Managing the Transition
Degradable Plastics in New Zealand

A Guide and Industry Commitment

PLASTICS NEW ZEALAND

Contents

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1 Using Degradable Plastics in Australia: A Product Stewardship Guide and Commitment, PACIA 2007

List of Abbreviations

AS/NZS	Australian Standard / New Zealand Standard
ASTM	American Society for Testing of Materials (Standards)
CEN	Committee European de Normalisation (European Committee for Standardisation)
ISO	International Organisation for Standardisation
PACIA	Plastics and Chemicals Industries Association
PNZ	Plastics New Zealand

Foreword

Terry Mischefski
National President
Plastics New Zealand

Plastics processing in New Zealand is a strategic part of our country's export growth, it provides the necessary means for packaging our nations food, is used in the manufacture of medical supplies, and plays a major role in our construction industry, to mention a few.

Plastics New Zealand is serious about its responsibilities towards environmental issues, and has always taken the proactive approach. During the 90's our industry achieved self regulation, by registering all materials with HSNO, and in 2003 we launched the Plastics Sustainability Initiative.

In 2006 we published the Design for the Environment Guidelines which continues to be used as an education tool throughout New Zealand, and the Iconic Kiwi Plastics Products was published in 2007.

Our commitment and targets with the Packaging Accord were achieved through 2004 – 2009, and the Best Practice Energy Programme was launched in 2007, recognising us as leaders in our field. Our sector based programme is being used as a model by the Energy Efficiency and Conservation Authority.

Plastics New Zealand is serious about its responsibilities towards environmental issues, and has always taken the proactive approach

This year we launch ***Managing the Transition: Degradable Plastics in New Zealand – A Guide and Industry Commitment***. The purpose of this guide is to help all those designing products with degradable plastic polymers (raw material suppliers, manufactures, brand owners) to take a lifecycle approach and understand and apply all relevant factors. This includes educating stakeholders and consumers, and ultimately working towards acceptance by the public.

Our industry recognised the need for a collaborative effort from all sectors. Degradable plastics are a complex and evolving area with new products entering the marketplace all the time. Their increasing use in a wide range of applications has prompted the need to reduce potential misunderstandings about the environmental claims about these new products.

Signatories to this Guide will:

- **Assist the consumer to make informed decisions on the use of degradable plastics**
- **Consider the end of life options for their degradable plastic**
- **Ensure their impact on the environment is minimised**
- **Reduce the risk of misinformation, and**
- **Use clear and concise labelling.**

A reference group has been formed to oversee all aspects of this guide and update this living document as the need arises.

Plastics New Zealand would like to thank all those who have painstakingly over 2 years broken down the barriers and channeled their energy into creating a document which will be used by our industry and all interested parties for years to come.

1. Objective

To prepare a guide and industry commitment to assist with managing degradable plastics in New Zealand.

The guide has agreed definitions and standards to help consumers, manufacturers and brand owners understand the performance they can expect from degradable plastics and how they will degrade in the environment. The guide is a living document that will be updated as the need arises.

The guide has a plastics and packaging industry focus. It seeks signatories prepared to meet the commitments set out in the guide. This includes clear and accurate labelling of their degradable plastic products.

2. Introduction

Brand owners, retailers and consumers are interested in plastics made from renewable resources and those that break down in the environment. The interest is high for a range of uses, initially in the packaging applications such as trays, film and water bottles. Reasons include:

- Consumers wanting products with reduced environmental impact at all stages of manufacture, use and disposal
- Retailers and manufacturers perceiving a marketing advantage
- The perception that degradable plastics could help to address litter concerns
- Bioplastics utilise renewable resources, reduce reliance on oil and reduce the accumulation of greenhouse gases
- Compostable plastics can be organically recycled through composting along with organic waste.

There is confusion in the marketplace over what plastic to use and whether the various claims about how it breaks down in the environment are actually true.

Products made from degradable plastics will increasingly be introduced into the marketplace and we need to manage this introduction. Degradable plastics will enter both the recycling and composting systems in New Zealand and Australia and are potentially a contaminant in these systems.

Over the last two years we have addressed the issues surrounding the potential impact on the recycling of PET bottles and other recyclates. This has led to the development of a product stewardship approach for PLA (polylactic acid).

PLA is one of the many plastics derived from renewable material within the full suite of degradable plastics available on the market today (See Diagram 1). A number of these plastics are identifying their carbon source as either from petroleum based or atmospheric carbon.

Bioplastics comprise less than 1% of the global plastics supply and are expected to increase from 2% to 5% by 2012 (See Diagram 2). It is estimated that less than 200 tonnes of PLA has been manufactured into products in NZ. The use of prodegradants has not been quantified but anecdotal information would suggest that it is under 500 tonnes and growing steadily.

Preparation of this guide

Work began in 2006 and 2007 with a series of degradable plastics workshops and conference presentations. As our sister organisation, PACIA, in Australia has prepared a similar guide we asked Peter Bury of PACIA to talk with us about the lessons they had learned. Meetings were held with Ministry for the Environment officials to encourage their participation in the preparation of this guide.

During 2006 and 2007 the working group worked through a number of issues including the introduction of PLA water bottles. We visited 2 composting facilities. In 2008 the working group met monthly to prepare this guide which was approved by the Plastics New Zealand Environment Committee and the National Executive in early December 2008.

The working group and wider email group include: Plastics New Zealand, Ministry for the Environment, researchers, Packaging Council of NZ, brand owners, raw material suppliers, manufacturers (converters), recyclers and composters.

Diagram 1: Biobased Polymers

SOURCE: WARWICK HALL, AUSTRALASIAN BIOPLASTICS ASSOCIATION

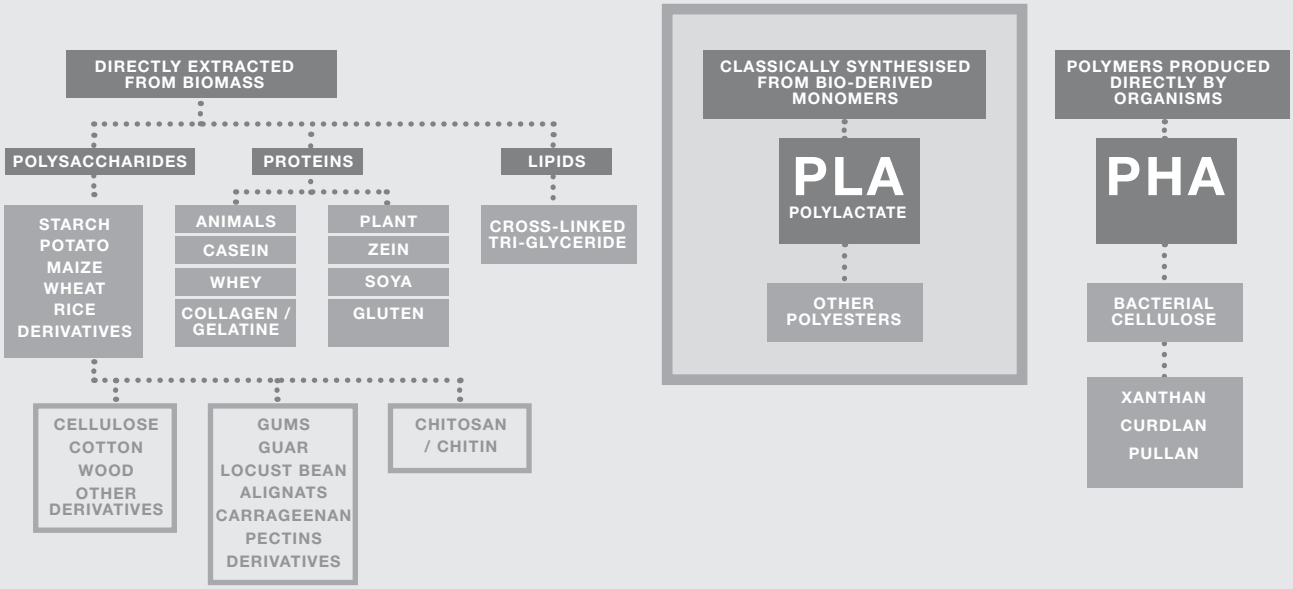
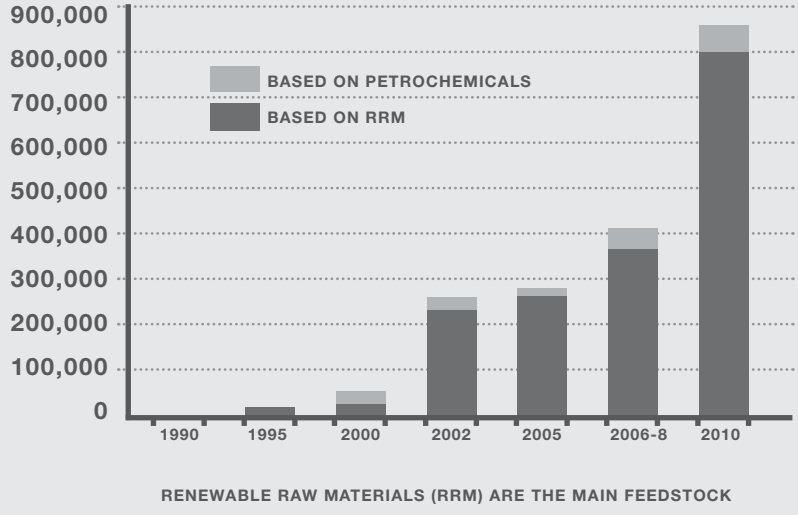


Diagram 2: Worldwide Manufacturing Capacity of Bioplastics

SOURCE: EUROPEAN BIOPLASTICS AND COMPANY ANNOUNCEMENTS



3. Classifying Degradable Plastics

Degradable plastics broadly describes plastics which are designed to break down into smaller particle sizes to a specific extent within a given time and within a specific end environment. [See AS/NZS ISO 14021:2000 – self-declared environmental claims]

Degradable plastics can be classified by both the materials they are made from and how they break down at the end of their life. New degradable plastics will continue to be introduced into the marketplace. Any classification needs to be able to accommodate changes in both inputs and outputs.

It is important to understand that biodegradable and non-biodegradable plastics can both be made from biobased/ renewable resource materials as well as from synthetic (petrochemicals – fossil fuel) resources. A fuller explanation is given in Appendix 1.

At this stage degradable plastics fall into **two distinct categories** based on their compostability according to international standards.

The **first category** is made up of plastics which are compostable according to international standards and are typically biologically degradable and so readily attacked and digested by microorganisms early on in their degradation process (within the timescales of the standards). Within this category are home compostable and commercial compostable options.

The **second category** is made up of plastics that are NOT compostable according to international standards and typically take longer times to degrade. They are typically degraded by a longer multi-step, sequential, process. For example, such a plastic would be;

(1) first broken down mechanically by chemical attack involving water, air (oxygen), and/or ultra violet light (sunlight), often with the help of additives which accelerate this chemical attack.

(2) then in a second step the result of this initial breakdown may provide, ultimately, a small enough size for attack and digestion by microorganisms. Only this second step can be termed "biodegradation".

Plastics which fall into the second category will eventually under go biological degradation after mechanical degradation, but not within the time/temperature constraints required by current commercial composting systems and standards.

The term biodegradable is often misunderstood and misused. Use of the term biodegradable should include a reference to an international standard and/or the **specific time**, temperature, water, air exposure conditions required.

Two important points are noted:

1. Where there are combinations of products they all need to be certified compostable

2. Hybrid blends such as wood or starch filled [mixed] with polyolefins, e.g. polyethylene, are not degradable in the terms of this guide because there is no mechanism to break down the polyolefin.

Products from both groups have a number of potential end of life environments that include both physical and chemical recycling, soil and water (marine and freshwater), compost, energy recovery and landfill.

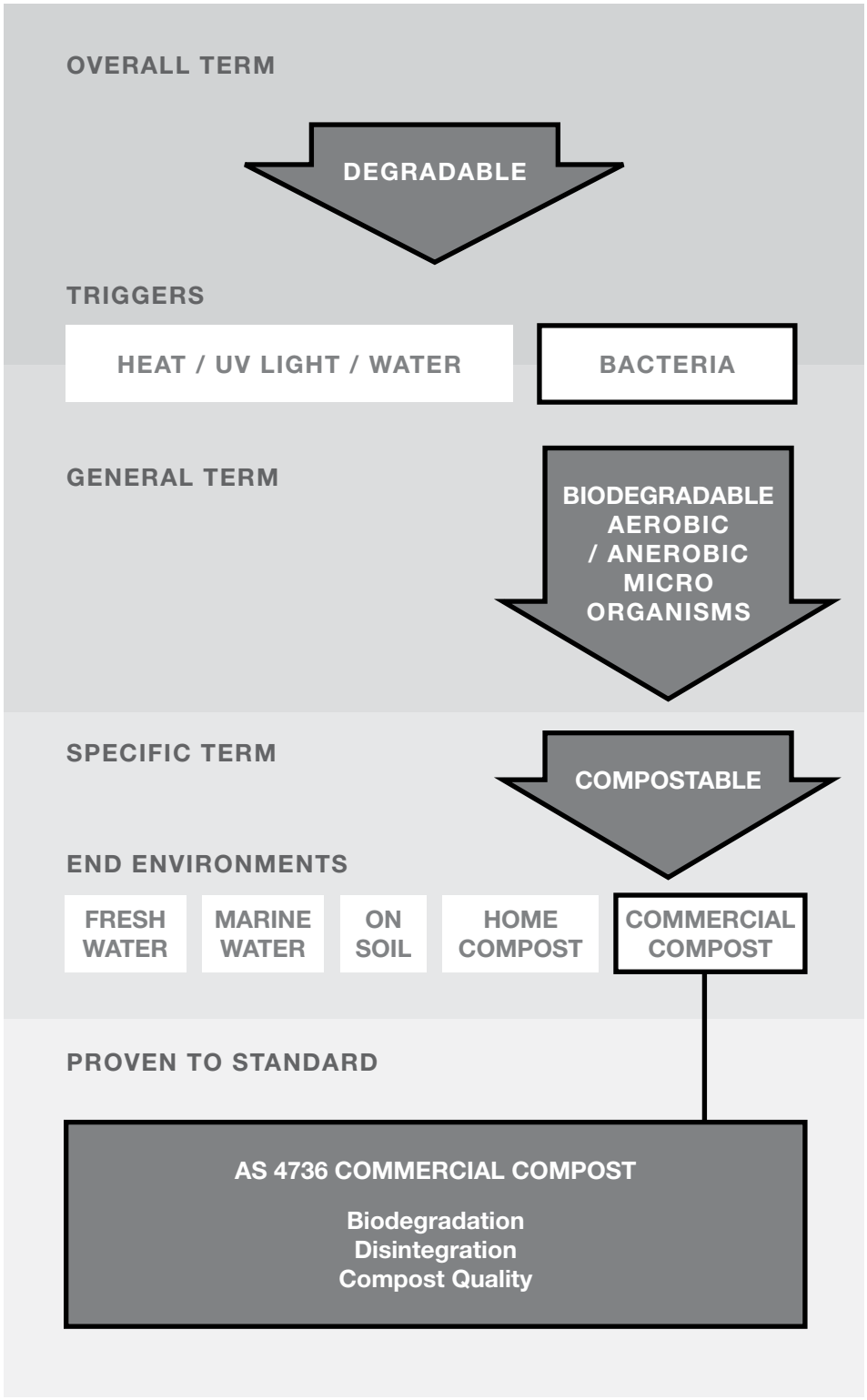
In general the preferred end of life option for all plastics is recycling. Care needs to be taken that degradable plastics do not contaminate recycling streams.

End of life options need to be determined by taking into account all or some of the following factors as described in Guidance 1: Sound Life Cycle Design. End of life options include:

- recycling
- compost
- energy recovery
- landfill (least desirable disposal option).

This approach links to the Australian system, (See Diagram 3) where degradable plastics are classified by meeting specific standards relating to specific end environments, i.e. commercial compost, home compost, on soil, marine water and freshwater.

Diagram 3: Specific end environments for Australian Standards



4. Principles

Information on material selection should be based on scientific merit to enable the most appropriate material to be used.

The application of this principle requires:

1. Information to be accurate, unambiguous and not misleading.
2. Information to identify and communicate the environments in which degradable plastics break down and the degradation processes.
3. The use of sound science.
4. The application of internationally recognised life cycle assessment [ISO 14040:2006 and 14044:2006] and other evaluation tools where appropriate to support claims.
5. That all signatories support the development and application of appropriate international performance and test standards for materials and products.
6. Industry to assist with ongoing education and the adoption of product stewardship programmes which:

- Engage consumers, government and stakeholders in product supply and recovery chains
- Provide credible information
- Create a common understanding of materials and products, how they are made, how they break down and in what environments
- Review and update knowledge and how it is communicated
- Report on activity, progress and developments

5. Commitments and Guidance

Commitments

	issue	tool/aim
Commitment 1 Clear and accurate information and labelling	Need to know what type of plastic it is	*Plastic Identification Code*[2] Certified International labelling standards
Commitment 2 To not make false claims	Need consistent interpretation of the rules to not confuse the consumer	Self declared environmental claims AS/NZS ISO 14021:2000, *Green Marketing and the Fair Trading Act Guide: 2008*
Commitment 3 Reference group	Plastics industry needs to coordinate policy and standards development	Establish reference group out of working group with cross section of stakeholders and geographical spread
Commitment 4 Education	Need to know the impacts of choices	Education about degradable plastics and infrastructure for end of life options. Update frequently asked questions.

Guidance

	issue	tool/aim
Guidance 1 Sound life cycle assessment and Design for the Environment	Incorporate lifecycle principles into design of degradable plastics. Decisions to use a degradable plastic need to consider where and how the product will degrade and the life cycle environmental impacts	Internationally recognised life cycle assessment [ISO 14040:2006 and 14044:2006] *Plastics New Zealand Plastics Design for the Environment Guidelines 2006*
Guidance 2 User's guide to materials	Key parameters that apply to end-of-life environments	PNZ will maintain a list of materials for which certification to a recognised standard for degradable plastics has been verified by a credible and independent organisation
Guidance 3 Definitions and terms	Consistent use and understanding of terms	Better understanding of commonly used terms that relate to degradable plastics

Commitment 1: Clear and accurate information and labelling

Clear and accurate information and labelling is a foundation of reliable and consistent decision making. Communities and governments rely on industry to provide clear, useful and verifiable information to help them make decisions about products in the marketplace. Communities, governments and industry also rely on regulatory agencies and courts to uphold the law when false or misleading information creates confusion amongst users or creates an uneven commercial playing field.

Plastics need to be labelled with the Plastic Identification Code go to www.plastics.org.nz.

Labelling will be in accordance of all relevant International Standards for degradable materials.

Stakeholders commit to seek and use accurate information to guide decision making.

Raw material suppliers will provide information on material performance and suitability for applications. This includes first importers of finished goods claiming degradable properties.

Product manufacturers will request, use and pass on verified information and advice on material suitability for product applications.

Specifiers and users will request, use and pass on verified information on material product performance. They will use this information to guide product design over of the whole lifecycle. This includes brand owners, product designers and retailers.

2 **Identification**: Refer to www.plastics.org.nz Need to make the products easily identifiable for visual sorting and communicate changes in / additional new products and materials with RONZ (Recycling Operators of New Zealand) www.ronz.org.nz . This will involve working at the design phase to achieve a better means of identification on the visual sorting lines at NZ recycling plants.

Commitment 2: To not make false claims

Consistent interpretation of the rules is required to not confuse the consumer. Standards have been set out in AS/NZS ISO 14021:2000 *Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)*. The objective of this standard is to harmonise the use of self declared environmental claims.

This should result in:

- Accurate and verifiable environmental claims that are not misleading
- Increased potential for the market to stimulate environmental improvements in production, processes and products
- Prevention or minimisation of unwarranted claims
- Reduction in marketplace confusion
- Facilitation of international trade
- Increased opportunity for purchasers, potential purchasers and users of the product to make more informed choices.

The New Zealand Commerce Commission has prepared the Green Marketing and the Fair Trading Act Guide, December 2008 (www.comcom.govt.nz) to educate businesses about avoiding making misleading or untrue claims about their products or services under the Fair Trading Act.

Commitment 3: Degradable Plastics Reference Group

Industry leadership is vital in not only providing and updating accurate information, but also to instil confidence with consumers, governments, industry and regulators that best practice and responsible management underpins business activity.

Plastics New Zealand commits to participating in and supporting the Degradable Plastics Reference Group with the following scope:

1. Oversight:

Oversee the guide including:

- Meeting at least two times per year, with minutes recorded, to take into consideration local and overseas developments and how these may need to be accommodated
- Maintain the guide as a living document and make it available electronically in its updated form.
- Conducting a review after 5 years (2014) and updating the guide where necessary in consultation with government and the specifiers and users of degradable plastics.

2. Advice, reference and liaison:

Coordinate PNZ's representation and provide advice to external groups including liaison with other groups where industry guidance and development is required such as recyclers and organic composters.

3. Accountability and Reporting:

Report annually on the guide, including its use and any development. The report will be incorporated into the PNZ Annual Report.

Commitment 4: Education

Customers and consumers need to know the impact of choices of degradable material including where it is sourced from, how it will perform, how to recycle or dispose of it and what infrastructure is in place to find the best end of life option.

Regular updating of the FAQ [frequently asked questions] and accessibility of this guide on the Plastics New Zealand website will help to keep the consumer better informed.

Guidance 1: Sound life cycle design

Sound design principles over a product's life cycle can play a valuable role in determining the appropriate materials, processes and resources to create a product which meets technical and environmental specifications.

Any decision to use a degradable polymer should:

- Be based on a good understanding of where and how the product may end up and how it will degrade
- Recognise and minimise life cycle environmental impacts (not just end of life)

Good design for degradability means that:

1. Degradation will occur in the right place at the right time
2. Functional and mechanical properties of the product are not compromised
3. Potential impacts on other stakeholders, including plastic recyclers and organic composters, are eliminated or minimised
4. Potential environmental impacts are identified, considered and managed
5. Additional manufacturing does not compromise the performance and degradability of the base material

6. All are informed and educated with robust and verifiable information

7. Degradability adds value against a Triple Bottom Line assessment (social, environmental and economic).

Plastics New Zealand has prepared Design for the Environment Guidelines which can be found on the website at www.plastics.org.nz. There are also internationally recognised life cycle assessment standards, for example ISO 14040:2006 and 14044:2006.

Guidance 2: User's guide to materials

A register of certified degradable materials is available at the PACIA website www.pacia.org.au.

These degradability claims confirm certification to one of the internationally recognised standards for degradable plastics.

It should be noted that as differences exist between test methods, the stringency of environmental requirements, prescribed by the different standards for degradable plastics, may also vary.

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Standards

The working group has recommended that signatories to this guide certify to internationally recognised compostability standards for degradable plastics or equivalent, consistent with recommended labelling such as EN13432, ISO17088 and AS4736.

Certification is required to one of the following internationally recognised standards:

EN13432 (Europe Standard) ***Packaging - requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the acceptance of packaging.***

The certifying bodies are AIB Vincotte and DIN Certco (refer to labels below).

AS4736:2006 (Australian Standard) - ***Biodegradable plastics – Biodegradable plastics suitable for composting and other microbial treatment***

- Biodegradability – must biodegrade 90% when tested to ISO 14855
- Compostability – no more than 10% of the original dry weight retained on a 2mm sieve after 12 weeks tested to ISO 16929
- Toxicity
  - compost quality must not be negatively affected
  - Maximum levels for certain elements
  - No ecotoxic affect on plants and earthworm

Based on EN 13432:2000

Note: as at May 2009 two plastic companies have tested against the Australian standard and the remaining companies use the international standard EN13432 as it is universally recognised. These companies have added on the Australian ecotoxic "worm" test.

ISO 17088:2008 *Specification for compostable plastics*

This standard specifies procedures and requirements for the identification and labelling of plastics, and products made from plastics, that are suitable for recovery through aerobic composting. The four following aspects are addressed:

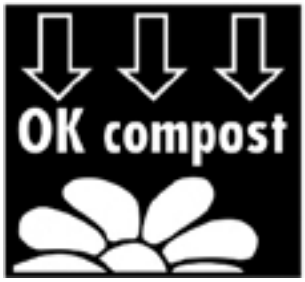
1. biodegradation;
2. disintegration during composting;
3. negative effects on the composting process and facility;
4. negative effects on the quality of the resulting compost, including the presence of high levels of regulated metals and other harmful components.

This specification is intended to establish the requirements for the labelling of plastic products and materials, including packaging made from plastics, as "compostable" or "compostable in municipal and industrial composting facilities" or "biodegradable during composting" (for the purposes of this International Standard, these three expressions are considered to be equivalent). The labelling will, in addition, have to conform to any international, regional, national or local regulations (e.g. European Directive 94/62/EC).

Labelling and declarations

AS/NZS ISO14021:2000 – *Environmental labels and declarations – self declared environmental claims*.

Examples of internationally recognised logos:



Guidance 3: Definition and Terms

These definitions and terms aim for the consistent use and better understanding of commonly used terms that relate to degradable plastics

End of Life Environments

Aerobic digestion
Degradation in the presence of air. Composting is a form of aerobic degradation.

Anaerobic digestion
Degradation in the absence of air, as occurs in dry landfills or in purpose built anaerobic digesters. Anaerobic degradation may also be referred to as biomethanisation.

Flushable
Suitable for disposal in the sewerage system by flushing down a toilet.

Freshwater
Water that is not salty.

Landfill: dry-tomb
A landfill that is constructed to restrict contact between waste, and air and water.

Landfill: other
Method of solid waste disposal, including wet cell landfills, where refuse is buried.

Litter
Scattered rubbish, not properly disposed of in landfill, recycling, composting or other formal rubbish disposal methods.

Marine water
Salt water that comes from the sea.

Mulch
Any pasteurised organic product such as a covering of straw or compost (excluding polymers which do not degrade such as plastics, rubber and coatings) that is suitable for placing on soil surfaces.

Open air environment
Any environment that is open to the surrounding atmosphere.

Plastics recycling
The recovery of scrap or waste plastics and reprocessing into useful product.

Plastic to fuels
The conversion of plastics to fuel sources such as diesel.

Septic tank
A tank in which solid organic sewage is decomposed and purified by anaerobic bacteria.

Sewerage sludge
Sludge with active, live degradation microorganisms.

Soil
The portion of the earth's surface consisting of disintegrated rock and humus.

Wastewater
Water that has been used in washing, flushing, manufacturing, etc., sewage.

Categories for Degradable Plastics

Degradable

Broadly describes plastics which are designed to break down into smaller particle sizes to a specific extent within a given time and within a specific end environment. [See AS/NZS ISO 14021:2000 – self-declared environmental claims].

Biodegradable

Any organic substance capable of being broken down by microorganisms in the presence of oxygen (aerobic) to carbon dioxide, water, biomass and mineral salts or any other elements that are present (mineralisation). Alternatively, any organic substance able to be broken down without the presence of oxygen (anaerobic) to carbon dioxide, methane, water and biomass and mineral salts or any other elements that are present (mineralisation).

Compostable

Any organic substance capable of being broken down by microorganisms in the presence of oxygen (aerobic) to carbon dioxide, water, biomass and mineral salts or any other elements that are present (mineralisation) with the additional requirement of a time constraint and meets the requirements of EN13432, ISO17088 or AS4736-2006.

Note: the difference between biodegradable and compostable rests purely with time constraints and presence of impurities which requires the introduction of standards.

Compost

A mixture of various decaying organic substances, such as dead leaves or manure, used for fertilising soil. The NZ standard NZS 4454:2005 defines compost as: *Organic matter that has undergone controlled aerobic composting to achieve pasteurisation, stability and maturity. Compost has at least 95 % by mass of material that has passed a 20 mm sieve.*

Compost - commercial

Compost produced in an industrial scale compost plant, a feature of which is the controlled and sustained elevation of temperature.

Compost - home

Compost produced in a small scale home composting system which is usually less managed than a commercial facility and thus tends not to achieve sustained elevated temperatures.

Oxodegradable

A multi-stage degradable plastic which breaks down first by oxidation to a size that can eventually be attacked and digested by microorganisms under certain conditions (NB: no standard definition currently exists).

Photodegradable

A plastic capable of degradation by ultraviolet radiation degrading the chemical bond or link in the polymer or chemical structure of a plastic.

Prodegradant

An additive that accelerates a degradation process.

Water soluble

Capable of dissolving in water under specific conditions.

Material types and sources

Thermo-plastic starches

Thermoplastic starches have a starch (amylose) content greater than 70% and are based on gelatinised vegetable starch and, with the use of specific plasticising solvents, can produce thermoplastic materials with inherent biodegradability.

Polyesters

Polymers with ester groups in their backbone chains. All polyesters degrade eventually, with hydrolysis being the dominant mechanism. Degradation rates range from weeks for aliphatic polyesters (e.g. polyhydroxyalkanoates) to decades for aromatic polyesters (e.g. PET).

Starch Polyester blends

Starch-based polymers which are blended with high-performance polymers, such as polyesters to achieve the necessary performance properties for different applications.

Renewable sources

Sources of raw material from which plastics may be produced which are able to be replaced by new growth.

Performance Standards and protocols

ASTM - American Society of Testing and Materials.

EN European Standard.

Environmental claim verification[3]:

Confirmation of the validity of an environmental claim using specific predetermined criteria and procedures with assurance of data reliability.

Environmental Impact[4]

Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities or products.

ISO - International Standards

A standard published by the International Organisation for Standardisation and commencing with ISO (e.g. ISO 16929).

Material Selection Information

Information available to consumers that describes the qualities and applications of a material and may aid selection of an appropriate material for a particular purpose.

Performance Standard

A standard that references one or more test standards and stipulates the results required.

Self-declared environmental claims – refer to ISO14021:2000

Environmental claims that are made, without independent third-party certification, by manufacturers, importers, distributors, retailers or anyone else likely to benefit from such a claim.

Test Standard

A standard that sets out a method for testing a characteristic of a degradable plastic, but that does not indicate what result is required when performing that test.

3 Refer ISO 14021:2000
4 Refer ISO 14021:2000

6. Frequently Asked Questions

1. What are degradable plastics?

Degradable plastics are designed to breakdown over specific timeframes either biologically or mechanically. The defining characteristic is the time [minutes, months, years] it takes to degrade and this determines composting ability as well as reuse and recovery. The length of time depends on the type of degradable material, the end environment, and the conditions it is exposed to including light, heat, microorganisms and water. International composting standards [EN13432, ISO 17088 and AS4736] have been developed to give a timeframe within which the material must degrade in order for it to be labelled as 'compostable'.

2. Are all biodegradable plastics compostable?

No. All compostable plastics are biodegradable [biologically degradable], however, not all biodegradable plastics are compostable within the timeframes or conditions stipulated in the relevant international standards for compostability.

3. Are all degradable plastics made from renewable resources?

No. It is important to understand that biodegradable and non-biodegradable plastics can both be made from biobased/ renewable resource materials as well as from synthetic (petrochemicals – fossil fuel) resources.

4. What are the main types of degradable plastic and how do they differ?

Degradable plastics fall into **two distinct categories.** The ***first category*** is made up of plastics which are compostable according to international standards and are typically biologically degradable and so readily attacked and digested by microorganisms early on in their degradation process (within the timescales of the standards). Within this category are home compostable and commercial compostable options.

The ***second category*** is made up of plastics that are NOT compostable according to international standards and typically take longer times to degrade. They are typically degraded by a longer multi-step, sequential, process. For example, such a plastic would be (1) first broken down mechanically by chemical attack involving water, air (oxygen), or ultra violet light (sunlight), often with the help of additives which accelerate this chemical attack. Then, in a second step (2) the result of this initial breakdown may provide, ultimately, a small enough size for attack and digestion by microorganisms. Only this second step can be termed "biodegradation".

Plastics which fall into the second category will eventually under go biological degradation after mechanical degradation, but not within the time/temperature constraints required by current commercial composting systems and standards.

5. What is meant by compostable plastics?

Compostable plastics are those that comply with a recognised composting standard. The most common standard is the European Industrial Standard EN13432. For a list of the plastics independently verified to conform to known composting standards, in this case EN13432 and the Australian standard AS4736:2006, go to www.pacia.org.au. In the future plastics will be verified to ISO 17088.

6. Will compostable plastics decompose in my home compost bin?

Only if it meets the home composting standard e.g. EN13432 (home OK compost). Home composting conditions are different (lower temperature) to commercial composting conditions. There are separate testing procedures, certification and labelling systems for each.

7. Is biodegradable plastic packaging suitable for home composting?

Typically not, unless the packaging is labelled as suitable for home composting according to international standards.

8. What are the end products of biodegradation and do they have any harmful effects on the environment?

The end products of biodegradation carried out in the presence of air (oxygen) are carbon dioxide, water, mineral salts, and biomass. In the absence of air (oxygen) these products are methane, carbon dioxide, biomass, and mineral salts.

This is one of the reasons for having standards as they determine if biodegraded products qualify for use as compost. These standards look for any side effects from the residual material such as soil fertility and the ability of worms to survive.

9. What are oxodegradable plastics? Are these different?

Oxodegradable plastics are one of a number of materials that fall into the second category of degradable plastics. They are conventional commercial plastics manufactured from petrochemicals (such as polyethylene) with metal and/or other additives (prodegradant) which are designed to accelerate degradation under defined conditions of time, temperature, heat and oxygen (air) and ultra-violet light. Attack by oxygen results in the plastic degrading to a size that can eventually be attacked and digested by microorganisms under certain conditions. In the case of current oxodegradable plastics, this two step process does not meet current commercial or home composting standards (time, heat, air, and water).

10. Is it true that the use of oxodegradable plastics leave residual plastic particles in the soil?

Yes, as it does not meet the composting standards as described in EN13432. [Refer to Q4]

There is ongoing research into this area and this document will be updated accordingly.

11. Is it true that oxodegradable plastics will leave residual plastic particles in the oceans and on the seashore?

Yes. Over a prolonged period, the action of sunlight would cause the prodegradant-containing plastic to photodegrade to the point where a product, such as a plastic shopping bag, would disintegrate into smaller and smaller pieces, possibly culminating in non-visible-sized litter. Non prodegradant-treated plastic would typically not degrade under these conditions in the same exposure period.

12. Can oxodegradable plastics be composted?

They do not meet the EN13432 composting standard.

13. Do oxodegradable plastics degrade in landfill?

No. Degradation is not beneficial to landfill sites. [Refer to Q16]

14. Can oxodegradable plastics be used as fuel?

Yes. The presence of the prodegradant additive does not interfere with the way in which polyethylene or polypropylene will burn in a commercial incinerator. Please note plastic is not suitable for burning in domestic fires.

15. Is it better to buy products in "biodegradable" plastic packaging?

Unless the packaging has to be biodegradable to do its job, it's unlikely that biodegradability would impart an advantage. The indiscriminate promotion of the biodegradability of packaging could result in increased littering. There's widespread misconception in the market that if it is biodegradable, then it must be better for the environment than if it is not biodegradable. This is generally misleading. Some people think that if something is biodegradable, it is therefore more sustainable. Not necessarily. Not all biodegradable/compostable plastics are made from renewable resources. [Refer to Q17]

16. Is biodegradable plastic better in a landfill than ordinary plastic?

If disposal to landfill is the only disposal option, most people think something that will "biodegrade" in the landfill is better than something that won't. The reality is the opposite. Unless a landfill is specifically designed to be a bio-digester, intended to generate captive methane from the anaerobic digestion of organic waste and use the methane as fuel, it's much better that the landfill acts as an inert tomb where nothing degrades. That means you have a physically stable landfill without the risk of subsidence and damage to any structures built on the mature land fill site. It also means that the landfill doesn't produce harmful methane gas which, if it is allowed to escape to the atmosphere, is about 25 times more damaging a greenhouse gas than carbon dioxide.

17. Since in most localities in NZ to date, "bioplastics" are not accepted for kerbside collection as a recyclable, then surely I'm better to make my bottle from PET, which is recyclable and therefore more sustainable?

When thinking about the larger issue of environmental impact, it's important to think about the whole lifecycle of the product from design through to disposal. It is better to take a full 'lifecycle' approach (considering design, raw materials, manufacture and use) than simply focus on options when you have finished using the product and its packaging [See question 19]. For more information refer to the ***Plastics New Zealand Design for the Environment Guidelines*** and Appendix 1: ***Managing the Transition: Degradable Plastics in New Zealand – A Guide and Industry Commitment***. www.plastics.org.nz

18. If PLA packaging ends up as litter in a natural water way, how quickly will it biodegrade?

PLA (polylactide) is a member of the polyester plastic family, but based on a renewable resource. For a PLA bottle to break down quickly, you need moisture and elevated temperature. In a natural water way, you'll only have one out of two. Generally, the average temperature day and night will be at a level which would mean biodegradation would take between 2 and 4 years, maybe longer.

19. Can bioplastic packaging be recycled in New Zealand?

In New Zealand bioplastic packaging is currently not accepted in recycling and commercial composting systems. For this situation to change it will require a sufficient volume of bioplastic in the marketplace to ensure the recovery infrastructure can collect it. As with other plastics the implementation and observance of appropriate labelling and collection-sorting facilities can help prevent cross-contamination of plastics recycling streams. Contact the signatories to this guide, ***Managing the Transition: Degradable Plastics in New Zealand – A Guide and Industry Commitment***, for further information.

20. Can degradable plastics interfere with existing recycling systems?

Yes, when recycled degradable plastic is mixed with non degradable plastics this will reduce the performance and life of the final product. [Refer to Q19]

21. Why is it that a plastic bag labelled "100% biodegradable" has not degraded even after prolonged exposure to the weather?

Claims of "100% degradability" or "100% biodegradable" should include a reference to an international standard or the specific time, temperature, water, air exposure conditions required for that claim to be true.

22. As a consumer how do I dispose of plastic bags which are labelled as 'degradable'?

Plastic bags claiming to be 'degradable' cannot be expected to break down under the conditions used in current commercial composting, unless clearly certified as compostable according to international standards, and, if not able to be composted, are recommended to be disposed of as rubbish to landfill.

23. Where do I send my biodegradable plastic waste for composting?

Only plastics meeting international composting standards can be technically considered for composting in New Zealand. At this stage, due to cross-contamination with other plastics, many commercial operators do not want to accept biodegradable plastic as it has the potential to compromise the quality of the final product.

24. What is a realistic time frame for all plastic products to be made from clean, fully sustainable materials other than oil?

This is not likely to occur in the foreseeable future. The current production of bioplastics is less than 1% of global plastics and is expected to possibly increase to between 2-5% by 2012. This volume is small in comparison to conventional polyethylene, which is the plastic most commonly used to make commodity products such as shopping bags. It will take some time before polyethylene is replaced by an alternative plastic based on a sustainable feedstock from a renewable resource. Major plastic manufacturers throughout the world continue to research alternatives and new plastics regularly enter the market.

25. What is the difference between 'renewability' and 'sustainability'?

Sources from which plastics can be produced are 'renewable' if they can be replaced by natural processes e.g. new plant growth. If these sources are under competitive pressure for use as food or other uses they may not be 'sustainable'.

26. Are there plastics made from renewable resources that are durable?

Yes, bioplastics strengthened with glass and natural fibres are used in furniture and many non packaging applications where durability is a key feature. For example replacing large metal components in automobiles and other modes of transport with bioplastics has led to major reduction in vehicle weight and an increase in fuel efficiency.

27. Will degradable plastics change the amount of litter or people's littering behaviour?

- Littering is a complex problem created by consumer behaviour, the type of product and packaging and unsuitable infrastructure including bin type, type of container, location and recovery services.
- It is unclear that introducing degradable plastics will change consumer behaviour, and consequently, the amount of litter in the environment.
- There are some concerns that people who are currently likely to litter, would still litter, or may litter more, if they believe that the product will degrade.
- Overall, addressing litter and littering is best managed through a combination of education, infrastructure and enforcement of suitable regulations.

Successful legal action has been taken by the Australian Competition and Consumer Commission (ACCC) against a company that made misleading claims. The court declared *"the company had engaged in false or misleading conduct or conduct likely to mislead or deceive, misrepresented the benefits and performance characteristics of the bags and misled the public on the nature and characteristics of the bags".* The court prevented the company from *"promoting that the bags biodegrade, disintegrate or will be of benefit to the environment, unless it has independent scientific evidence to support such claims".*

Source: ACCC Consumer Express July 2004 and Green Marketing and the Trade Practices Act, ACCC 2008

7. Appendix: Classifying Degradable Plastics

Plastics can be degraded through several mechanisms and on different scales. Two common scales of degradation are:

(a) the degradation of a plastic structure or form, such as a bottle or film, which essentially disintegrates into smaller pieces – this is the break down of the physical structure or form, and,

(b) degradation on a molecular scale where the polymer chains (molecules) break down, resulting in a lowering of molecular weight, generating smaller molecules. (www.plastics.org.nz)

Degradation can be initiated via a chemical mechanism (for example induced by oxidation, hydrolysis, UV exposure/weathering, dissolution, etc), physical/mechanical destruction, or via biodegradation, which involves breakdown via the specific action of microorganisms (bacteria, fungi, yeasts).

Often there will be a chemical or mechanical degradation before biological degradation can occur.

Whereas many common plastics **are designed to be durable**, some ***are designed to be degradable***. There are various ways of classifying degradable plastics and it is important to consider the nature and environmental effects of the degradation products, and also the timescales of degradation, particularly when referring to biodegradation and when considering end of life disposal options. It is also important to understand that biodegradable and non-biodegradable plastics can both be made from biobased or renewable resource materials (RRM), and from synthetic (fossil) resources. One way is to classify four groups within the umbrella of degradable plastics is:

(1) **biobased biodegradable/ compostable plastic**s are plastics made from renewable resources (i.e made from RRM : renewable resource materials) such as starches, proteins, and certain biopolyesters such as polylactic acid (PLA; when the lactic acid is sourced from a renewable resource) which can biodegrade under certain conditions. Often, for many bioplastics this will occur via a biodegradation mechanism early in the degradation process and many are compostable according to international standards. However, not all plastics referred to as bioplastics, i.e. where the term refers to those plastics derived from renewable resources, are necessarily compostable or biodegradable.

(2) **synthetic biodegradable/ compostable plastics** are plastics derived or partially derived from petrochemical derived monomers (or non-renewable resources) and yet are designed to degrade via a biodegradation mechanism early in the degradation process and are compostable according to recognised standards . This includes, for example, certain polyesters (e.g. polysuccinate esters (where the succinic acid is derived from non- renewable resources, polycaprolactone). Some can be made from either synthetic or renewable resources. They are sometimes also referred to bioplastics because of their ability to be composted and to biodegrade according to recognised testing standards.

(3) **Conventional plastics**, traditionally made from fossil sources (e.g. petrochemicals), such as polyethylene, (but which may also potentially come from renewable resources in the future) can be formulated with an additive which will promote or accelerate degradation of the polymer chains under certain (typically oxidation) conditions. The additive is a **prodegradant** and the formulated plastic is an **oxodegradable plastic**. Over time the plastic will disintegrate and will degrade or gradually break down into smaller chains to a size that can eventually be attacked and digested by microorganisms under certain conditions.

(4) **Blends or hybrid materials** which are mixtures of degradable plastics with typically non-degradable plastics. For example, starch–polyethylene blends are a mixture of a biodegradable (starch) component with a typically non-degradable (polyethylene) component. Such materials will probably disintegrate and the degradable plastic component will degrade, with its chains breaking down, while the non-degradable plastic chains will persist.

In order to claim to be compostable all degradable plastics must be certified to an international standard such as EN13432 or ISO17088. This does not necessarily mean that compostable plastic can be composted at home.

There are other ways of classification e.g. using terms such as photodegradable, but the above encompasses the current, more commonly encountered categories.

Note on Bioplastics

Bioplastics are typically defined as either:

(a) plastics which are compostable according to recognised testing standards (e.g EN13432), whether based on renewable (biobased) or non-renewable (fossil) resources,

or

(b) plastics which are based on renewable resources, whether compostable or not. (Thus polyethylene where the ethylene is derived from a renewable resource may be referred to as a bioplastic).

Note on Organic Recycling

Organic recycling encompasses both composting (aerobic treatment) and biogasification (anaerobic treatment, producing methane). Compostability is tested within a defined timescale according to recognised standards and conditions.

End of Life Options

The preferred end of life option is recycling both physical and chemical recycling.

Depending on the plastic itself, and the additives and formulations, some degradable plastics can be recycled again as a plastic (e.g. most polyesters), if degradation has not been significantly initiated or triggered and, usually, if it is reasonably pure. Recycling as a plastic is essentially using the end-of-life plastic directly as a feedstock plastic in another manufacturing process. Often it is also called mechanical recycling.

Some plastics can be composted (some in home composting, some only in industrial composting, as measured by specific testing standards).

Some plastics will be degradable in the environment (soil, water/marine). Some will degrade in waste water, sewage or bio-waste treatment processes.

Some plastics can be combusted (for energy/thermal recovery), or, they can be sent to landfill or incinerated under industrially controlled conditions.

Other options are emerging through research.

Infrastructure - Of course the actual or realistic options will depend on the local logistics, the facilities available, and the conditions operating in the facilities, as well as market-drivers. For example PLA can only be recycled as a plastic if it is collectable. Similarly it can only be composted if suitable (operating with certain minimum conditions) composting facilities are in place.

The rate of degradation is important as are, also, the nature and environmental effects of the products of degradation processes. The method of disposal has to be consistent with the rate of degradation of material in the process, such that accumulation is controlled. The end products of the disposal should be safe and not negatively impact on the disposal process, or on the use of the end products of that disposal process.

As to whether a particular plastic can be labelled as compostable this depends on whether they have been tested according to recognised international standards (e.g. EN13432).

Increasingly, Life Cycle Assessments (LCA) are also becoming an important factor in categorising plastic products. Again international standards are in a place to enable assessments of the environmental profiles and performance (CO_2/other emissions, energy consumption etc) of plastic products. There is also a recognised standard for renewable carbon content in a material.

The difference between biodegradable and compostable rests purely with time constraints and the presence of impurities. This requires the introduction of standards.

8. Signatories

The initial signatories are listed on the last two pages of this Guide.

An electronic register of signatories is also maintained by Plastics New Zealand containing the following information for each entry:

- Organisation
- Date signed
- Name of signatory
- Position in organisation

Admission of new Signatories

Stakeholders who are not signatories to this Commitment, but who are willing to make the commitments set out in the Guide, may apply to become signatories by applying to the Degradable Plastics Reference Group. Approval will not be unreasonably withheld or delayed.

Applications will be reviewed by the Degradable Plastics Reference Group which is authorised to admit new signatories.

The name of the new signatory organisation will be included in the list of signatories on the Plastics New Zealand website and in annual reporting.

De-listing of Signatories

Signatories are expected to honour the Commitments set out in this document and as they are added to or updated. Signatories who, in the assessment of the Degradable Plastics Reference Group, have not met their commitments, and are not demonstrating dedicated effort to meet these commitments, may be removed from the list of Signatories.

Concerns regarding signatories can be raised in writing to the:

Degradable Plastics Reference Group
c/- Plastics New Zealand
P O Box 76 378
Manukau City
New Zealand

Signatories as at July 2009

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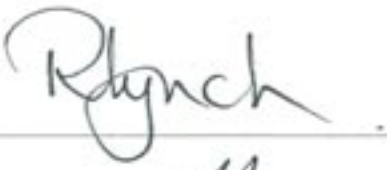

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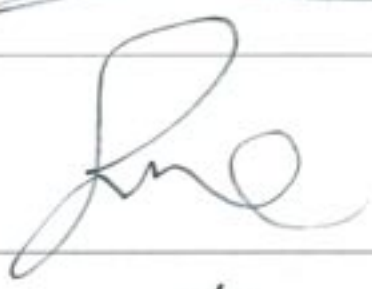

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