
Quality requirements and quality assurance of digestion residuals in Germany

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1 Introduction

The Bundesgütegemeinschaft Kompost (BGK) is the carrier of the RAL quality label for compost, digestate products and composted sewage sludge. BGK is recognised by RAL, the German Institute for Quality Assurance and Certification, as being the organisation to handle monitoring and controlling of all quality labels in Germany.

The 'RAL Compost Quality Label' (RAL GZ 251) was awarded in January 1992. It was also registered in the trade mark register at the Federal Patent Office. In the year 2000 an additional quality assurance system for digestion residuals (RAL GZ 256) was introduced. With the revision in 2007 the digestate products are divided into two product groups for digestion residuals according to the input materials: the RAL GZ 245 for digestion products and the RAL GZ 246 for digestion products produced from renewable energy crops. The RAL GZ 258 for AS Humus (sewage sludge compost) was introduced in 2003.

Today there are more than 500 members in this organisation, and 425 composting plants and 67 digestion plants and 13 composting plants for sewage sludge compost take part in the quality assurance system and have applied for the RAL quality label.

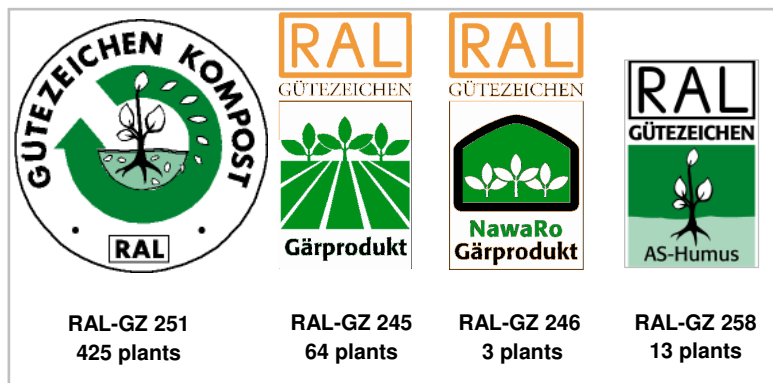


Figure 1: RAL quality assurance labels for compost and digestate products in Germany 2007

The Compost Quality Assurance Organisation was founded in order to monitor the quality of compost and digestate products. Through consistent quality control and support of the producers of compost and digestate products in the marketing and application sectors, the organisation aims to promote composting and anaerobic digestion as a key element of a sustainable biowaste management.

2 BGK Quality Assurance System

The BGK has defined general quality standards (the RAL quality label for compost and for digestion products and sewage sludge compost) and established a nationwide system for external monitoring of composting and digestion plants and of compost and digestion products.

The quality assurance program contains the definition of quality requirements, enables quality monitoring, and can enforce quality standards or discipline plants for failure to meet regulations and labelling of the quality standard. The type, extent and frequency of evaluations depend on the capacity of the composting or digestion plant. In order to guarantee an identical standard for the monitoring all over Germany, BGK established a central office where all results originated from external monitoring are evaluated and controlled.

The quality assurance system comprises the following elements:

- External monitoring: continuous and independent control of product quality;
- Internal monitoring: control and documentation of the decomposition respiratory digestion process by the plants;
- Quality criteria: standardisation of the product quality;
- Quality label: characterisation of the product quality;
- Compulsory declaration: description of the essential product characteristics and constituents;
- Application guidelines: information on correct application;
- Furnishing proof and the documents required by the plants to show treatment according to the Biowaste and Fertiliser Ordinance to the regional competent authorities.

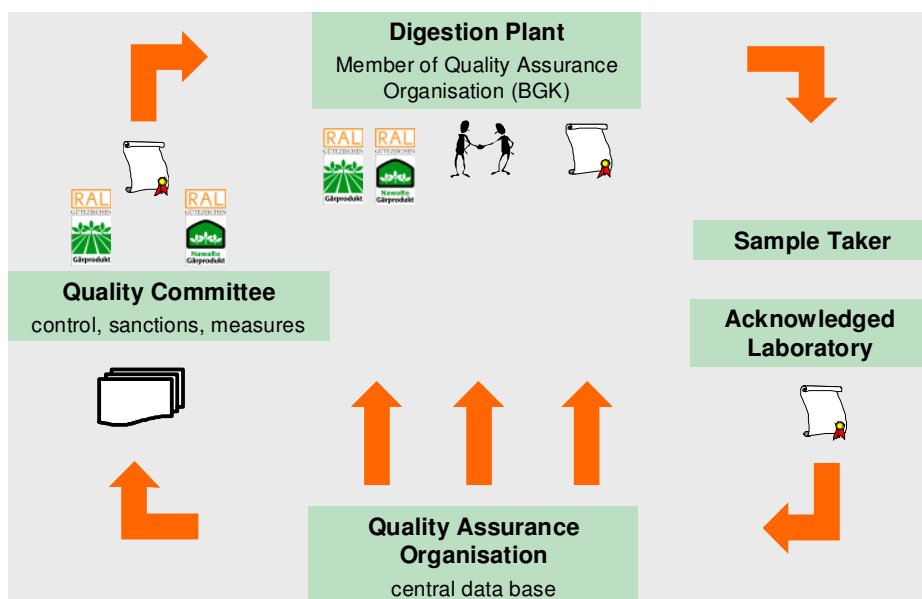


Figure 2: Course of the Quality Assurance System

The quality committee of the BGK has issued specifications for quality products from digestion and the quality labels represent these specifications. This allows a standardisation of quality for digestate products and enhances the product's sales image. The symbol awarded by the BGK also means that there are regular checks by independent bodies to ensure that product quality is maintained after the label has been awarded. The up-to-date product quality criteria for digestate residuals and directives of the Bundesgütegemeinschaft Kompost are the basis for the awarding of the RAL quality labels to digestion plant operators. The RAL quality criteria are valid for the different product types of digestate products.

3 Quality Requirements and Quality Assurance

The main elements of the BGK QAS for digestate products and for digestate products from renewable energy crops are process requirements for operation quality, product quality and application requirements.

Process requirements and suitable input materials

- Positive list in accordance with the animal by-products regulation, biowaste ordinance and fertiliser regulation for digestate products from biowaste
- Positive list in accordance with the fertiliser regulation and the renewable energy sources act (EEG) for digestate products from renewable crops
- 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

- (2) 4 - (10) 12 times a year according to the quality guidelines, 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 ordinance and fertiliser regulation for digestate products from biowaste.
- Application requirements based on the fertiliser regulation for digestate products from renewable energy crops.
- Application requirements due to good practical use.

3.1 Quality requirements for digestate products

The quality and process requirements are different for the different digestate products. The origin of the input material is essential for the process requirements and the quality label.

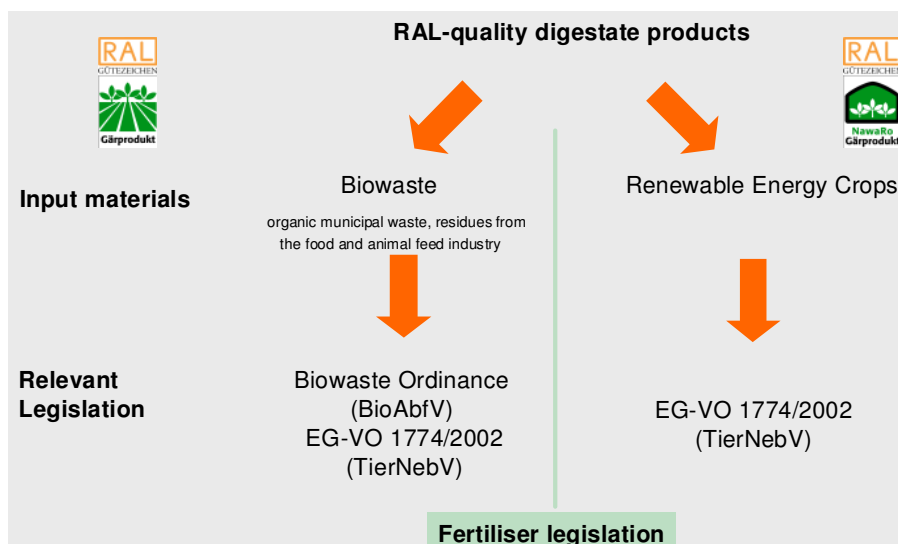


Figure 3: Differentiation of RAL-quality digestate products

Input materials for digestate product from biowaste (RAL GZ 245)

Suitable raw materials for digestate products from biowaste are listed in Annex 1 of the Biowaste Ordinance and include the following groups of organic waste materials: organic municipal waste, residues from the food and animal feed industry and organic industrial waste, and mineral composting

additives. The positive list of input material for the quality label of digestate product (RAL-GZ 245) is laid down in the guidelines of the quality assurance for digestate product.

Input materials for digestate product from renewable energy crops (RAL GZ 246)

Suitable raw materials for digestate products from renewable energy crops are listed in the Renewable Energy Source Act and exclude all waste derived materials. Following groups of organic materials are included: manure, slurry and dung from animal origin, energy crops and diversified materials, like green-waste from landscaping and straw. The positive list of input material for the quality label of digestate product from renewable energy crops (RAL-GZ 246) is laid down in the guidelines of the quality assurance for digestate product from renewable energy crops.

Types of digestate products

As well for digestate products from biowaste as for digestate products from renewable energy crops the two labels can be authorised for liquid (dry matter content $\leq 15\%$) and solid digestate products (dry matter content $> 15\%$):

Minimum quality criteria

The minimum quality criteria for digestate products include valuable ingredients (organic matter and nutrients), potentially toxic elements (heavy metals and pathogens), physical contaminants and the degree of fermentation. Further the quality of the digestate products is describes by the precautionary-benefit-ratio, regarding comparable contents of harmful matter and considering precautionary soil protection aspects and is called as benefit value index.

Quality criteria for digestate products from biowaste (RAL GZ 245)

Quality criteria	Quality requirements
Hygienic aspects	<ul style="list-style-type: none"> - Proof for successful treatment for sanitization (heating of the input material to 70 °C for at least 1 hour or input-output control) - Proof of compliance with the hygienic requirements by temperature profiles (monitoring the process temperature) - Maximum of 2 germinable weeds and sprouting plant parts per liter - Salmonella not traceable
Impurities	<ul style="list-style-type: none"> - Maximum 0,5 M.-% dm selection and weighing of impurities (glass, plastics and metals > 2 mm) - With an impurity content > 0,1 M.-% dm: maximum area sum of the selected impurities shall not exceed 25 cm²/l fm
Degree of fermentation	<ul style="list-style-type: none"> - Organic acids (total) ≤ 4.000 mg/l
Odour	<ul style="list-style-type: none"> - Free from annoying odours
Organic Matter	<ul style="list-style-type: none"> - Minimum 30 M.-% dm, determined by loss on ignition
Heavy metal content (Pb, Cd, Cr, Cu, Ni, Hg, Zn)	<ul style="list-style-type: none"> - Limit values correspond to the waste and fertiliser legislation - For micro-nutrients Cu and Zn plausible value should not be exceed.
Parameter for declaration	<ul style="list-style-type: none"> - Product type (digestate product liquid or solid) - Name of producer - Bulk density (volume weight) - Dry matter content - pH-value - Salt content - Plant nutrients (total) (N, P₂O₅, K₂O, MgO, S) - Nitrogen soluble (NH₄-N; NO₃-N) - Micro-nutrients (according to fertiliser legislation) - Organic matter - Alkaline effective matter (CaO) - Benefit value index - Weight or volume - References for good practical use

The quality criteria for digestate products from renewable energy crops differ only in the case of hygienic requirements. The thermophilic or mesophilic treatment with a temperature of > 37 °C for a dwell time of 20 days is sufficient. Input materials containing any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products shall be excluded for mesophilic treatment.

Specific hygienic requirements for digestion plants with animal-by product material

For digestion plants with treatment of animal-by product material the sanitization process has to be controlled by determining additionally hygienic parameters like E.coli or Enterococci.

3.2 Testing procedures and documentation for the RAL quality label for digestate products

Authorisation to use the RAL quality label for digestate products is granted in accordance with the quality and testing regulations of the German Compost Quality Assurance Organisation, BGK. The digestate producer must demonstrate the quality of the products for every digestion plant he has in operation, throughout the first year's recognition procedure and the following years' monitoring procedure. The frequency of the investigations during the one year recognition procedure and the subsequent ongoing monitoring procedure depends on the plant input capacity. At least four analyses for digestate products from biowaste should be carried out during the first year of operation – one for every season – to assess the essential quality characteristics over the course of the year. At least one sample should be taken every three months. In the following years, when the plant is acknowledged normally, it is possible to reduce the frequency and scale of analyses. Sampling and investigations should be done by an approved external monitor – usually a laboratory which does the sample taking and the analyses – in line with the procedures laid down by the Quality Committee of the BGK.

The results of the analyses are reported to the central office of BGK, saved in the central data base and are supervised by the independent quality committee. The documentation and record system of the BGK contains the supervision of the operation log and sample record as well as the analyses records. Based on the analyses record of the last year an annual product certificate, including declaration and application requirements for good practical use as well and the quality label for digestate products is issued by the quality assurance organisation.

4 The state of RAL-digestate products

In 2007 67 digestion plants take part in the quality assurance system for digestate products in Germany. Approximate 2 Mio. t of input material are treated anaerobically in quality assured digestion plants. Currently 94 % of the digestate products are awarded for the RAL quality label 245. The quality assurance for digestate products from renewable crops is in the starting phase. In respect to the Renewable Energy Source Act (EEG), where a bonus for the energy production out of renewable resources is paid, it is expected that the quality assurance for digestate products from renewable energy crops will increase.