysis results of one batch

- Quality certificate
  Results and evaluation of analysis of the last year

- Documentation overview
  Summary report of all analysis results for the operator and the quality assurance committee for control and sanctions
Annual Report

- Documentation of the concrete quality attributes
- Product declaration for fertiliser regulations
- Accordance with current legislations and regulations
- Median values of valuable ingredients and the spectrum of the expected variance (tolerance)
- Calculation base for fertilization account and counselling
- Application recommendations for horticulture, agriculture and landscaping
Annual report

Quality assurance system

Legal conformity

Product declaration

Further specifications
Application recommendations are based on the analysis results of the last year and are included in the annual quality certificate.

Contents of the Annual Quality Certificate

- Product type
- Agreement with legislation and specific regulation (water retention areas)
- Declaration according to fertiliser regulation
- Quality criteria and analysis results with variation range
- Calculation of application rate and application recommendations according to good practical use
Verleihungsurkunde

Die Bundesgütegemeinschaft Kompost e.V.
verleiht hiermit
auf Grund des vom Gütezweckbund Meereswirtschaft (BGK) ausgestellten Gütezweckbriefs

der Firma
Kompost GmbH

Inkonventionale
Mietenhausen (BGK-Nr. 9999)
Vorstand M. S. K. Kiefer M. Hausenhausen

die vom Deutschen Institut für Güteüberwachung und Kontrolle e.V. (DIB) anerkannten und durch H. Frank auf der Deutschen Fachmesse

RAL-Gütezeichen Kompost

Für das Produkt
Fertigkompost

Die Verleihung des Gütezeichens besagt, dass die Einhaltung der güte- und Prüfbestimmungen überprüft wird.

Köln, den 17. Mai 2006
Bundesgütegemeinschaft Kompost e.V.

Der Vorstand
der Bundesgütegemeinschaft

Der Obmann
des Bundesgütezweckbundes
Process Requirements for Composting Plants

are characterised by
- suitable input materials,
- operation conditions for sanitization (55 °C for two weeks or 65°C (60°C in closed plants) for one week,
- hygiene model type system (HBPS),
- good plant management (reduction of odour emissions, effective separation of impurities).

is proved by
- regular plant inspections.
## Product Analysis of Compost Products for Recognition and Monitoring

<table>
<thead>
<tr>
<th>Input Amount (t/a)</th>
<th>Recognition procedures</th>
<th>Monitoring procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2.000</td>
<td>4</td>
<td>&lt; 8000 t input material per year</td>
</tr>
<tr>
<td>≥ 2.001</td>
<td>6</td>
<td>≥ 8.000 t input material for every 2.000 t input material per year</td>
</tr>
<tr>
<td>≥ 6.001</td>
<td>8</td>
<td>≥ 8.000 t input material for every 2.000 t input material per year but as maximum 12 analysis per year</td>
</tr>
<tr>
<td>≥ 12.001</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
Differentiation of the RAL quality for Digestate Products

Input materials
- Biowaste: organic municipal waste, residues from the food and animal feed industry
- Renewable Energy Crops
- Manure

Relevant Legislation
- Biowaste Ordinance (BioAbfV)
- EG-VO 1774/2002 (TierNebV)

Fertiliser legislation

Bundesgütегgemeinschaft
Kompost e.V.
Process Requirements and Input Materials for Digestation

**Input materials**
- Biowaste from separate collected organic municipal waste, residues from the food and animal feed industry
- Renewable energy crops, Manure, slurry, dung, straw

**Process requirements**
- Sanitization at 70 °C for at least 1 h or thermophilic fermentation at > 55° for 24 h and a dwell time of 20 days
- Treatment at > 37 °C for a dwell time of 20 days
- Salmonella not traceable

- operation control by plant visits of independent quality managers
- control by independent sample takers and by declaration in analysis report
## Product Analysis of Digestate Residues for Recognition and Monitoring

<table>
<thead>
<tr>
<th>Quality label/Quality assurance</th>
<th>Recognition procedures</th>
<th>Monitoring procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Digestate product from biowaste (RAL-GZ 245)</strong></td>
<td>one analysis for every 1.500 t input material per year</td>
<td>one analysis for every 2.000 t input material per year</td>
</tr>
<tr>
<td></td>
<td>min. 4, max. 12 per year</td>
<td>min. 4, max. 12 per year</td>
</tr>
<tr>
<td><strong>Digestate product from renewable energy crops (RAL-GZ 246)</strong></td>
<td>one analysis for every 1.500 t input material per year</td>
<td>one analysis for every 8.000 t input material per year</td>
</tr>
<tr>
<td></td>
<td>min. 4, max. 8 per year</td>
<td>min. 2, max. 4 per year</td>
</tr>
</tbody>
</table>
Product quality

Valuable criteria
- Decomposition degree (compost)
- Degree of fermentation (digestate)
- Bulk density
- pH-value, salt content
- Plant nutrients
- Carbonats
- Organic matter content

Precautionary environmental criteria
- Hygienic aspects (salmonellae)
- Viable weeds and plant parts
- Impurities
- Potential toxic substances (heavy metals)
- Degree of pollution (visible content of impurities)
### Product Quality – valuable criteria

<table>
<thead>
<tr>
<th>Quality criteria</th>
<th>Parameter</th>
<th>Compost fresh / mature</th>
<th>Digestate solid / liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic matter</td>
<td>Loss on ignition [M. %]</td>
<td>≥ 15 / ≥ 30</td>
<td>≥ 30 / ≥ 40</td>
</tr>
<tr>
<td>Dry matter</td>
<td>Dry matter [M.-%]</td>
<td>≥ 55</td>
<td>-</td>
</tr>
<tr>
<td>Nutrients</td>
<td>$N_t, P_2O_5, K_2O, MgO, S$ [% / dm]</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td>Alkaline effective matter</td>
<td>CaO [% / dm]</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td>Nitrogen soluble</td>
<td>$NH_4-N+NO_3-N$ [mg/l FM]</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td>Salt content</td>
<td>Salt content [g/l FM]</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td>pH-value</td>
<td>pH-value</td>
<td>Declaration</td>
<td>Declaration</td>
</tr>
<tr>
<td>Rotting degree / Fermentation degree</td>
<td>°C / Organic acids [mg/l]</td>
<td>60 – 40,1 / ≤ 40</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&lt; 1500</td>
</tr>
</tbody>
</table>
## Precautionary Environmental Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impurities &gt; 2 mm [% dm]</td>
<td>≤ 0.5</td>
<td></td>
</tr>
<tr>
<td>Degree of pollution [cm² / l FM]</td>
<td>≤ 25</td>
<td>Only determinable, if impurity content exceed 0.1 M.-%</td>
</tr>
<tr>
<td>Pb [mg /kg dm]</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Cd [mg /kg dm]</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Cr [mg /kg dm]</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Ni [mg /kg dm]</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Cu [mg /kg dm]</td>
<td>100</td>
<td>If the content of Cu and Zn is referred to manure etc., plausible higher values in digestate are allowed.</td>
</tr>
<tr>
<td>Zn [mg /kg dm]</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Hg [mg /kg dm]</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Viable seeds and sprouting plant parts</td>
<td>2 seeds / l</td>
<td></td>
</tr>
</tbody>
</table>
Compost from Biodegradable Waste

Currently about 50% of German households are involved in the separate collection of biowaste (bio-bins/bio-containers).

 Approximately 8 million tons of biowaste are treated in 800 composting plants to produce 5 million tons of compost.

70% of the produced compost is labelled with the quality label RAL-GZ 251.
Composting and Digestion Plants

Production plants in the Quality Assurance System

Composting plants 433

Digestion plants 99 / 8
Compost and Digestate Products in 2009

Input amounts in 2009

| RAL-GZ 251 | Compost | 5.800.000 t/a |
| RAL-GZ 245 | Digestate product from biowaste | 2.070.000 |
| RAL-GZ 246 | Digestate product from renewable energy plant | 330.000 |
## Compost Quality – valuable criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Average of 2006</th>
<th>Average of 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{OM}_{\text{LOI}}$ [%]</td>
<td>38.9</td>
<td>39.1</td>
</tr>
<tr>
<td>$N_t$ [% / dm]</td>
<td>1.39</td>
<td>1.40</td>
</tr>
<tr>
<td>$\text{P}_2\text{O}_5$ [% / dm]</td>
<td>0.66</td>
<td>0.67</td>
</tr>
<tr>
<td>$\text{K}_2\text{O}$ [% / dm]</td>
<td>1.16</td>
<td>1.15</td>
</tr>
<tr>
<td>$\text{MgO}_i$ [% / dm]</td>
<td>0.71</td>
<td>0.70</td>
</tr>
<tr>
<td>$\text{CaO}$ [% / dm]</td>
<td>4.08</td>
<td>3.80</td>
</tr>
<tr>
<td>$\text{NH}_4\text{-N}+\text{NO}_3\text{-N}$ [mg/l FM]</td>
<td>255</td>
<td>242</td>
</tr>
<tr>
<td>Salt content [gl FM]</td>
<td>4.62</td>
<td>4.64</td>
</tr>
<tr>
<td>pH-value</td>
<td>7.60</td>
<td>7.60</td>
</tr>
</tbody>
</table>
## Compost - environmental criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Ø 2006</th>
<th>Ø 2007</th>
<th>90th Percentile</th>
<th>Min - Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impurities &gt; 2mm [% dm]</td>
<td>0.09</td>
<td>0.08</td>
<td>0.38</td>
<td>0.00 – 2.98</td>
</tr>
<tr>
<td>Stone &gt; 5mm [% / dm]</td>
<td>1.36</td>
<td>1.32</td>
<td>3.32</td>
<td>0.00 – 17.95</td>
</tr>
<tr>
<td>Pb [mg /kg dm]</td>
<td>37.0</td>
<td>36.0</td>
<td>65.5</td>
<td>4.0 -166.0</td>
</tr>
<tr>
<td>Cd [mg /kg dm]</td>
<td>0.42</td>
<td>0.42</td>
<td>0.72</td>
<td>0.00 – 2.00</td>
</tr>
<tr>
<td>Cr [mg /kg dm]</td>
<td>21.1</td>
<td>21.2</td>
<td>32.0</td>
<td>3.72 – 307.0</td>
</tr>
<tr>
<td>Cu [mg /kg dm]</td>
<td>45.8</td>
<td>43.3</td>
<td>77.0</td>
<td>2.20 – 1004.0</td>
</tr>
<tr>
<td>Ni [mg /kg dm]</td>
<td>13.1</td>
<td>13.1</td>
<td>23.0</td>
<td>1.76 – 87.9</td>
</tr>
<tr>
<td>Zn [mg /kg dm]</td>
<td>169.0</td>
<td>168.0</td>
<td>249.0</td>
<td>22.0 – 835.0</td>
</tr>
<tr>
<td>Hg [mg /kg dm]</td>
<td>0.11</td>
<td>0.11</td>
<td>0.22</td>
<td>0.00 – 0.97</td>
</tr>
</tbody>
</table>
## Compost - environmental criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Green-waste</th>
<th>Bio-waste</th>
<th>Green/Bio-waste</th>
<th>Limit values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samples</td>
<td>947</td>
<td>288</td>
<td>1.519</td>
<td>Type 1: 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2: 150</td>
</tr>
<tr>
<td>Pb [mg /kg dm]</td>
<td>32.6</td>
<td>41.4</td>
<td>38.0</td>
<td>Type 1: 1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2: 1.5</td>
</tr>
<tr>
<td>Cd [mg /kg dm]</td>
<td>0.40</td>
<td>0.45</td>
<td>0.44</td>
<td>Type 1: 70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2: 100</td>
</tr>
<tr>
<td>Cr [mg /kg dm]</td>
<td>19.5</td>
<td>23.0</td>
<td>21.9</td>
<td>Type 1: 70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2: 100</td>
</tr>
<tr>
<td>Cu [mg /kg dm]</td>
<td>36.7</td>
<td>53.8</td>
<td>50.2</td>
<td>Type 1: 70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2: 100</td>
</tr>
<tr>
<td>Ni [mg /kg dm]</td>
<td>12.3</td>
<td>13.3</td>
<td>13.6</td>
<td>Type 1: 35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2: 50</td>
</tr>
<tr>
<td>Zn [mg /kg dm]</td>
<td>148.0</td>
<td>193.0</td>
<td>177.0</td>
<td>Type 1: 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2: 400</td>
</tr>
<tr>
<td>Hg [mg /kg dm]</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>Type 1: 0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type 2: 1.0</td>
</tr>
</tbody>
</table>
Quality of Compost and Digestate

Compost quality
Due to the homogenous input material for compost (98% of separately collected biowaste from households and park and garden waste) the quality characteristics are constant.

Digestate quality
There is a great variance in the quality of digestate residuals due to the different types of input materials (manure, food residues from industry, renewable energy plants and separately collected biowaste).
# Digestate Quality – Valuable Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2003</th>
<th>2007</th>
<th>10th</th>
<th>90th</th>
<th>2003</th>
<th>2007</th>
<th>10th</th>
<th>90th</th>
</tr>
</thead>
<tbody>
<tr>
<td>OM&lt;sub&gt;LOI&lt;/sub&gt; [%]</td>
<td>63.4</td>
<td>66.5</td>
<td>49.5</td>
<td>77.7</td>
<td>51.2</td>
<td>56.6</td>
<td>37.4</td>
<td>67.3</td>
</tr>
<tr>
<td>N&lt;sub&gt;t&lt;/sub&gt; [% / dm]</td>
<td>7.9</td>
<td>10.4</td>
<td>2.6</td>
<td>17.3</td>
<td>2.3</td>
<td>3.1</td>
<td>1.1</td>
<td>4.2</td>
</tr>
<tr>
<td>P&lt;sub&gt;2&lt;/sub&gt;O&lt;sub&gt;5&lt;/sub&gt; [% / dm]</td>
<td>2.9</td>
<td>3.6</td>
<td>1.1</td>
<td>6.0</td>
<td>1.4</td>
<td>1.7</td>
<td>0.9</td>
<td>4.4</td>
</tr>
<tr>
<td>K&lt;sub&gt;2&lt;/sub&gt;O [% / dm]</td>
<td>4.4</td>
<td>4.9</td>
<td>2.4</td>
<td>8.3</td>
<td>0.9</td>
<td>1.1</td>
<td>0.7</td>
<td>3.0</td>
</tr>
<tr>
<td>MgO&lt;sub&gt;t&lt;/sub&gt; [% / dm]</td>
<td>0.9</td>
<td>0.7</td>
<td>0.4</td>
<td>1.8</td>
<td>0.9</td>
<td>0.9</td>
<td>0.7</td>
<td>1.4</td>
</tr>
<tr>
<td>CaO [% / dm]</td>
<td>5.6</td>
<td>4.4</td>
<td>2.6</td>
<td>10.8</td>
<td>7.5</td>
<td>5.8</td>
<td>2.8</td>
<td>20.5</td>
</tr>
<tr>
<td>NH&lt;sub&gt;4&lt;/sub&gt;-N+NO&lt;sub&gt;3&lt;/sub&gt;-N [mg/l FM]</td>
<td>2521</td>
<td>3030</td>
<td>1256</td>
<td>4624</td>
<td>1011</td>
<td>744</td>
<td>93</td>
<td>2438</td>
</tr>
<tr>
<td>Salt content [gl FM]</td>
<td>14.7</td>
<td>18.4</td>
<td>8.2</td>
<td>25.8</td>
<td>5.7</td>
<td>5.8</td>
<td>2.5</td>
<td>11.7</td>
</tr>
<tr>
<td>pH-value</td>
<td>7.9</td>
<td>8.0</td>
<td>7.4</td>
<td>8.4</td>
<td>7.8</td>
<td>8.0</td>
<td>7.2</td>
<td>8.5</td>
</tr>
<tr>
<td>Sample amounts</td>
<td>143</td>
<td>433</td>
<td>64</td>
<td>69</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Digestate - Environmental Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Liquid</th>
<th></th>
<th>Solid</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2003</td>
<td>2007</td>
<td>10(^{th})</td>
<td>90(^{th})</td>
</tr>
<tr>
<td>Impurities &gt; 2mm [% dm]</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.12</td>
</tr>
<tr>
<td>Stone &gt; 5mm [% / dm]</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Pb [mg /kg dm]</td>
<td>7.7</td>
<td>6.0</td>
<td>3.0</td>
<td>48.9</td>
</tr>
<tr>
<td>Cd [mg /kg dm]</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Cr [mg /kg dm]</td>
<td>15.1</td>
<td>12.6</td>
<td>6.0</td>
<td>34.6</td>
</tr>
<tr>
<td>Cu [mg /kg dm]</td>
<td>90.6</td>
<td>78.0</td>
<td>35.7</td>
<td>394</td>
</tr>
<tr>
<td>Ni [mg /kg dm]</td>
<td>15.0</td>
<td>11.2</td>
<td>6.1</td>
<td>27.9</td>
</tr>
<tr>
<td>Zn [mg /kg dm]</td>
<td>376</td>
<td>334</td>
<td>187</td>
<td>829</td>
</tr>
<tr>
<td>Hg [mg /kg dm]</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Analyses amount</td>
<td>143</td>
<td>433</td>
<td>64</td>
<td>69</td>
</tr>
</tbody>
</table>
Marketing Structure

- Diverses: 52.5%
- Profigardening: 15.0%
- Specific crops: 9.9%
- Hobbygardening: 11.9%
- Landscaping/Recultivation: 4.7%
- Soil Manufactory: 3.4%
- Agriculture: 2.6%
QAS as an important marketing tool

In several food processing industries only quality assured compost products are allowed:

- Sugar beet industry
- QAS of cropping systems
- Organic farming system
  (157 composting plants are listed in the official input material list of the organic farming organisation)

In environmental conventions of potential risk areas:
- Water protection areas
Information

Publications
Quality assurance guidelines for composts and digestate products
Methodbook for the analysis of organic fertiliser, soil improver and substrates
Humuswirtschaft & Kompost - printed version 2 times a year
Humuswirtschaft & Kompost Aktuell – online version monthly

Application brochures (4 pages) -
Hobby gardening, market gardening, landscaping etc.

Comprehensive brochures (20 – 30 pages) -
Organic fertilising in cropping systems,
Compost application in landscaping

Website www.kompost.de
- Name of composting or digestion plant
- Name of laboratory
- Name of sample taker
- Type of Product
- Grain size
- Proof of temperature protocol
- Date of sampling
Analysis report
Page 2

Analysis results:

- Physical parameter
- Biological parameter
- Chemical parameter
- Plant nutrients
- Soil improving parameters
- Heavy metals
Declaration and conformity sheet:

- Conformity proof of legislation
- Declaration according to the Fertiliser Ordinance
- Input materials
- Fit for purpose
- Application requirements
- Nutrient amount
- Fertilising calculation
- Hygienic proof
# Documentation of Analysis Results

### Dokumentation von Untersuchungsergebnissen im Rahmen der Gütesicherung Kompost (RAL-GZ 251)

<table>
<thead>
<tr>
<th>Produktionsanlage</th>
<th>9999</th>
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<td>Region</td>
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<td>Deutsch</td>
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<td>Produkt</td>
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<tr>
<td>Überwachung seit</td>
<td>28.02.2003</td>
<td></td>
<td>01.01.2009</td>
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### Tabelle der Probenannahmen

<table>
<thead>
<tr>
<th>Probenannahme</th>
<th>Probe 1</th>
<th>Probe 2</th>
<th>Probe 3</th>
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<th>Probe 6</th>
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</tbody>
</table>

### Einzelheiten

- **Legende**: 
  - [Fertig-K](#) | [Fisch-K](#) | [Mulch-K](#) | [Substrat](#) | [Datum](#) | [Person](#) | [Institut](#) | [Bestätigung](#) | [Signatur](#) |
- **Begleitende Unregelmäßigkeiten**: 
  - **Unterichtungsstunde**: 182

### Anhang

- **Wassergehalt**: 35.0 %
- **C/N-Verhältnis**: 36.0
- **C/N-Verhältnis**: 36.0
- **Temperatur**: 23.0
- **pH-Wert**: 7.8
- **zu Bestätigen**: 20.02.2003

### Stand

*Stand: 28.02.2003*
Documentation of Analysis Results

- Data and facts of the compost plant
- Products and their proportion
- Demonstration of the median values
- Recording of missing examinations
- Recording of labs defaults (delayed reports)
- Designation of exceeded values
- Designation of implausible values
  - Quarterly overview of the analysis results
  - Document for producers for internal survey
  - Document for quality committee for external survey
Sample taking in practice

1. Basics of sample taking
2. Terms and definitions
3. Steps of sample taking
   - Sampling equipment
   - Sample taking types
   - Collective and lab sample
   - Transport/shipment
4. Cleaning of the sampling equipment
1. Basics of sample taking

- „Sample taking“ stands for the removal of a small portion from a large bulk material for the purpose of examination, where all properties of this portion (sample) must match with the properties of the main material mass.

- The drawn sample must be representative for the sampled material!
1. Basics of sample taking

- An exact analysis doesn't make sense, when the sample taking is incorrect.

- A correct sample taking with the smallest possible failure is for an accurate evaluation of
  - major relevance!!!
Proportion batch to sample quantity

BATCH
300 Mg
=300.000 kg

SAMPLE\(^{(\text{Lab})}\)
=20 l

ANALYSIS
=10 g
Terms and definitions

According to BGK methods book

- **BATCH**: Quantity of a fertiliser which reflects a UNIT according to composition, labeling and spatial location.

- **SPOT SAMPLE**: Small portion of a batch, which is formed a removal operation

- **COLLECTIVE SAMPLE**: Total quantity of all spot samples from a batch.

- **FINAL SAMPLE**: Small portion of a collective sample or a reduced collective sample determined for the examination.
Definition of sample types

- Batch
- Spot samples
- Collective sample
- Lab sample
- Test sample
2. Steps of a sample taking

**Preparation**
- Consideration of the specification for sample taking
- Determination of the sample taking strategy
- with liquid materials:
  1. Mixing up of the container
  2. Cleaning of dead storage areas
- Documentation in the sample taking protocol

**Removal of spot samples**
- Use of suitable sampling equipment
- Representative distribution of the extraction points

**Formation of collective sample**
- Merging of the spot samples
- Homogenisation

**Formation of lab sample**
- Reduction of the collective samples
- Utilisation of suitable sampling containers
- Bottling of lab samples

**Shipment**
- Packaging of lab samples
- Shipment in 24 h to the lab
- If needed: cool sample

Bundesgütegemeinschaft
Kompost e.V.
Steps of a sample taking

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Specifications for sample taking

Reason for the examination
- External monitoring
- Self monitoring

Sampling location
- Compost/biogas plant
- Other treatment plant

Examination parameter
- Valuable material (org. matter, nutrients)
- Heavy metals, Impurities
- Organic compounds (e.g. PFT)
- Microbiological parameter
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**Shipment**
Quantity of the spot samples

The size of spot sample depends on the material:

Solid materials (e.g. composts)
- Grain sizes < 20 mm: minimum 2 litre per spot sample
- Grain sizes > 20 mm: minimum 3 litre per spot sample

Liquid materials (e.g. digestates)
- Minimum 1 litre per spot sample
Number of spot samples

For solid materials (e.g. compost)

- **Number of diggings per 2 profiles:**
  - Until 500 m³  1 digging with 2 profiles
  - Until 1000 m³  2 diggings with 4 profiles

- **Number of spot samples per collective sample:**
  - Until 500 m³  20 spot samples
  - Until 1000 m³  40 spot samples

The collective sample must not be smaller than 40 litre.
Sample taking tools for solid materials

- SCREW DRILL with minimum 100 mm diameter or portable motor-powered screw drill oder soil auger in form of a screw,
- WHEEL LOADER
- SPADE, SHOVEL
- HOE
Sample taking equipment for solid material

Feed screw with cutting edge

Sample taking equipment for compost (overall view)

Cylinder
Examples for diggings

Complete opening

- 2 profiles
- Digging

Triangular or incomplete digging
Steps of a sample taking

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Shipment
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Collective sample and lab sample

- The SPOT SAMPLES were merged into a collective sample.
- The minimum volume of the COLLECTIVE SAMPLE may not go below the requirements.
- The COLLECTIVE SAMPLE must be homogenised.
- The COLLECTIVE SAMPLE must be reduced until the needed quantity for the lab sample (Final sample, original sample) is given.
- The quantity of the LAB SAMPLE depends on the material type and the purpose of the examination.
  (Example: Compost 20 l resp. liquid digestate 7-10 l).
Homogenisation
Steps of a sample taking

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Packaging of the lab sample

Sample box:
- dry, tight against humidity,
  largely air tight boxes
  e.g. clean plastic bags minimum 20 l or
  plastic bins with locking ring and rubber lip

Labeling:
- Origin and sampled batch
- Date of sample taking
- Address of the lab
Sample transport to the lab

- As fast as possible
- Within 24 hours

  Cooling (e.g. at high ambient temperature)
  if needed (Cooling box)
Cleaning of the sampling equipment

- Sampling equipment has to be efficiently cleaned after each sample taking.
- Sampling material must not be carried over by the sampling equipment.
- Cleaning agents and disinfectants have to be applied according to the manufacturers' instructions.
- Residues must not remain at the equipment.