CARICOM REGIONAL STANDARD

Compost - Requirements

DCRS 86:202X

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Committee representation

This CARICOM Regional Standard was developed under the supervision of the Regional Project Team (RPT)- Compost and hosted by the CARICOM Member State, Guyana, which at the time comprised the following members:

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Foreword

This CARICOM Regional Standard CRS XX:202X, Compost – Requirements has been developed under the authority of the CARICOM Regional Organisation for Standards and Quality (CROSQ). It was approved as a CARICOM Regional Standard by the CARICOM Council for Trade and Economic Development (COTED) at its XX Meeting in MM YY YY.

This regional standard is the result of a Letter of Understanding for Technical Cooperation signed in 2023 between the Inter-American Institute for Cooperation on Agriculture (IICA) and CROSQ, with the consultation and support of stakeholders in the Caribbean.

The purpose of this compost specification is to provide measurable parameters, transparency and harmonisation of requirements for the compost produced and traded in the region. Further, this regional standard will encourage and further develop the industries that produces and collects solid waste to develop a sustainable, cyclical, environmentally friendly bioeconomy that converts solid waste into a value-added product-compost.

This regional standard is intended to be used by manufactures of compost, importers and exporters, national competent authorities, consumers and other stakeholders.

The regional standard was developed following the review of several publications as outlined in the Bibliography (Annex E) and contains a number of other normative and informative annexes with important information critical to the understanding and application of this standard.

1 Scope

This standard specifies the minimum requirements and test methods for compost quality. It covers the use of agricultural and municipal organic solid waste as primary feedstock inputs for compost production.

This standard does not allow for the following to be primary feedstock inputs:

- municipal sewerage sludge (MSS);
- livestock mortalities;
- food waste;
- *Sargassum* seaweed, and
- industrial by-products

2 Normative reference

The following document is referred to in the text in such a way that some or all of its content constitute requirements of this document. For dated references, only the edition cited applies.

Test Method for the Examination of Composting and Compost (TMECC), 2015.

3 Terms and definitions

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

3.1
agricultural waste
waste produced as a result of various agricultural operations.
Note 1 to entry This standard refers to livestock bedding and manure and plant litter.

3.2
compost
organic soil conditioner obtained by biodegradation of a mixture principally consisting of various vegetable residues, occasionally with other organic material and having a limited mineral content.

3.3
composting
aerobic process designed to produce compost.

3.4
dry matter
residue left after the moisture has been removed by drying (e.g. 100% dry matter).

3.5
eutrophication
enrichment of water by nutrients, that induce and accelerate vegetal biomass production, accompanied by oxygen deficits, accumulation of organic matter and heavy changes in population composition and structure.

3.6
faecal coliforms (iso-thermotolerant coliform organism)
microorganism which can grow and which has the same fermentative and biochemical properties at 44 °C as it has at 37 °C.

3.7
food waste
The waste that is generated along the food chain from production, distribution, retail and consumption,specifically meat and fish scraps (including expired meat or fish) bone, dairy, fats and oils.

3.8
industrial by-product
is a residual material resulting from industrial, commercial, mining, and agricultural operations that are not primary products and are not produced separately in the process, these include but not limited to dairy products, baked goods, cardboard and other compostable packaging (e.g. bioplastics), pomace and treated wood shavings and saw dust.

3.9
moisture content
raito of the mass of the quantity of water in a material to the mass of the dry material.

3.10
most probable number (MPN)
maximum likelihood estimate of the number of microorganisms in a specified volume of water, derived from the combination of positive and negative results in a series of volumes of the sample examined by standard tests.

3.11
municipal sewage sludge
dewatered semi-solid material produced by municipal wastewater treatment plant processes.

3.12
municipal solid waste (MSW)
waste from households, offices, hotels, malls, trade premises, schools, institutions, food and beverage premises, markets and municipal services, such as street cleaning and maintenance of recreational areas, which municipalities take care of.

Note 1 to entry: This standard refers to yard trimmings, agro processing and vegetable market waste.

3.13
pH
a measure of the acidity or alkalinity of a solution, numerically equal to 7.0 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity.

3.14
total solids (TS)
sum of dissolved and suspended solids.

4 Requirements

4.1 Composted materials shall meet the limits for the parameters specified in Table 1. The importance of these parameters is discussed in Annex C.

Table 1- Maximum allowable limits (Dry mass) and test methods for selected elements

Parameter	**Limit/ Value**	**Test Method**
Physiochemical:		
Particle size	1/2"(13 mm) mesh	
Moisture Content	10-15%	03.01 Air Capacity, TMECC.
Foreign Matter/Impurities	> 2 mm or > 0.5%/ dm	03.06 Glass Shards, Metal Fragments and Hard Plastics, TMECC
Weeds/Seeds	0.0%	05.09 Viable Weed in Compost, TMECC.
pH	6-8	04.11 Electrometric pH Determination for Compost, TMECC.
Electrical Conductivity (EC)	11≤ dS/m	04.10 Electrical Conductivity for Compost, TMECC
Total Primary Macronutrient (NPK)	>5%	
Maturity and Stability:		
Organic matter content	50-60%	05.07- Organic matter, TMECC.
C/N Ratio	20:1	05.02- (A) Carbon to Nitrogen Ratio, TMECC.
Biological:		
Feacal Coliform	< 1000 MPN g-1 TS	07.01-B Faecal Coliforms, TMECC.
Alternatively for pathogen control the time-temperature regime may be used for composts derived from yard waste (mainly tree and shrub trimmings, plant remains, grass clippings, and chipped trees. See Annex A.		

NOTE 1 Current scientific research suggests that exposure to certain PFAS may lead to adverse health outcomes. However, research is still ongoing to determine how different levels of exposure to different PFAS can lead to a variety of health effects. It is recommended that PFAS limits also be considered for compost quality. This standard does not have a firm established requirement for PFAS. A suggested limit for PFAS is is **0.1 mg/kg**, when tested in accordance with (1) Method 1633 Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS and (2)Method 1621 Determination of Adsorbable Organic Fluorine (AOF) in Aqueous Matrices by Combustion Ion Chromatography (CIC).

4.2 Compost materials may meet the limits for the parameters specified in Annex D (Table 4) where possible.

5 Labelling

5.1 All labels attached to, accompanying or on the compost packaging or product in accordance with Annex B.

Annex A
(normative)

A.1 Temperature-time regime to suppress pathogens in compost

A.1.1 The temperature-time regime stipulates that:

a) In- vessel composting should maintain temperatures ≥ 55°C for three days.

b) Windrow composting should maintain temperatures ≥ 55°C for 15 days and turned 5 consecutive times.

c) Aerated static pile composting should maintain temperatures ≥ 55°C for three days.

NOTE 2 The temperature time regime should be used for composts made using only plant litter.

Annex B
(normative)

B.1 Labelling

B.1.1 The label attached to, accompanying or on the compost packaging shall include the following:

a) Producer information: name, address, and contact. A company logo may be included; ,

b) Country of origin,

c) Feedstock materials used to make compost,

d) Package volume and/or weight (litres, kg, g, ml, etc.)

e) Compost characteristics:

i. Nitrogen %

ii. Phosphorous %

iii. Potassium %,

f) Directions for use,

g) Warnings (B1.3), and

h) Date of production and Batch number.

B.1.2 The label attached to, accompanying or on the compost packaging may include the following:

a) pH,

b) EC- d/Sm, and

c) Heavy metal content (if detected):

i. Arsenic mg/kg

ii. Cadmium mg/kg

iii. Lead mg/kg, and

iv. Mercury mg/kg.

B.1.3 Table 2 provides guidance on the type and extent of label warnings to be included on the compost label.

Table 2- Label Warnings- Example

Label Warnings	
This product may contain plant litter and livestock manure. It contains living microorganisms such as bacteria and fungi. This product may cause the following risks to humans and the environment.	
Risk	Dust inhalation may lead to respiratory irritation and infection. Persons suffering from asthma, allergies, or compromised immune systems are most at risk. Open wounds may become infected if contact is made with this product. Skin and eye irritation may occur due to contact with dust. Enrichment of water bodies due to improper application or disposal. Inert materials- this product may contain small fragments of glass, metal and other sharp materials that could cause physical injury.
Safety	Wear suitable protective clothing and equipment to protect, skin, eye, and respiratory tract. Open wounds should be properly covered before handling. Wash thoroughly with soap after handling.
First Aid	If eye contact occurs, flush eyes thoroughly until discomfort is reduced. If dust inhalation occurs along with symptoms such as persistent coughing and difficulty breathing. Please seek medical attention.
Disposal	Do not dispose into water ways or in any manner that may negatively impact the environment.

Annex C
(informative)

C.1 Importance of compost quality parameters

Table 3- Compost quality parameters and their importance

Parameter	Importance
Physicochemical	
Particle size	▪ Sieving compost improves homogeneity and removes un-composted materials and impurities. ▪ The need for sieving may depend on intended use. ▪ Open field applications using compost may have larger particle size tolerances in comparison to its use for potting mixtures (Hogg et al. 2002). ▪ Mesh sizes of 3/8 (~9.5mm) and ½ (~13 mm) inch are commonly used in the US (USCC n.d.)
Foreign matter /impurities	▪ The presence of foreign materials such as glass, plastic, metal, and rocks reduce the aesthetic appeal and utilisation of compost. ▪ Agricultural machinery may become burdened because of plastics or wires impeding or entangling moving parts. ▪ Equipment damage may also occur due to the presence of hard objects. ▪ Broken glass and other sharp objects can compromise working conditions due to high risk of injury. ▪ Environmental health may be compromised due to compost containing high levels of physical contaminants such as plastic, glass and metal. ▪ The density and volume of certain foreign materials (e.g. rock and plastic) may disproportionately affect the declared net weight and volume of compost. ▪ Compost quality standards for developed countries generally restrict foreign matter based on particle size and ratio.
Weeds	▪ Weeds are highly competitive and contribute to diseases and pests in crops (Isaac, Brathwaite, and Ganpat 2012). ▪ Weeds such as nut grass *Cyperus rotundus* L. are highly invasive and costly to control (Pirzada et al. 2015). ▪ Composting temperatures of 55-65 Celsius are sufficient to sterilize weed seeds (Liu et al. 2020; Grundy, Green, and Lennartsson 1998). ▪ Compost quality standards for weed seeds in most developed countries are restricted to 3-5 weeds per liter (Hogg et al. 2002).
pH	▪ pH influences nutrient and heavy metal availability in soil and compost (Walker, Clemente, and Bernal 2004). ▪ Compost pH is usually slightly neutral to alkaline however plant growth requirements vary (Costello et al. 2019). ▪ An acceptable pH range for compost is 5.5 – 8.5 (US EPA 2011; Dougherty 1999).
Soluble salts- Electrical conductivity (EC)	▪ High soluble salt concentrations in compost can be phytotoxic to sensitive plants and inhibit seed germination and seedling growth (Dougherty 1999). ▪ Low soluble salt concentrations may be indicative of low nutrient levels, particularly potassium, calcium, or magnesium (USDA and CCREF 2001). ▪ A soluble salt concentration of ≤ 5 dS/m is preferred for composts (Dougherty 1999; Gondek et al. 2020). ▪ Depending on the area of application (e.g. Field or nursery) it may be necessary to analyze background soil data to determine compost application rate (Hogg et al. 2002).
Essential nutrients	▪ Nutrient levels in composts may vary with the type of organic materials being composted (Lanno et al. 2021). ▪ Nitrogen and phosphorus levels in composts are particularly important

Parameter	Importance
	due to the risk of eutrophication (Isiuku and Enyoh 2020). ▪ Laboratory determination of N and P may only be necessary based on the type of feedstock material composted such as manure. ▪ Feedstock materials such as manure tend to increase nutrient and EC levels of compost (Gondek et al. 2020). ▪ Baseline soil data may also help to determine if there is any potential for environmental contamination and compost application rates.
Heavy metals	▪ All heavy metals above environmentally acceptable levels are toxic to living organisms (Singh et al. 2011). ▪ Heavy metals such as copper, cobalt, chromium, manganese, zinc, nickel, iron are considered essential for living organisms while arsenic, cadmium, lead, mercury are regarded as toxic to living organisms (Bibi 2023). ▪ Cadmium, mercury, and lead are extremely important due to their high mobility in the environment (UNEP 2023). ▪ Arsenic, chromium, copper, nickel, are also regarded as common heavy metals which can pollute the environment (UNEP 2023). ▪ Feedstock materials such *Sargassum* seaweed and certain livestock manures (swine and poultry) are potential sources of arsenic (Alleyne, Neat, and Oxenford 2023; Hashmi et al. 2018). Therefore, heavy metal levels in compost may be linked to feedstock material. ▪ Certain composting techniques aimed at optimizing the composting process a have demonstrated the potential to reduce the bio-availability (passivate) of heavy metals in compost (Dede et al. 2023). ▪ Integrated- composting [hot composting > vermicomposting] resulted in heavy metal immobilisation and reduced bioavailability (Hashmi et al. 2018).
PFASs (Forever chemicals)	▪ Poly- and perfluoroalkyl substances (PFASs) are synthetic chemicals that are highly persistent in the environment (Fabregat-Palau, Vidal, and Rigol 2022). ▪ PFASs are used various types of food packaging, clothing, cooking and in industrial applications such as fire prevention materials (Schaider et al. 2017; Bolan et al. 2021; Goossen, Schattman, and MacRae 2023). ▪ Negative health effects including cancer and immunotoxicity are associated with PFASs (Shahsavari et al. 2021; Schaider et al. 2017) ▪ Plant bioaccumulation of PFASs increases the risk of dietary exposure through the consumption of contaminated agricultural produce (Sivaram et al. 2022; Bolan et al. 2021). ▪ Contaminated composts and manures are major contributors of poly- and perfluoroalkyl substances (PFAS) into the soil (Röhler et al. 2021; Bolan et al. 2021). ▪ Carbon-rich materials with low DOC contents indicated higher PFAS sorption and may be indicative of potential bioremediation through composting (Fabregat-Palau, Vidal, and Rigol 2022; Hale et al. 2017). ▪ Germany and Austria set limits of 0.1 mg/kg. ▪ In April 2024, the US EPA finalised a critical rule to designate two widely used PFAS – PFOA and PFOS – as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund (US EPA 2024b). The US Composting Council is working with the EPA regarding PFAS to develop appropriate standards for the composting industry. The US EPA proposed the following methods for the determination of PFAS: ➢ Method 1633 Analysis of Per- and Polyfluoroalkyl Substances ➢ (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS (US EPA 2023). ➢ Method 1621 Determination of Adsorbable Organic Fluorine (AOF) ➢ in Aqueous Matrices by Combustion Ion Chromatography (CIC)

Parameter	Importance
	(US EPA 2024a).
Moisture content	▪ Moisture supports biological activity in compost. ▪ Compost stored with high moisture (> 60%) increases difficulty in handling and transportation. ▪ Compost with high moisture content is susceptible to anerobic conditions. ▪ Excessively dry (< 35%) compost may present a dust hazard during handling (Dougherty 1999). ▪ Moisture content can exaggerate bulk density values (mass per unit volume). ▪ The preferred range for storing compost is 40-50% (Dougherty 1999).
Organic matter content	▪ Organic matter content is an indirect estimate of organic carbon and helps provide insight into the level of degradability of organic materials (Compost Quality Council 2001). ▪ A reduction in organic matter content indicates stabilization and humification of feedstock materials (Mahapatra, Ali, and Samal 2022). ▪ Low organic matter content (<25%) may be an indication of high levels of soil or sand in the compost, whereas high organic matter content (> 65%) may indicate of an unstable compost (Sullivan et al. 2023). ▪ Some organic materials such as lawn clippings naturally have a low C/N ratio. ▪ There isn't any consensus on an ideal compost organic matter content amongst developed countries and it could range between 30-70% (USCC, n.d.). ▪ Dougherty (1999) suggests a preferred organic matter content of 50-60%.
C/N Ratio	▪ A reduction in C/N ratio is indicative of an advanced stage of decomposition of compost feedstock materials. ▪ A reduction in C/N ratio ≤ 20 is considered a good sign of compost maturity (Mahapatra, Ali, and Samal 2022).
Biological: *pathogens*	▪ Microbes are essential to organic matter degradation. ▪ A variety of viruses, fungi and bacteria, helminths and Protozoa colonise compost (USCC n.d.) ▪ Tests for pathogens usually include Faecal coliforms, *Salmonella* sp. and *E. Coli*. ▪ A Pathogen risk assessment for composts derived from feedstock materials such as manure is necessary, however such tests are considered costly (USDA and CCREF 2001). ▪ Strict adherence to temperature-time regime is also permitted in some US states to manage analysis costs (USDA and CCREF 2001). ▪ Canadian standards also apply the temperature-time to compost derived from yard waste (mainly tree and shrub trimmings, plant remains, grass clippings, and chipped trees (CCME 2005). ▪ The temperature-time regime stipulates that: ➢ In- vessel composting should maintain temperatures ≥ 55°C or greater for three days. ➢ Windrow composting should maintain temperatures ≥ 55°C or greater for 15 days and turned 5 consecutive times. ➢ Aerated static pile composting should maintain temperatures ≥ 55°C or greater for three days.
Stability and maturity	▪ Compost stability and maturity are often used interchangeably. Compost maturity refers to the degree of completeness of composting (Compost Quality Council 2001) whereas compost stability refers to the specific stage of decomposition of organic matter (Mahapatra, Ali, and Samal 2022). ▪ Tests for stability and maturity are multi-parametric and requirements vary between countries. ▪ Canadian compost quality standards require:

Parameter	Importance
	➢ a minimum curing time of 21 days and at least 1 additional test based on O_2 respiration rate, CO_2 evolution or self-heating test < 8 °C above ambient temperature (CCME 2005). ▪ US compost quality standards require a compost C/N < 25 before considering additional tests (Compost Quality Council 2001). ➢ Two or more tests should be used to assess compost. ▪ Dewar's self-heating test followed by oxygen-demand or CO_2-respiration and Solvita test are the most used maturity tests respectively in the US (Compost Quality Council 2001).
Sensory evaluation:	
Odor	Strong odors emitted from compost may be an indication of immaturity.
Visual	This is a subjective assessment however, finished compost resembles humus rich soil in contrast to initial substrate material.

See Bibliography for full citation of sources.

Annex D
(informative)

D.1 Other maximum allowable limits and test methods for selected elements

Table 4- Other maximum allowable limits and test methods for selected elements

Parameter		**Limit / Value**			**Test Method**
Physicochemical					
Nitrogen	Total				04.02 -(A) Total Kjeldahl Nitrogen (TKN), semi-micro Kjeldahl technique, TMECC.
	Nitrate	>50ppm			04.02-B Nitrate Nitrogen Determination, TMECC.
	Ammonium	<100 mg/L			04.02-C Ammonium Nitrogen Determination, TMECC.
Phosphorous		800-2500mg/l			04.03 - (B) Water-soluble phosphorus, TMECC.
Potassium		500-2000 mg/l 04.04-B water-soluble potassium, TMECC.			500-2000 mg/l 04.04-B water-soluble potassium, TMECC.
Heavy Metals					
Arsenic		<41 mg/kg			04.06- As TMECC.
Cadmium		39 mg/kg			04.06 - Cd TMECC.
Mercury		17 mg/kg			04.06 - Hg TMECC.
Lead		300 mg/kg			04.06 - Pb TMECC.
Maturity and Stability		Very mature	Mature	Immature	
Dewar self heating °C		<10	10-20	>20	05.08-14 Dewar self-heating test, TMECC.
Solvita index		7-8	5-6	<5	05.08-17 Solvita maturity index, TMECC.
Seed germination %		>90	80-90	<80	05.05-4 Seedling emergence and relative growth, TMECC.
Biological					
Salmonella		< 3 MPN (4·g) -1 TS			07.02 Salmonella, TMECC.

Annex E

(informative)

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CARICOM REGIONAL ORGANISATION FOR STANDARDS AND QUALITY

The CARICOM Regional Organisation for Standards and Quality (CROSQ) was created as an Inter-Governmental Organisation by the signing of an agreement among fourteen Member States of the Caribbean Community (CARICOM). CROSQ is the regional centre for promoting efficiency and competitive production in goods and services, through the process of standardization and the verification of quality. It is the successor to the Caribbean Common Market Standards Council (CCMSC) and supports the CARICOM mandate in the expansion of intra-regional and extra-regional trade in goods and services.

CROSQ is mandated to represent the interest of the region in international and hemispheric standards work, to promote the harmonisation of metrology systems and standards, and to increase the pace of development of regional standards for the sustainable production of goods and services in the CARICOM Single Market and Economy (CSME), and the enhancement of social and economic development.

CROSQ VISION: The premier CARICOM organisation for the development and promotion of an Internationally Recognised Regional Quality Infrastructure; and for international and regional harmonized CARICOM Metrology, Standards, Inspection, Testing and Quality Infrastructure

CROSQ MISSION: The promotion and development of standards and standards related activities to facilitate international competitiveness and the sustainable production of goods and services within the CARICOM Single Market and Economy (CSME) for the enhancement of social and economic development.

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