

Information Sheet No. 3-11

Sample Management for Consistent Analysis of Products and Raw Materials

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Need for standard sample management procedures

Laboratory testing of recycled organics products is required to provide assurance that products meet minimum quality requirements, are fit for purpose, and/or are consistent with customer specifications.

The purpose of this information sheet is to define standard sample management procedures from the point of dispatch at the manufacturing facility right through to the point of testing at a laboratory.

Assessing compliance to an Australian or industry standard via off-site (independent) laboratory testing provides independent verification of the quality of the product(s) supplied to customers.

Independent quality testing of products also provides an important management tool for organics processing facilities by providing a check on the reliability and performance of the process control system for product manufacture.

However, non-representative sampling of product from windrows (for example), or poor sample handling and management by either the organics processing facility or the laboratory may produce unreliable testing results that do not accurately reflect the overall characteristics of the product available for sale.

It is important to note that recycled organics products (eg. composts) are 'biologically active'. The chemical, physical and biological properties of the product can change after sampling, if samples are not managed correctly.

This means that standard procedures are required to ensure correct and consistent sampling and sample management. If these procedures are not followed consistently, laboratory test results will be unreliable.

For example, if a 20 litre sample of *composted soil conditioner* is sampled from a compost windrow, and is left to stand for 2 weeks in a sealed plastic bag in a site office or laboratory, the properties of the product are likely to change.

Plate 1. Finished batch of composted soil conditioner ready for off-site laboratory testing according to Australian Standard AS 4454 (2003).



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Microorganisms in the biologically active compost product will continue to decompose some of the organic matter, resulting in the consumption of oxygen in the air contained in the bag. Eventually all of the oxygen in the sample bag will be consumed, and bacteria present in the sample that favour low oxygen (*anaerobic*) conditions will start to thrive.

Anaerobic microorganisms will continue to break down the organic product, and will tend to produce compounds such as volatile fatty acids (which can smell if high enough in concentration, particularly for relatively immature *pasteurised* products).

These compounds can lower the pH of the sample, resulting in a pH test result that is not representative of the pH of the compost in the windrow.

Clearly, if manufacturers of recycled organics products are to derive consistent results from off-site laboratory testing, samples sent for analysis need to be managed in a standard manner to minimise variation in the product caused by transport, storage and handling.

Testing laboratories also need to recognise that proper sample management and prompt testing of samples following receipt is required to provide consistent and relevant results.

By following these methods, changes in the properties of samples can be minimised, thus improving the consistency and reliability of results generated from laboratory testing.

It is recommended that compost manufacturers demand assurance from their commercial laboratory that they follow the procedures recommended here, or such other procedures as are relevant to the needs of the specific manufacturer's context, product or material.

Taking a representative sample of "compost" product

The sample (or sampling points) should reflect the overall characteristics of the "compost" product being tested.

Laboratory analysis of a sample that is not representative of the bulk product will produce unreliable, non-representative results.

A method of taking a representative sample from a large batch of product for testing is provided in Information Sheet No. 3-3 in this series.

By following this sampling procedure, a sample which reflects the overall characteristics of the bulk product can be obtained.

Packaging and dispatch of the "compost" product samples

To minimise changes that can occur between collecting the "compost" sample and laboratory analysis of samples, samples should be taken, packaged and sent to the laboratory on the same day by overnight courier.

A number of courier services can provide overnight delivery, and these can be found in the Yellow Pages™.

Depending on the range of tests to be performed, and the relevant Standard to be tested against, usually between 6 and 10 litres of representatively sampled product is required.

A procedure for packaging the sample is as follows:

1. Place the 6 – 10 litre sample of product into a plastic bag. Loosely tie the end of the bag.
2. Prick approximately 20 small holes in the bag with a small sharp point (eg. the point of a cheap school compass) to allow the contents of the bag to breath during transport.

Definitions

Anaerobic

In the absence of oxygen, or not requiring oxygen. Composting systems subject to anaerobic conditions often produce odorous compounds and other metabolites that are partly responsible for the temporary phytotoxic properties of compost. Anaerobic conditions are important for anaerobic digestion systems.

Composted Soil Conditioner

Any composted product, including vermicast, manure and mushroom substrate, that is suitable for adding to soils. This term also includes 'soil amendment', 'soil additive', 'soil improver' and similar terms, but excludes polymers which do not biodegrade, such as plastics, rubber and coatings. Soil conditioner has not more than 20% by mass of particles with a maximum size above 16 mm.

Pasteurised

An organic product that has undergone controlled aerobic and thermophilic biological transformation to achieve pasteurisation, but is relatively immature and lacking in stability compared to compost.

3. If the sample is to be analysed for organic contaminants, a representative 1 litre sample needs to be placed into a sterile glass jar and sent to the laboratory as well. This is because the organic contaminants can react with plastic polymers in the bag.
4. Place sample/s into an appropriately sized eski or polystyrene box (e.g. similar to ice-packed broccoli box).
5. Insert relevant documentation into the polystyrene box and **seal** the lid to the box and any air holes with masking tape.
6. Place a label on the top of the box and address it to the relevant laboratory marked '**Urgent Sample for Analysis**'.
7. Arrange for the collection of the parcel by a courier for overnight delivery to the laboratory.

8. Store the sample box in a cool location out of direct sunlight whilst awaiting collection.

Polystyrene is a good insulator, and is recommended for transport as sealed insulated boxes can be effective in reducing temperature extremes during transport.

The temperature in the cargo bays of aircraft can often fall below -20°C , which can have an impact on the biological properties of products containing compost.

Transport of samples in sealed polystyrene boxes can therefore assist in reducing the impact of air transport on samples.

A test that may be impacted by this form of transport is the self heating test (AS 4454, 2003).

This test is based on the principle that actively decomposing or immature products liberate heat, due to high levels of microbial activity.

Microbial activity responsible for generating this heat may be compromised for a period of time following such transport.

However, packaging of the sample into polystyrene can minimise such extreme temperatures, producing more reliable results.

Samples should be protected from light, as some compounds that may be present in the sample can be degraded by light.

If the sample cannot be sent the day of collection, it is recommended that the bagged sample be stored under refrigerated conditions ($2-3^{\circ}\text{C}$) for no more than 3 days prior to packaging (as specified above) for dispatch.

For extended storage of product, product should be frozen ($\sim 0^{\circ}\text{C}$) to halt all microbiological activity.

Storage under these conditions will affect the microbial population in the product, and may affect the reliability of stability tests (eg. self heating test).

Receipt and processing of “compost” product samples at the laboratory

Laboratories should minimise delays in processing of samples, in particular, for those tests that are likely to be affected by inconsistent and/or excessive storage time.

AS 4454 (2003) requires that *products shall be tested as soon as possible after receipt at a laboratory, and certainly within four days of receipt.*

It is recommended here that tests which can be influenced by continued biological activity in the sample should be performed within a two days of receipt at a laboratory.

Tests that should be performed within this two day period of receipt of the sample, based on (normative) tests specified in the Australian Standard AS 4454 (2003) include:

1. Appendix H: moisture content and level of physical contamination.
2. Appendix A: pH, electrical conductivity, ammonium, nitrate and soluble phosphorus content.
3. Appendix E: toxicity to plants.
4. Appendix K: self heating test.
5. Appendix M: Presence of plant propagules in pasteurised products.

If the tests specified above will not be performed within this two day period, it is recommended that the insulated container be opened, and that the bagged sample should be stored under refrigerated conditions ($2-3^{\circ}\text{C}$) whilst awaiting analysis.

Samples should be protected from light, as some compounds that may be

present in the sample can be degraded by light.

Other tests defined in the Australian Standard AS 4454 (2003) do not need to be undertaken as promptly, as the results are unlikely to be as affected by storage for durations exceeding two days. For these other tests, it is appropriate for the sample to be stored in the sample bag under conditions consistent with those specified in the relevant Australian Standard (AS 4454, 2003).

AS 4454 (2003) requires that *if [samples] must be stored after receipt, a sub-sample is to be taken for as-received moisture determination. If the sample is drier than a moisture content of 40-50%, water is to be added to bring it into this range and the sample stored in a large container that is loosely sealed to minimise water loss but to allow oxygen entry, [samples should be stored in cool conditions] at $18-25^{\circ}\text{C}$.*

These other tests should be performed within a two-week period.

Perforations inserted into the side of the bag should be effective in maintaining relatively aerobic conditions in the bag, whilst reducing moisture loss. If perforations have not been inserted into the bag, the laboratory technician should do so as defined in the previous section.

“Compost” maturity testing

There are two tests specified in the relevant Australian Standard (AS 4454, 2003) that relate directly to product stability and maturity. These tests are:

- Appendix E (normative): toxicity to plants.
- Appendix K (normative): self heating test.

For reliable results from the self heating test, the test should be commenced within one week of sampling. The sample should not be refrigerated, and should be stored, as specified above, in a plastic bag, in cool conditions below

25°C (Crouchley, 2001). The bag allows dissipation of heat and retention of moisture, and should have air holes as previously specified to allow circulation of air to support oxygen entry and maintenance of aerobic conditions.

For reliable results from the toxicity test, where sample product has been refrigerated, the sample should be left to stand at room temperature until product reaches ambient temperature before initiating this test. This is because rate of seed germination can be influenced by the temperature of the growing media (Handreck and Black, 1994).

Packaging and sample management for raw materials

The sampling and analysis of compostable organic materials (raw materials) is often necessary when establishing the suitability of a raw material for processing, and for establishing a suitable compost recipe that incorporates the specific raw material.

The types of analysis that may be conducted relate to moisture content, carbon to nitrogen ratio, and potentially to the screening for contaminants such as heavy metals, organochlorine compounds and pesticide/herbicide residues.

The goal of testing of raw materials,

particularly unstable materials, should be to analyse the material in the state in which it is likely to arrive at the processing facility.

It is recommended that for unstable raw materials such as lawn clippings and food waste, samples should be managed in the following manner:

1. Obtain a representative sample of sufficient size for the tests being conducted (ask laboratory for guidance on this).
2. Place the sample of raw material into a plastic bag, remove excess air and tie the end of the bag closed. Alternatively, “ziplock” resealable bags can be used.
3. Refrigerate the sample without freezing (2-3 °C) as soon as possible after sampling.
4. If the sample is to be analysed for organic contaminants, a representative 1 litre sample needs to be placed into a sterile glass jar and sent to the laboratory as well. This is because the organic contaminants can react with plastic polymers in the bag. This sample should also be refrigerated prior to shipping.
5. Arrange for the collection of the parcel by a courier for overnight delivery to the laboratory.
6. Place the cool sample/s into an

appropriately sized eski or polystyrene box.

7. Place an ice-pack into the eski to maintain cool conditions during transport. This is particularly important where overnight/same day delivery is not possible.
8. Insert relevant documentation into the polystyrene box and **seal** the lid to the box and any air holes with masking tape.
9. Place a label on the top of the box and address it to the relevant laboratory marked ‘**Urgent: Sample for Analysis**’.
10. Store the sample box in a cool location out of direct sunlight whilst awaiting collection.
11. Upon arrival at the laboratory, the laboratory should remove the sample from the eski and keep the sample refrigerated and protected from direct light until ready to analyse.
12. Products shall be tested as soon as possible after receipt at the laboratory and certainly within four days of receipt.
13. Tests that can be influenced by continued biological activity in the sample should be performed within two days or receipt at the laboratory.

Important references

- Crouchley, T. (2001). Evaluation of Dewar Flask Self Heating Test. Submission to Australian Standards committee CS-037-01 Composts and Mulches from Richgro Garden Products, Western Australia.
- Handreck, K. and Black, N. (1994). Growing Media for Ornamental Plants and Turf. University of New South Wales Press, Sydney, Australia
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