

## Information Sheet No. 6-4

### Buyer beware: quality issues for recycled organics products

Information Sheet No. 6-4  
Second Edition 2003

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#### Introduction

There are a range of recycled organics (RO) products containing 100% RO (e.g. *mulch*) and others containing a proportion of RO (e.g. potting mixes and soils).

As a consumer, it is important to differentiate between high and low quality products and to be able to select products that are appropriate to specific applications.

RO products include:

- Potting mixes;
- Mulches;
- *Soil conditioners*;
- Blended or organic soils (topsoil applications)
- Top dressing;
- Low density soils, and
- Playground surfacing.

Within each of these categories are a range of products that can be used in different situations, including:

- Potted plants
- Home gardens
- Commercial landscaping
- New housing developments
- Parks, gardens, playgrounds and other community open spaces
- Roadside applications

- Forestry and agricultural applications, and
- Mine site applications

The products identified in this Information Sheet are consistent with the specifications given in the various Australian Standards (see Information Sheet 6-5).

#### Issues to consider

The use of RO may carry a risk, which is often linked to product variance.

This variance is related to:

- The proportion of RO used to create a blended product;
- The raw materials used to create a product;
- The level of processing a RO product receives (e.g. pasteurisation, composting, maturation), and
- The (often confusing) brand names used to identify a product.

Using products that comply with relevant Australian Standards reduces most risks.

As certification represents a minimum standard, it does not mean

**Plate 1.** Application of a composted soil conditioner to a soil bed at The University of NSW.



a product is appropriate to consumer requirements. Consumers must select the best product for their needs. Problems may occur if products are used in inappropriate situations (e.g. incorporating a surface mulch into soil).

### 1. Potential problems

Problems that may occur following the inappropriate application of RO products may include: *phytotoxicity*, nitrogen drawdown, chemical or physical contamination, odours, weed propagation, and transference of pathogens to plants and animals.

These problems are associated with the production methods used to manufacture products (Table 1).

#### *Phytotoxicity*

Some RO products can damage seedlings or sensitive plants (Rynk *et al.*, 1992).

Phytotoxins (compounds toxic to plants) may come directly from organic matter in RO products or from microbes that decompose the organic matter (Handrick and Black, 1999).

Problems of phytotoxicity occur when RO products have not been properly *pasteurised* or *composted* (Haug, 1993). Pasteurisation alone may not be sufficient to counteract phytotoxic effects.

Metabolites such as organic acids from decomposing organic matter may damage existing plant roots and retard plant growth (Zucconi *et al.*, 1981). This damage greatly increases the probability of pathogen attack on weakened plants (Handrick and Black, 1999).

The release of ammonia from organic matter with a low carbon to nitrogen ratio can also have phytotoxic effects (Haug, 1993).

Products at risk of producing phytotoxic effects include raw and pasteurised RO products.

#### *Nitrogen drawdown*

The ability of an RO product to consume soluble nitrogen – an essential plant nutrient – is referred to as nitrogen drawdown (Handrick and Black 1999).

Woody material may result in nitrogen drawdown if incorporated into soil. Bacteria draw nitrogen from the soil during the decomposition process. This is the main reason why some products (e.g. mulch) are only suitable for surface application. If incorporated into soil they are likely to cause nitrogen drawdown and starve plants of nitrogen. This can result in a decrease in growth and plant death.

The extent to which drawdown occurs is represented by the nitrogen drawdown index (NDI). This index measures the rate of disappearance of nitrate-nitrogen from a solution containing nitrogen.

A NDI of 1 indicates that all added nitrogen remains in the RO product after a period of 4 days. If no nitrogen is left, then the material is given a drawdown index of 0.

*Select recycled organics products that are pasteurised or even better, composted, to minimise risks!*



RO products with a low nitrogen drawdown index may benefit from the application of a fertiliser containing nitrogen (e.g. in the form of ammonium nitrate) if they are to be used as plant growing media (Handrick and Black 1999).

Products at risk of having a low NDI include raw and pasteurised RO products and woody mulches if mistakenly incorporated into soil.

#### *Residual chemicals*

The presence of residual chemical substances in RO products may have detrimental effects on plant and animal health. For example, wood and timber based RO products may contain preservatives (e.g. formaldehyde, creosote and heavy metals) that are harmful to plant, animal and human health. Others can contain pesticides and herbicides, though most tend to be broken down with a full composting process (Buyuksonmez *et al.*, 2000; and Recycled Organics Unit, 2000a).

Where products comply with relevant Australian Standards, there should not be any residual chemical toxicity issues.

Products at risk of containing residual chemicals include wood based raw and pasteurised RO products that have not undergone a full composting process.

#### *Physical contamination*

Products that do not comply with the relevant Australian Standards may possess hazardous or unsightly physical contaminants such as stones, metal, plastic and glass.

Products at risk of containing physical contaminants include those derived from contaminated *feedstock*. Good *process control*, however, should aim to remove these before products are sold.

#### *Plant propagules*

Plant propagules within low quality RO products may include seeds and cuttings (Recycled Organics Unit 2000b).

Viable plant propagules in RO products can contribute to the establishment of weeds that compete with other plants for nutrients and

**Table 1.** Advantages and disadvantages of raw, pasteurised and composted recycled organics products.

	<b>Raw</b>	<b>Pasteurised</b>	<b>Composted</b>
<b>Cost</b>	<i>Cheap</i>	<i>Less expensive than compost</i>	<i>Most expensive</i>
<b>Quality</b>	<i>Lowest</i>	<i>Moderate</i>	<i>Highest</i>
	<ul style="list-style-type: none"> <li>Organic matter benefits for soil</li> </ul>	<ul style="list-style-type: none"> <li>Organic matter benefits for soil</li> <li>Eliminates plant propagules</li> <li>Eliminates plant and animal pathogens</li> <li>May supply some nutrients to soil</li> </ul>	<ul style="list-style-type: none"> <li>Organic matter benefits for soil</li> <li>Eliminates plant propagules</li> <li>Eliminates plant and animal pathogens</li> <li>Eliminates phytotoxicity and nutrient problems</li> <li>May supply nutrients to soil</li> <li>Long lasting</li> </ul>
<b>Risks</b>	<i>Highest</i>	<i>Moderate</i>	<i>Lowest</i>
	<ul style="list-style-type: none"> <li>Inappropriate application</li> <li>Non-standard product names</li> <li>Phytotoxicity</li> <li>Presence of physical and chemical contaminants</li> <li>Nitrogen drawdown problems</li> <li>Plant propagules may be present</li> <li>Plant and animal pathogens may be present</li> <li>Bad odours</li> <li>May decompose rapidly</li> </ul>	<ul style="list-style-type: none"> <li>Inappropriate application</li> <li>Non-standard product names</li> <li>Phytotoxicity</li> <li>Chemical contaminants may be present</li> <li>Nitrogen drawdown problems</li> <li>Decomposes less rapidly than raw materials</li> </ul>	<ul style="list-style-type: none"> <li>Inappropriate application</li> <li>Non-standard product names</li> <li>Decomposes less rapidly than pasteurised or raw products</li> </ul>

water and increase landscape maintenance requirements.

Plant propagules can be destroyed through effective pasteurisation and composting procedures. Heat in well-managed composting processes is sufficient to destroy plant propagules. High standards of process control ensure that all materials spend sufficient time in the hot centre of a compost system to facilitate the thermal death of propagules and pathogens.

Products at risk of having plant propagules include raw RO products, poorly managed composts and derived RO products.

*Animal and plant pathogens*

Pathogens are microorganisms capable of producing disease or infection in plants or animals. The heat produced during *thermophilic*

composting can kill pathogens (Recycled Organics Unit 2000b).

Poorly composted or pasteurised RO products may contain pathogens and plant propagules (see above).

Consumers can have confidence that Australian Standards certified products are free of harmful plant and animal pathogens.

*Product names*

In many instances it is difficult to identify product type and application based upon the brand name a company gives a product.

Standards Australia has clearly defined product categories and labelling requirements for RO products. However, the brand name a manufacturer gives a product is not controlled.

Brand names may be misleading. For example, products may be given such names as “Planting or digging composts” or “Soil mixes” when in fact they are composted mulches suitable for soil surface application.

These labelling problems may contribute to the inappropriate use of a product.

All products are at risk of having an ambiguous label. However Australian Standards certified products must be labelled with an Australian Standard defined product category – providing consumers with a method of identifying products to meet their needs.

**2. Product preparation**

RO products may come in three forms: raw, pasteurised and composted (Table 1). Of these three possibilities, raw products present the greatest risks. There are fewer risks

with the purchase of pasteurised or composted products.

#### Raw products

Raw (non-pasteurised) products may carry many hazards. These products include leaf mulches or wood chips (shredded plant material). Raw products may contain seeds, viable plant materials and plant pathogens. Using raw products increases the risk of spreading these problems.

Raw materials do not comply with any relevant Australian Standards for mulches or soil conditioners and can only be used as surface mulches.

Raw products may contribute to the problems mentioned in the previous section, including phytotoxicity, nitrogen drawdown, residual chemical contaminants, plant propagules and pathogens.

Raw products are relatively cheap compared with pasteurised or composted materials. However, they do not last as long in/on soil as do their processed equivalents.

#### Pasteurised products

Pasteurisation occurs at temperatures above 55°C. This process eliminates weeds and pathogens (animal, human and plant) (Haug, 1993). It requires that all plant materials spend sufficient time at these temperatures to effectively kill weeds and pathogens.

As pasteurisation represents the initial stage of the composting process, problems of phytotoxicity or nitrogen drawdown may still occur because the material is not fully composted.

Pasteurised RO products are generally more expensive to purchase than their raw equivalents, because they require a higher degree of processing.

#### Composted products

Aerobic composting is primarily achieved through the actions of microorganisms under specified levels of air, water, food and temperature (Recycled Organics Unit, 2000b).

Composted products need to be processed for a minimum period of 6 weeks.

Assuming consumers have selected an appropriate product, the previously mentioned risks do not apply to fully mature composted products.

As the composting process requires significantly more time than that of pasteurisation, consumers will have to pay more for composted products.

Composted RO products last longer, because they do not decompose as rapidly as raw or pasteurised material (EcoRecycle, 1998).

### 3. Immaturity, stability and maturity

Maturity gives a product stability. This reduces the risk of contamination, toxicity and further thermophilic decomposition.

Stability and maturity are influenced by the level of composting and/or processing a product has undergone.

Raw and pasteurised products are generally unstable and immature. Fully composted products, by contrast, are both stable and mature.



Be aware of immature 'stable' products. They may lose their stability and cause problems if they are re-wet.

Not all stable products are mature. Stability may only be temporary if a product has not been properly matured.

Stability is a measure of the amount of biological activity a material exhibits in its current state (Haug, 1993). Stability may therefore be lost if the state of a product changes (e.g. increase in moisture content, change in product temperature).

Be aware: immature products can give the appearance of stability if:

- they have been treated with heat for a short period or are very dry;
- they have a high *carbon to nitrogen ratio* (e.g. wood chips), or
- if they have a low moisture content.

#### Characteristics of mature products

Mature products exhibit the following qualities (Rynk *et al.*, 1992):

- Stability with correct moisture
- 'Earthy' odour
- Carbon to nitrogen ratios of 15:1 – 18:1
- A neutral pH
- Lack of phytotoxicity
- Low ammonia content (no odour)
- Relative reduction in volatile solids content
- Absence of original ingredients.

#### Product maturity testing

Consumers should be aware of test methods for determining the maturity of a product.

There are a number of procedures that can be used to determine the maturity of an RO product. These include:

- Reheating (Standards Australia, 2002);
- Oxygen consumption (Recycled Organics Unit, 2000c); or

- Carbon dioxide and ammonia evolution (laboratory testing, Solvita test) (Recycled Organics Unit, 2000c).

Of these approaches, the Solvita test is the quickest (4 hours) (field-based) method for determining product maturity (see Recycled Organics Unit, 2000c). This test gives an index of product maturity on a scale from 1, least mature, to 8, most mature.

The Solvita test index can be used to identify the suitability of RO products for different uses. The test uses gel that absorbs carbon dioxide and ammonia. Both these compounds tend to be produced by immature products. As the gel absorbs carbon dioxide and ammonia, the colour changes. This colour can be compared to a chart, which approximates the level of maturity of the product. For example (numbers in brackets are “Solvita colour ranges”):

- (1-4) spreading on fallow land
- (2-5) spreading on row crops
- (3-5) hot house beds
- (4-7) orchards, vineyards etc.
- (5-8) organic/artificial soil beds
- (6-8) general gardening
- (6-8) top dressing
- (7-8) bedding plants/ container media/ potting mixes
- (7-8) seedling starters

The Solvita test is widely used by large quantity RO buyers in the United States of America.

Less mature products continue to decompose after application, and consequently their related benefits do not last as long as those of mature products. Buyers of RO should not pay premium prices for immature products.

#### *Recycled organics pH effects*

Depending upon application, the pH of RO products may impact upon plant growth and health.

A pH of <6 may affect plants intolerant to slightly acidic to acidic conditions, while a pH of greater than 7.5 is generally deleterious to plant growth. At pH's >7.5, ammonia can be formed and this is toxic to plants.

RO products with a pH of between 6-7.5 are relatively safe for use with most plants

### How can you identify quality?

It is important for consumers to be able to identify quality products.

Indicators of product quality are summarised below, from least risky to most risky:

1. Product certification;
2. Quality endorsed manufacturer and product batch test certificates;
3. Batch test certificates that show a product complies with the relevant Australian Standard, and
4. Anything else, it's a case of buyer beware.

#### *Certified products (highest level of confidence)*

Select products that are quality certified to the relevant Australian Standards. Certified products are required to identify the relevant Australia Standard product category, making it easy to identify the best product for consumer requirements. With small orders, purchasing Australian Standard certified products is the simplest way of getting a quality result.



For bulk purchases, the 'Certified Product' logo should be on the product specification sheet.

## Definitions\*

### Mulch

Any pasteurised organic product (excluding polymers which do not degrade such as plastics, rubber and coatings) that is suitable for placing on soil surfaces. Mulch has at least 70% by mass of its particles with a maximum size of greater than 15 mm.

### Soil conditioner

Any composted or pasteurised organic material 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 conditioners may be either 'composted soil conditioners' or 'pasteurised soil conditioners'. Soil conditioner has not more than 15% by mass of particles with a maximum size above 15 mm.

### Phytotoxicity

Toxic to plants. Partially decomposed organic materials or immature composts are often phytotoxic, but this usually decreases with time. Such products may be phytotoxic due to a number of factors, including: low nutrient content; high oxygen consumption; presence of fatty acid or alcohol metabolites formed by microorganisms under anaerobic conditions; or due to excessive concentrations of salts, heavy metals and other organic compounds.

\* Recycled Organics Unit (2002).

#### *Quality endorsed company and batch testing (Moderate level of confidence)*

If certified products are unavailable or too expensive, then consumers may want to purchase non-certified products from quality endorsed companies. Quality endorsed companies need to have documented and consistent manufacturing processes. They are therefore likely to produce a more consistent product, and effective pasteurisation is likely to have been



**Figure 1.** Example of a batch test certificate.

**Laboratory Services #2**  
 ABN 000 000 000  
*Specialising in the Analysis of Composts and Products Containing Recycled Organics*

12 King St      Tel: (02) 0000 1111  
 Travell NSW 1111      Fax: (02) 0000 0111

Laboratory Services #2 is a NATA accredited laboratory with expertise in testing to AS 4454, AS 3743, AS 4419 and AS 4422.

Note: All results and recommendations assume that sample(s) provided are representative of bulk material.

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**TEST REPORT: Nutrient assessment of compost**

Date sample received: 01/03/99  
 Sample identification: 1109-1999  
 Sample condition: Compost, moist (fresh, as required)  
 Client: Mr John Citizen  
 Quality Compost Products Pty. Ltd.  
 101 Thine Rd  
 Timber NSW 0101

Test(s) required: Basic nutrient assessment  
 Product compliance requirements: Composted soil conditioner  
 Testing methodology: Australian Standard AS 4454-1999

TEST	UNIT	RESULT	QC (%) <sup>1</sup>	AS4454	COMMENTS
pH	pH units	7.4	101	5.0-7.5	Pass
Conductivity	dS/m	1.55	97	No limit	<sup>2</sup> Pass
Ammonium-N	mg/L	110	98	< 300	Pass
Ammonium-N + Nitrate N	mg/L	112	100	> 100	<sup>3</sup> Pass
Total N	%	0.71	99	> 0.8	See note 4

**Notes:**  
 1. Tests were performed with reference to an internal standard for quality control (QC) purposes. QC results within 3% of the range of the internal standard (97-103%) are acceptable.  
 2. See *Summary and Recommendations* on page 2.  
 3. See *Summary and Recommendations* on page 2.  
 4. See *Summary and Recommendations* on page 2.

Signed: *Robin F. Thomas*      Checked by: *Sue Smith*  
 Chemist      Quality Manager

\*\*\* Customer Support Line 1800 000 222 \*\*\*      Page 1 of 2

achieved. These products should have batch test certificates (Figure 1) from accredited laboratories to prove that they are compliant with the relevant Australian Standards.

*Batch testing (Minimum level of confidence)*

If neither a certified product nor a product from a quality endorsed company is available, consumers can purchase a product that has been tested by a reputable laboratory. A batch test certificate (for the current batch) can be produced to show product compliance with relevant Australian Standards (e.g. Figure 1).

*Non-certified product with no batch test certificate (Buyer Beware!)*

The purchase of products that lack certification and have not been batch tested carries many of the previously mentioned risks.

If a buyer cannot identify the qualities of a product, the effects of a product will remain uncertain after application. Such products and suppliers should be avoided, as they may cause serious problems to soils, plants, animals and even human health.

**Conclusions**

It is important for consumers to realise the potential hazards associated with the purchase of RO products.

Product quality and product type can be quite diverse depending upon the level of processing undertaken.

Consumers should purchase products that are appropriate to their end-use. This can sometimes be difficult given the non-standardised brand names given to some RO products.

Consumers should look for product and company accreditation and

**Definitions\***

**Pasteurisation**

The process whereby organic materials are treated to kill plant and animal pathogens and weed propagules.

**Composting**

The process whereby organic materials are pasteurised and microbially transformed under aerobic and thermophilic conditions for a period not less than 6 weeks. By definition, it is a process that must be carried out under controlled conditions yielding mature products that do not contain any weed seeds or pathogens.

**Raw**

Any compostable organic material that is distributed as a recycled organic product without having been subjected to a pasteurisation or composting process, and may contain weed propagules and pathogenic microorganisms.

**Feedstock**

Material used for the manufacture of recycled organics products (e.g. woody garden organics, food organics).

**Process control**

Stringent and documented monitoring of all critical control points in a composting operation so as to minimise defects and make products which can be guaranteed to customers.

**Thermophilic**

Temperatures above 45°C. Used to describe a stage of composting in which high temperatures are sustained resulting in high rates of decomposition and pasteurisation of the organic material. Heat tolerant microorganisms survive well in these conditions.

**Carbon to nitrogen ratio**

The ratio of the weight of organic carbon (C) to that of total nitrogen (N) in an organic material.

\* Recycled Organics Unit (2002).

