

IRISH BIOENERGY ASSOCIATION (IRBEA)



A DRAFT INDUSTRY STANDARD FOR ANAEROBIC DIGESTION DIGESTATE

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Issue for Public Consultation

Comments on this Draft Industry Standard for Anaerobic Digestion Digestate are invited from any interested party. Please send comments, via email only, to noel.gavigan@irbea.org by **Wednesday 12th December 2012**.

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1. INTRODUCTION

The development of the anaerobic digestion (AD) industry in Ireland is expected to proceed at increased pace in the coming years due to changes to the supporting legislative, policy and financial environments. As well as producing renewable electricity and heat through the production and oxidation of biogas generated by the AD process, the digestate by-product material from the AD process displays many beneficial properties when used as an organic fertiliser and/or soil conditioner, thus offering significant potential as a replacement for chemical fertiliser for agri-food, and other, land uses.

However, incorrect use or application of digestate, as with any other fertiliser/soil conditioner, has the potential to result in detrimental effects on the receiving environment. It is therefore important that a standard be developed to manage the production of digestate to a specified quality level in order to ensure that any potential for negative environmental impacts from digestate use is mitigated and/or eliminated.

The development of a standard for the production of digestate through anaerobic digestion also serves to enhance marketing of digestate by engendering confidence in end-users of digestate (farmers, horticulturalists etc.) who may not have prior knowledge of or experience with digestate, through the production of digestate of a defined quality and in accordance with an applicable standard.

This is also especially true for organisations (supermarkets, representative associations etc.) involved in the purchase and/or production of products for which digestate may have been used directly or indirectly and which may ultimately become part of the food chain.

The development of a standard will also provide assistance for and information to regulators of anaerobic digestion facilities when determining procedural requirements for facilities under their control. However, it does not remove any obligations required under waste authorisations or animal by-product approvals.

The purpose of this standard is to ensure the production of quality digestate from suitable input materials through the effective, controlled processing of input materials through their retention within the anaerobic digestion process for an appropriate retention time. Producing digestate in a controlled manner will ensure the production of a quality, homogenous digestate that meets market needs and protects the environment.

It is intended that this standard be relevant to and achievable by the AD industry while promoting the production and use of digestate in an environmentally friendly manner that is not injurious to human, animal and/or plant health. However, it is important that adherence with this standard does not prove to be cost prohibitive and does not create excessive administrative burdens for AD facility operators.

The standard will promote the benefits of the utilisation of digestate as a fertiliser and/or soil improver and will ensure the provision of a sufficient level of information to end users regarding its use.

This standard has been developed based on a review of existing standards and quality assurance schemes in place and/or proposed throughout Europe. This review identified the pertinent issues to be addressed in a standard for anaerobic digestion digestate which are consequently covered in this document.

This standard is developed to draft stage only at this point in time. Following a period of public consultation, responses from this consultation period will be taken into consideration.

Further decisions will be made in time in relation to the official adoption of this draft standard and the requirement for the development of a quality assurance scheme to support the implementation of a fully adopted standard.

2. SCOPE

This draft standard for digestate produced from anaerobic digestion specifies requirements for digestate produced from source segregated, separately collected biodegradable waste materials and non-waste materials.

The characteristics of acceptable input materials are described in Section 5.

The draft standard applies to digestate produced from anaerobic digestion in three forms; whole digestate, separated fibre and separated liquor. These forms of digestate are defined in Section 4.

3. NORMATIVE REFERENCES

Normative references specify the full title of test methodologies referred to in this standard.

Work has been undertaken at a European level at the European Committee for Standardisation (CEN), through a mandate from the European Commission (Mandate M/330), to develop 'horizontal' standards in the fields of sludge, biowaste and soil i.e. standards that can be commonly applied throughout Europe for the testing of these materials.

This mandate considered standards for sampling and analytical methods for hygienic and biological parameters as well as inorganic and organic parameters and developed draft standards through a task force named the 'Horizontal standards in the fields of sludge, biowaste and soil'.

For most sampling and analytical topics, the final consultation and validation of the draft standards took place in autumn 2007 and work is being undertaken through the CEN Technical Committee (TC) 400 on the formal adoption of these standards, which has occurred in a number of instances.

Until formal adoption of all of these standards, testing and sampling may also be carried out in accordance with test methods developed by CEN TC 223 'Soil improvers and growing media'.

To this end, test methodologies identified in Section 6 of this draft standard and described in the following are generally those being addressed under CEN TC 400.

BGK e.V 2006	<i>Gehalt an keimfahigen Samen und austriebsfähigen Pflanzenteilen. In: Methodenbuch zur Analyse organischer Dungmittel, Bodenverbesserungsmittel und Substrate (Content of viable weed seeds and plant parts. In: Book of Methods for the analysis of organic manures, soil conditioners and substrates). Kapitel IV. B1. Editor Kehres and Thelen Jungling M. Bundesgutegemeinschaft Kompost e.V, Köln</i>
CEN/TS 16177:2012	<i>Sludge, treated biowaste and soil — Determination of ammonium nitrogen and nitrate nitrogen after extraction with 1 mol/l potassium chloride</i>
FprCEN/TR 16193	<i>Sludge, treated biowaste and soil — Detection and enumeration of Escherichia coli</i>
FprCEN/TS 16202	<i>Sludge, treated biowaste and soil — Determination of impurities and stones</i>
I.S. EN 15933	<i>Soil, sludge, and treated biowaste — Determination of pH</i>
I.S. EN 15935	<i>Sludge, treated biowaste, soil and waste — Determination of loss on ignition</i>
I.S. EN 16086-2	<i>Soil improvers and growing media - Determination of plant response – Part 2: Petri dish test using cress</i>
I.S. EN 16168	<i>Sludge, treated biowaste and soil — Determination of total nitrogen using dry combustion method</i>
I.S. EN 16169	<i>Sludge, treated biowaste and soil — Determination of Kjeldahl nitrogen</i>
I.S. EN 16174	<i>Sludge, treated biowaste and soil — Digestion of aqua regia soluble fractions of elements</i>
I.S. EN 16179	<i>Sludge, treated biowaste, and soils in the landscape - Guidance for sample pre-treatment</i>
ISO 15985:2004	<i>Plastics: Determination of the ultimate anaerobic biodegradation and disintegration under high-solids anaerobic-digestion conditions - Method by analysis of released biogas</i>

prEN 15215-1	<i>Soils, sludges and treated bio-wastes — Detection and enumeration of <i>Salmonella</i> spp. in sludges, soils and organic fertilisers of similar consistency to the matrices validated — Part 1 : Membrane filtration method for quantitative resuscitation of sub-lethally stressed bacteria (to confirm efficacy of log reduction treatment procedures)</i>
prEN 15215-2	<i>Soils, sludges and treated bio-wastes — Detection and enumeration of <i>Salmonella</i> spp. in sludges, soils and organic fertilisers of similar consistency to the matrices validated — Part 2 : Liquid enrichment method in Selenite Cystine medium followed by enrichment in Rappaport – Vassiliadis medium for semi quantitative Most Probable Number (MPN) determination</i>
prEN 15215-3	<i>Soils, sludges and treated bio-wastes — Detection and enumeration of <i>Salmonella</i> spp. in sludges, soils and organic fertilisers of similar consistency to the matrices validated — Part 3: Presence/absence method by liquid enrichment in peptone-novobiocin medium followed by Rappaport Vassiliadis medium</i>
prEN 15937	<i>Sludge, treated biowaste and soil — Determination of specific electrical conductivity</i>
prEN 16170	<i>Sludge, treated biowaste and soil — Determination of trace elements by inductively coupled plasma optical emission spectrometry (ICP-OES)</i>
WICSS99031	<i>Sludge, treated biowaste, and soils in the landscape – Sampling Framework for the preparation and application of a sampling plan</i>
WICSS99058	<i>Sludge, treated biowaste, and soils in the landscape Sampling Part 1: Guidance on selection and application of criteria for sampling under various conditions</i>
WICSS99057	<i>Sludge, treated biowaste, and soils in the landscape – Sampling Part 2: Guidance on sampling techniques</i>
WICSS99032	<i>Sludge, treated biowaste, and soils in the landscape – Sampling Part 3: Guidance on sub sampling in the field</i>
WICSS99059	<i>Sludge, treated biowaste, and soils in the landscape – Sampling Part 4: Guidance on procedures for sample packaging, storage, preservation, transport and delivery</i>
WICSS99060	<i>Sludge, treated biowaste, and soils in the landscape Sampling Part 5: Guidance on the process of defining the sampling plan</i>

4. TERMS & DEFINITIONS

For the purpose of this draft standard, the following terms and definitions apply.

Additive:	a material added during the anaerobic digestion process to enhance or improve the anaerobic digestion process or the environmental performance of the process
Agriculture:	livestock farming, the use of land as grazing land, fruit growing, seed growing, meadowlands, land used for growing arable crops, biomass growing for non-food purposes, market gardens, nursery grounds
Anaerobic Digestion:	a controlled process, under managed conditions, of the decomposition of organic matter in the complete absence of oxygen carried out by the concerted action of a range of bacteria species, producing biogas and digestate
Animal By-products (ABP):	means entire bodies or parts of animals, products of animal origin or other products obtained from animals, which are not intended for human consumption, including oocytes, embryos and semen
ABP Approval:	a written permission from the Department of Agriculture, Food and the Marine (DAFM) authorising the treatment of animal by-products at an anaerobic digestion facility
Biocide:	a chemical agent capable of destroying living organisms
Biodegradable:	capable of undergoing biologically mediated decomposition in either aerobic or anaerobic conditions
Biogas:	combustible gas derived from decomposing biological waste under anaerobic conditions, typically containing 50 – 60% methane
Composting:	process characterised by autothermic and thermophilic aerobic biological decomposition of a solid organic substrate
Digestate:	substrate resulting from the anaerobic digestion process which may be subsequently separated into a fibre or liquor
	<i>whole digestate</i> is the un-separated substrate i.e. digestate prior to any separation step
	<i>separated fibre</i> is the fibrous fraction derived by separating coarse fibres from whole digestate; also referred to as 'solid digestate' or 'digestate fibre'; to be considered a separated fibre, this material must be capable of retaining its physical dimensions when surcharged i.e. be 'stackable'
	<i>separated liquor</i> is the liquid fraction remaining after separating coarse fibres from whole digestate; also referred to as 'liquid digestate' or 'digestate liquor'
Dilution:	the process of making a substance less concentrated
Dry matter:	mass fraction of the total solids content of a sample remaining after a drying process at a specified temperature under specified conditions
Dry weight:	mass fraction of a sample excluding water expressed as mass fraction calculated by determination of dry residue or water content i.e. weight of a sample less the weight of the water in the sample

Electrical conductivity:	reciprocal of the resistance, measured under specified conditions, between the opposite faces of a unit cube of defined dimensions of an aqueous solution i.e. the measure of the capacity of a material to conduct electricity
Facility:	an identified location for the specific carrying out of anaerobic digestion; inclusive of all infrastructure within a defined boundary
Feedstock agreement:	a written agreement between a facility operator and supplier of input material specifying, at a minimum, the source, nature and quantity of input material and the quality criteria which an input material must meet in order to be considered appropriate for acceptance
Fit for use:	not containing any properties or characteristics that would prevent a material from being suitable for its intended use
Forestry:	the process for controlling the establishment, growth, composition, health and quality of forests
Fungicide:	a chemical compound or biological organism used to kill or inhibit fungi or fungal spores.
Horticulture:	raising of plants either in soil in-situ, in a field, under protective cover or in containers with growing media
Hydraulic residence time:	the average length of time material undergoing anaerobic digestion remains in a reactor (digester); determined by the loading rate and operational reactor capacity
Hygiene/hygenisation:	(related to) the degree of processing at which human, animal and plant pathogens have been reduced to acceptable levels
Impurities:	undesirable elements or substances commonly or naturally contained in a material that lowers the materials quality or value, but (depending on its amount) may or may not make it unfit for its intended use
Indicator species:	a species whose presence, absence, or relative well-being in a given environment is indicative of the hygiene and/or quality of that environment as a whole
Input material:	material that is accepted for processing at an anaerobic digestion facility; also known as 'feedstock' material
Land restoration:	recovery of land from a brownfield, underutilised or contaminated state to make it suitable for reuse or fit for purpose through a range of activities including stabilisation, contouring, maintenance, conditioning, reconstruction, re-vegetation and/or the destruction, removal or containment of contaminants.
Maturity:	characteristic of material which makes it fit for use and ready for use in a specific application
MLV index:	Munoo-Liisa vitality index as a measure of maturity of digestate that takes into account cress seed growth on a petri-dish bioassay including % germination and root length (RL)
Mesophilic AD:	anaerobic digestion which takes place optimally at approximately 37°C to 41°C or at temperatures between 25°C to 45°C where mesophiles are the primary micro-organism present
Mixed municipal waste:	means household waste, as well as commercial and other waste that, because of its nature or composition, is similar to household waste and which has been mechanically treated to remove various constituent parts.

For the purposes of this standard, it excludes municipal/urban wastewater treatment sludges and effluents.

Nutrients:	a food or other substance that provides energy or building material for the survival and growth of a living organism
Organic matter:	fraction of material of plant or animal origin present within an overall material; related to volatile solids content and typically determined through ignition of the dry solids at 550°C and measurement of losses (referred to as Loss on Ignition (LOI))
Pasteurisation:	process step during which the numbers of pathogenic bacteria, viruses and other harmful organisms in material undergoing anaerobic digestion are significantly reduced or eliminated by heating material of a specified particle size to a critical temperature for a minimum specified period of time
Pathogen:	any infectious agent that can cause disease in its host
Plant response test:	variation in plant germination and/or growth when sown and grown in a growing medium, soil improver or constituent thereof or in an extract obtained from these materials
pH:	measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity
Preservative:	a substance used for the treatment of organic material (typically timber/wood) to protect from fungal or insect attack
PTE:	potentially toxic elements (PTEs) are elements that have the potential to have toxic effects on humans, flora and fauna
Sampling:	the process of selecting representative portions of a selected material in order to facilitate laboratory (or otherwise) testing of that material to determine its specific characteristics
Separately collected:	collection and transportation of source segregated materials so as to facilitate treatment at an anaerobic digestion facility; separate collection can include the collection and transportation of similar source segregated materials from more than one source
Separation:	process or processes, either mechanical or non-mechanical, through which whole digestate is divided into a solid fraction and a liquid fraction; processes may include screening, pressing, centrifugation, sedimentation, filtration etc.
Source segregated:	suitable input material, segregated at source by the producer, in such a way as to avoid such material being mixed, combined or contaminated with other potentially polluting material during collection, treatment or storage. Non-organic contaminants e.g. plastic packaging, if present, must be removed, insofar as practical
Thermophilic AD:	anaerobic digestion which takes place optimally at approximately 50°C to 52°C but also at elevated temperatures up to 70°C where thermophiles are the primary micro-organism present
Waste authorisation:	a waste licence, waste facility permit or certificate of registration, issued and enforced by either the Environmental Protection Agency (EPA) or a local authority

Waste materials: materials that the holder discards or intends or is required to discard (as per Waste Framework Directive 2008/98/EC); a waste material is assigned a European Waste Catalogue (EWC) code based on the origin and nature of the waste

Weed seed: the part of any unwanted plant that germinates or emerges; inclusive of plant propagules

5. INPUT MATERIALS

5.1 Characteristics of Suitable Input Materials

Suitable input materials for the production of digestate in accordance with this draft industry standard shall be biodegradable waste or non-waste material that:

- is primarily of animal or vegetal origin,
- has been segregated at source,
- has been collected separately,
- is accepted at an anaerobic digestion facility in keeping with the requirements of a feedstock agreement

Input materials shall be accepted at an aerobic digestion facility in compliance with any applicable facility waste authorisation or ABP approval.

Biodegradable plastics can only be considered as acceptable input materials provided that they can be independently certified as being degradable in the anaerobic digestion process in accordance with ISO 15985 or similar approved standard.

5.2 Feedstock Agreement

A feedstock agreement must be in place between an anaerobic digestion facility operator and all suppliers of input materials to that facility.

A feedstock agreement is not required where an agricultural based anaerobic digestion facility accepts input material produced at that premises only i.e. a plant processing manures and/or other suitable input materials generated at that farm holding only.

A feedstock agreement must identify the means by which the quality of the input material is ensured.

5.3 Exclusions

Mixed municipal waste (as defined in Section 4) or materials derived from mixed municipal waste are not considered acceptable input materials when demonstrating adherence with this draft industry standard.

Materials that contain substances that could inhibit the anaerobic digestion process or contaminate the digestate such as fungicides, biocides, preservatives, mineral oils and paints are not acceptable input materials when demonstrating adherence with this draft industry standard.

5.4 Additives

The use of additives during the anaerobic digestion process should only serve to improve the anaerobic digestion process and/or the environmental performance of the process.

Additives should not be used for the purpose of dilution of the characteristics whose limits are defined in this draft industry standard.

6. DIGESTATE QUALITY & TESTING

6.1 Digestate Quality Introduction

The requirements for demonstrating the quality of digestate are important for ensuring confidence for end-users who utilise digestate in a range of applications, including agricultural, horticultural or forestry applications, as well as regulators who over-see anaerobic digestion facilities.

The parameters identified for demonstrating the quality of digestate are:

- Hygiene
- Weed seeds
- Potentially toxic elements (PTE's)
- Impurities
- Maturity
- Nutrients
- Dry matter content
- Organic matter content
- pH
- Electrical Conductivity (EC)

These parameters are described in more detail in 6.3.1. to 6.3.7.

In the event that digestate produced from anaerobic digestion is used as an input material to subsequent aerobic composting, then applicable compost quality parameters, as identified in a relevant compost standard, must be used to demonstrate quality of that material post composting.

6.2 Digestate Testing

6.2.1 Sampling extent and frequency

The extent and frequency of sampling of digestate shall be in accordance with the requirements outlined in Tables 6-1 & 6-2.

6.2.2 Sampling Methodology

A sampling plan for the anaerobic digestion facility must be prepared in accordance with following methodologies:

- WICSS99031 - Framework for the preparation and application of a sampling plan
- WICSS99058 - Sampling Part 1: Guidance on selection and application of criteria for sampling under various conditions
- WICSS99060 - Sampling Part 5: Guidance on the process of defining the sampling plan

Sampling must be undertaken in accordance with the following methodologies:

- I.S EN 16179 - Guidance for sample pre-treatment
- WICSS99057 - Sampling Part 2: Guidance on sampling techniques
- WICSS99032 - Sampling Part 3: Guidance on sub sampling in the field
- WICSS99059 - Sampling Part 4: Guidance on procedures for sample packaging, storage, preservation, transport and delivery

Table 6-1 Extent of sampling post validation

Plant Type	Input Material Type	Feedstock Agreement	Pathogens	PTE's	Impurities	Nutrients	Dry Matter	Organic Matter	pH	EC	Maturity	Weed Seeds
A	Own ABP ¹ and/or energy crops (own) and/or vegetal material (own) - for use on own lands	Not required	As per DAFM (ABP) only	Not required	Not required	At landowner discretion ²	At landowner discretion					
A1	Own ABP and/or energy crops (own) and/or vegetal material (own) - for sale ³	Not required	Required (non-ABP) /As per DAFM (ABP)	Required	Not required	Required	Required	Required	Required	Required	Required	Required
B	Imported manures and/or imported energy crops and/or imported vegetal material (plus any of A) - for use on own lands	Required	As per DAFM (ABP) only	Required	Not required	At landowner discretion	Required	Required	Required	Required	At landowner discretion	At landowner discretion
B1	Imported manures and/or imported energy crops and/or imported vegetal material (plus any of A, A1) - for sale	Required	Required (non-ABP) /As per DAFM (ABP)	Required	Not required	Required	Required	Required	Required	Required	Required	Required
C	All other Inputs (plus any of A, A1, B , B1)	Required	Required (non-ABP) /As per DAFM (ABP)	Required	Required	Required	Required	Required	Required	Required	Required	Required

Table 6-2 Frequency of sampling post validation

Frequency of sampling after validation period	Sampling events	Comment
Total Feedstock < 5,000 tonnes per annum	Annually	(with min. 6 month between testing between calendar years)
Total Feedstock 5,000 - 10,000 tonnes per annum	Bi-annually	(with min. 4 month between testing)
Total Feedstock 10,000 - 20,000 tonnes per annum	Three times per year	(with min. 2 month between testing)
Total Feedstock > 20,000 tonnes per annum	Quarterly	(with min. 6 weeks between testing)

¹ 'Own ABP' defined as per DAFM Guidance i.e. manure and or milk and or colostrum derived from animals on the same farm premises as the AD plant is located

² 'At landowners discretion' – to allow landowner to reduce or eliminate the number of parameters to be tested, if desired, when applied to own lands – however, digestate must be applied in adherence with all environmental protection legislation (e.g. S.I. 610 of 2010) and good farming practice.

³ For sale **or** for use on other lands i.e. not own lands

6.2.3 Actions in the event of a test failure

Actions to be taken in the event of a test failure must be identified in the sampling plan developed. These actions may include, *inter alia*:

- implementation of corrective action procedures
- reporting to appropriate regulatory/competent authority
- assessment of facility's ability to operate to this standard i.e. re-validation of process

6.3 Digestate Quality

6.3.1 Hygiene

Hygiene requirements refer to the measures implemented at an anaerobic digestion facility to ensure the reduction of potential pathogens and other agents within digestate to acceptable levels.

The hygenisation of digestate is achieved through the maintaining of specific time and temperature profiles during the anaerobic digestion process and is demonstrated through the testing for the presence of identified indicator species.

Unless otherwise required by an ABP approval or waste authorisation, one of the time/temperature profiles identified in Table 6-3 must be maintained during the anaerobic digestion process⁴.

Table 6-3 Time/temperature profile options

1	Thermophilic digestion at 55°C for at least 24 hours with a hydraulic retention time of at least 20 days
2	Thermophilic digestion at 55°C preceded or followed by pasteurisation (70°C, 1 hour)
3	Thermophilic digestion at 55°C followed by composting under one of the following profiles: <ul style="list-style-type: none"> ○ 65°C or more for at least 5 days ○ 60°C or more for at least 7 days ○ 55°C or more for at least 14 days
4	Mesophilic digestion at 37 - 40°C preceded or followed by pasteurisation (70°C, 1 hour)
5	Mesophilic digestion at 37 - 40°C followed by composting under one of the following profiles: <ul style="list-style-type: none"> ○ 65°C or more for at least 5 days ○ 60°C or more for at least 7 days ○ 55°C or more for at least 14 days
6	Other time/temperature profiles that demonstrate equal effectiveness of hygenisation as 1 - 5

Indicator species to determine the effectiveness of the time and temperature profiles utilised in Table 6-3 are shown in Table 6-4.

⁴ Time/temperature profiles adapted from those proposed under the '3rd Working Document – Technical Report for End-of Waste Criteria on biodegradable waste subject to biological treatment; JRC-IPTS, August 2012

Table 6-4 Limit values for indicator species in digestate⁵

Parameter	Limit value	Test Method
Salmonella	Absent in 25g	prEN 15215-1, prEN 15215-2, prEN 15215-3
E. coli	1000 cfu/g fresh mass	FprCEN/TR 16193

6.3.2 Weed Seeds

Weed seed content in digestate shall not exceed the limit outlined in Table 6-5.

Table 6-5 Limit values for weed seeds in digestate

Parameter	Unit	Limit value	Test Method
Weed Seeds	Viable weed seeds per litre	2	BGK e.v 2006

6.3.3 Potentially toxic elements (PTE's)

PTE concentration in digestate shall not exceed the limits defined in Table 6-6.

Table 6-6 Limits for PTE concentration in digestate

Parameter	Unit	Limit value	Test Method
Cadmium	mg/kg dry weight	1.3	I.S.EN 16174/prEN 16170
Chromium	mg/kg dry weight	92	I.S.EN 16174/prEN 16170
Copper	mg/kg dry weight	149*	I.S.EN 16174/prEN 16170
Mercury	mg/kg dry weight	0.4	I.S.EN 16174/prEN 16170
Nickel	mg/kg dry weight	56	I.S.EN 16174/prEN 16170
Lead	mg/kg dry weight	149	I.S.EN 16174/prEN 16170
Zinc	mg/kg dry weight	397*	I.S.EN 16174/prEN 16170

***Note:** Copper and Zinc limit values are not absolute. Should these values be exceeded, specific labelling/information provision requirements must be adhered with, when material is being dispatched for sale or for use on other lands.

6.3.4 Impurities

The level of impurities in digestate shall not exceed the limits defined in Table 6-7.

⁵ For materials that do not come under the remit of an ABP approval

Table 6-7 Limits for impurities in digestate

Parameter	Unit	Limit value	Test Method
Total glass, metals and plastic > 2mm in any one plane	% dry weight	0.5	FprCEN/TS 16202
	cm ² /litre fresh weight	25 ⁶	FprCEN/TS 16202
Stones > 5mm	% dry weight	5	FprCEN/TS 16202

6.3.5 Maturity

The maturity of digestate is a measurement of the 'fitness for use' of the material in relevant applications and can be determined through a plant response test to determine the direct impact of a material on plant growth.

The means of determining acceptable maturity of digestate is outlined in Table 6-8.

Table 6-8 Maturity requirements for digestate

Parameter	Unit	Limit value	Test Method
Maturity	RL Index MLV Index	RL Index – ≥ 85% of control	I.S EN 16086-2

6.3.6 Nutrients

The nutrient content is an important consideration when utilising digestate, particularly in agricultural applications. Table 6-7 outlines the nutrient parameters to be analysed, with test methods specified.

Table 6-9 Nutrient content parameters for digestate

Parameter	Test Method
Total Nitrogen	I.S EN 16168/I.S.EN 16169
Ammonium Nitrogen	CEN/TS 16177:2012
Nitrate Nitrogen	CEN/TS 16177:2012
Total Phosphorus	I.S.EN 16174/prEN 16170
Total Potassium	I.S.EN 16174/prEN 16170

⁶ An area based limit is proposed for impurities in addition to a weight based limit. A limit of 25 cm²/litre fresh weight is suggested at this juncture – however, the exact area limit(s) to be applied will be ascertained prior to any formal adoption of this draft standard through testing of a range of digestates types (i.e. whole digestate, separated fibre, separated liquor) from varying input materials.

6.3.7 Dry matter, organic matter, pH & electrical conductivity

The means of analysing the parameters of the dry matter content, the organic matter content, the pH and the electrical conductivity of digestate is presented in Table 6-8.

Table 6-10 Dry matter, organic matter, pH & electrical conductivity parameters for digestate

Parameter	Limit Value	Test Method
Dry matter	Declaration only (as %)	I.S.EN 16168/I.S.EN 16169
Organic matter *	≥ 20% dry weight	I.S.EN 15935
pH	Declaration only	I.S.EN 15933
Electrical conductivity	Declaration only	prEN 15937
*Note: Applicable to separated fibre only or whole digestate if not followed by a separation step		

6.4 Declaration of Digestate Quality

The results obtained from the analysis of the parameters identified in Tables 6-3 to 6-10 must be declared and provided with all digestate.

Any declaration must indicate the stage in the anaerobic digestion process when testing was carried out.

ANNEX A – ELEMENTS OF A DIGESTATE QUALITY ASSURANCE SCHEME

The following elements should be addressed in the development of any digestate quality assurance scheme (QAS) created to support this draft industry standard. A QAS should be prepared and maintained in conjunction with an independent and certified auditing body.

Adherence with this draft digestate standard would be demonstrated through the achievement of initial validation and ongoing certification in accordance with any QAS developed.

A.1 Input Materials

The following elements should be considered in relation to input materials:

Input Material List

- The creation of a non-exhaustive list of materials to identify input materials that could be considered appropriate for acceptance at an anaerobic digestion facility, subject to conforming with acceptance criteria identified in this draft standard

Feedstock Agreement

- A *pro-forma* feedstock agreement between input material supplier and anaerobic digestion facility operators should be created specifying:
 - the information to be provided by the input material supplier e.g. source, description of material, quantity to be provided over a specified period
 - quality of input material to be achieved to be allowable for acceptance and the means of verification/demonstration of same
 - the required means of delivery/acceptance of material at the anaerobic digestion facility

Additives

- Identification of additives that are acceptable as input materials i.e. materials that improve the anaerobic digestion process and/or the environmental performance of the process
- Limits (if appropriate) to their use and/or quantity for use

A.2 Process Management

The following elements should be considered in relation to process management:

Quality Management Systems

- The requirement for the creation of a process specific QMS for an anaerobic digestion facility addressing, at a minimum:
 - standard operating procedures for all facility activities
 - specific processing requirements
 - data recording provisions to ensure traceability of material through the anaerobic digestion process and the achievement of specified time/temperature profiles
 - documentation control & reporting
 - incident and accident prevention and reporting
 - operator training
 - environmental policy

Hazard Analysis & Critical Control Point Plan

- The creation of a documented Hazard Analysis & Critical Control Plan (HACCP) addressing the identification, implementation and monitoring of critical control points (CCPs) and critical limits (CLs) related to the entire operation of the anaerobic digestion facility

Sampling

- Specific sampling methodology to be identified, in adherence with appropriate sampling standards, addressing, at a minimum, location, frequency, occasion, quantity, methodology, responsibility for sampling, quarantine requirements
- The sampling methodology must address corrective actions to be undertaken in the event of any test failure e.g. the non-achievement of specific quality parameters

Hygenisation

- Identification of the means by which a time/temperature profile, as per Profile No. 6 in Table 6-1, demonstrates equal effectiveness of hygenisation as the other profiles in Table 6-1.

A.3 Product Information Provision

It is considered that the following information be required as part of the QAS in relation to the digestate material produced at an anaerobic digestion facility and provided for sale from a facility or for use on other lands.

- Declaration of parameters tested and results obtained in accordance with this draft standard
- Quantity of material being provided
- Guidance on the end use and/or application of digestate, related to the digestate type
- Identification of the primary component(s) of the input material used to produce the digestate
- Identification of the hygiene regime to which the digestate has been exposed

In the event of exceedence of the Cu and Zn limit values, a specific means of identification of the quantity of Cu and Zn within the material should be developed in order to clearly identify this fact to the end user.

A.4 Other Elements

Other elements that should be considered in relation to the development of a QAS are outlined as follows.

Quality Assurance Scheme

- The identification of the means by which a facility will be initially validated to demonstrate adherence with the QAS and the period for which validation will last
- The identification of the means by which a facility will maintain its quality assurance accreditation post validation

Further Works investigating ammonia volatilisation

The issue of ammonia volatilisation from digestate material is identified as an area for which further investigation is recommended. Works in relation to digestate nutrient content carried out in Ireland have

identified disparities between ammonium N in digestate tested directly at the end of the digestion process and when tested after a period of storage (5 – 8 weeks) and prior to utilisation.

In some instances, there has been complete absence of ammonium N in digestate after the storage period which is attributed to the volatilisation of ammonia while in storage. Therefore, the declared ammonium N content of the digestate, based on testing carried out directly at the end of the digestion process, has the potential to be misleading.

It is recommended that work be undertaken during QAS development to:

- Assess this issue based on a review of existing data sources and/or through the carrying out of further laboratory based investigation
- Assess the potential for development or adaption of a field test that allows the (approximate) determination of ammonium N, for example, prior to use

**I.S. EN 16086-2 Soil improvers and growing media – Determination of plant response –
Part 2: Petri dish test using cress**

EN16089-2 offers benefits over other germination based maturity tests in terms of, *inter alia*, the means of presentation of the cress seeds and thus the determination of the maturity of the materials being tested. However, it is understood that application of this test method to digestate materials to date is limited.

Therefore, it is recommended that further works be undertaken to confirm the applicability of this method to the different digestate materials.