Industry Overview

POLYMORPHOUS POLYMERS

MOVING TOWARDS CONSENSUS ON DEGRADABLE PLASTICS

Research, testing and product development are coming together to give consumers some very clear and commercially available choices for compostable bags and other products.

David Riggle

Bags with degradable and biodegradable qualities are moving into commercialization.

CATCHING UP is a good description of what's been happening in the world of degradable polymers. When first commercially introduced in the late 1980s, the potential usefulness of plastic products that would not persist in the environment was immediately apparent — and attractive — to composters and solid waste managers, especially as a replacement for the ubiquitous polyethylene garbage bags commonly used for household trash. People wanted to believe that degradable plastics worked, but there were misconceptions about their performance on all sides. Adequate research and development had not been completed, and the field of biodegradable materials was so new that there were no universally accepted definitions and standard testing methods had yet to be established. (see "Degradables Tested in Compost Programs," *BioCycle*, Oct. 1989).

Fortunately, most of that has changed. Today, there are indeed a number of truly biodegradable polymers that will fully mineralize in compost within a reasonable amount of time, and researchers and manufacturers are continually improving their ingredients and formulations. A variety of products made with these polymers are commercially available. This article will focus primarily on bags used for the collection of yard trimmings, food residuals and other organics, but cutlery, plates, agricultural film, loose fill packaging and other items also can be found. (For the purposes of this article, "biodegradable" bags are a subset of "degradable" bags. In other words, all these bags degrade, but not all biodegrade. See sidebar "Defining the 'D' Word." Although production of both degradable polymers and products made with them have yet to scale up to levels that would make them cost competitive on a pound-to-pound basis with nondegradable polymers like polyethylene, even that is changing and the next few years could see prices drop to their lowest levels yet.

A COMMON GROUND

One of the most significant stumbling blocks for the first manufacturers and users of degradable polymers was that a defined vocabulary based on standardized and accepted test methods didn't exist. Few agreed what critical terms such as "degradable," "biodegradable," and "compostable" meant

> The requirements a material must satisfy through the appropriate test methods if it is to be termed "compostable" include mineralization (i.e., biodegradation to carbon dioxide, water and biomass), disintegration and environmental toxicity.

when they were applied to specific products, or how one would determine if the products performed as they were supposed to. While truly worldwide agreement on such a vocabulary still is not firmly in place, it's not far away. Even better is that continued movement towards such a goal is now recognized by researchers, manufacturers, marketers, legislators and consumers as a necessary prerequisite to further progress.

Perhaps the two most widely cited sources for degradable vocabulary and methodology are The American Society for Testing and Materials/Institute for Standards Research (ASTM/ISR) and its somewhat analogous counterpart, the European Committee for Standardization (Comité Européen de Normalisation or CEN). In 1991, ASTM/ISR created the Advisory Committee on Degradable Polymers (ACDP), which included representatives from industry associations, the U.S. Army and corporations such as Cargill, Procter & Gamble, Novon International and others. Over a period of several years, ACDP examined the behavior of degradable polymeric materials and devised a three-tiered testing strategy for assessing their compostability (see "Assessing the Degradability of Polymeric Materials," p. 71). In 1996, *A Standard Guide to Assess the Compostability of Environmentally Degradable Plastics* (ASTM D 6002-96) was issued, which documents validated test methods that can be used to generate the evidence needed to support environmental claims.

The CEN, which includes representation from the national standard bodies of European Community (EC) members, prepares European standards that are then published as national standards in each of its member countries. CEN's "Requirements for packaging recoverable through composting and biodegradation — Test scheme and evaluation criteria for the final acceptance of packaging" (CEN TC261 SC4 WG2) currently is in final draft form and is widely expected to be adopted and passed into legislation throughout the EC over the next couple years.

Although the myriad technical details contained in both the ASTM/ISR and CEN reports are too complex to be fully discussed here, their definitions for degradable, biodegradable and compostable are listed (see sidebar "Defining The 'D' Word"). Perhaps the key component of both — from a composter's perspective — are the requirements a material must satisfy through the appropriate test methods if it is to be termed "compostable." These include evaluating rate and extent of mineralization (i.e., biodegradation to carbon dioxide, water and biomass), disintegration and environmental toxicity.

Regarding ASTM's bottom line criteria, the clearest and most succinct summary to

DEFINING THE "D" WORD

DEGRADATION, in the world of composting and microbiology, refers to a reduction of the chemical complexity of compounds in organic matter. In terms of how plastic bags break down in a compost vessel or windrow, definitions being used by ASTM/ISR[1] and CEN[2] may shed some light on what certain critical words mean in this specific context.

DEGRADABLE TERMS

Degradable: "A material is called degradable with respect to specific environmental conditions if it undergoes a degradation to a specific extent within a given time measured by specific standard test methods."

Degradation: "...an irreversible process leading to a significant change of the structure of a material, typically characterized by a loss of properties (e.g. integrity, molecular weight or structure, mechanical strength) and/or fragmentation. Degradation is affected by environmental conditions and proceeds over a period of time comprising one or more steps."

Disintegration: "The falling apart into very small fragments of packaging or packaging material caused by degradation mechanisms."

Degradable plastic: "A plastic designed to undergo a significant change in its chemical structure under specific environmental conditions, resulting in a loss of some properties that may be measured by standard methods appropriate to the plastic and the application in a period of time that determines its classification."

BIODEGRADABLE TERMS

Biodegradation: "...a degradation caused by biological activity, especially by enzymatic action, leading to a significant change of the chemical structure of a material."

Biodegradable plastic: "A degradable plastic in which the degradation results from the action of naturally occurring microorganisms such as bacteria, fungi and algae."

Inherent biodegradability: "The potential of a material to be biodegraded established under laboratory conditions."

COMPOSTABLE TERMS

Compostable: "Capable of undergoing biological decomposition in a compost site as part of an available program, such that the material is not visually distinguishable and breaks down to carbon dioxide, water, inorganic compounds and biomass, at a rate consistent with known compostable materials."

Compostability: "... a property of a packaging to be biodegraded in a composting process. To claim compostability it must have been demonstrated that a packaging can be biodegraded and disintegrated in a composting system (as can be shown by standard test methods) and completes its biodegradation during the end-use of the compost. The compost must meet the relevant quality criteria. Quality criteria are e.g. heavy metal content, no ecotoxicity, no obviously distinguishable residues."

Compostable plastic: "A plastic that undergoes biological degradation during composting to yield carbon dioxide, water, inorganic compounds and biomass at a rate consistent with other known compostable materials and leaves no visually distinguishable or toxic residues."

[1]ASTM/ISR. Standard Guide for Assessing the Compostablility of Environmentally Degradable Plastics.

[2]CEN. Requirements for packaging recoverable through composting and bidegradation; Test scheme and evaluation criteria for the final acceptance of packaging.

date comes from The Society of the Plastics Industry's Degradable Polymers Council (DPC), an industry group representing producers of degradable polymers. "It is the position of the DPC," says a February, 1998 statement, "that collection bags claiming to be 'biodegradable' and 'compostable' should, at a minimum, satisfy ASTM tests showing conversion to carbon dioxide at 60 percent for a single polymer and 90 percent for other materials in 180 days or less, and leave no more than 10 percent of the original weight on a three-eighths-inch screen after 12 weeks."

In Europe, the end results look as though they will be much the same. The CEN draft cited above says that for a packaging material to be accepted as "organically recoverable," it must first be determined to be "inherently and ultimately biodegradable." In addition, a minimum of 50 percent of its total solids should exclude "largely inert" materials, and it must contain no hazardous substances. For materials that consist of only one polymer with no other additives, the degree of biodegradation based on carbon dioxide release or oxygen consumption (which includes the transformation of carbon into biomass) must be 60 percent or more in a test period lasting no more than six months [e.g. 180 days]. For polymer blends and copolymers with additives, the percent of biodegradation must be at least 90 percent. When examining disintegration, "a maximum of 10 percent of the original dry weight of a packing material may be retrieved in >2 mm (.078 inch) fraction of the compost after 12 weeks." CEN also notes

According to IBPMA, the biodegradables industry wants to give a clear signal to legislators, waste management, retailers and consumers that one standard, one set of criteria, one certification system and one logo for biodegradable and compostable products are acceptable.

Table 1. Degradable polymer developers, trademarks and bag makers*

Polymer Developer	*Trademark Name(s)*	*Key Components*	*Bag Maker/ Marketer*	*Other*
Bayer	BAK 1095	Polyester amide	–	[1]
BioPlastics	Envar	Starch and polycaprolactone	Grand River Technologies	–
Cargill Dow Polymers	EcoPLA®	Polylactic acid	Duro Bag Mfg. Co.	[2]
Chronopol	Heplon™	Polylactide	–	[3]
DuPont	Biomax®	Polyester, copolymer	–	[4]
Eastman	Eastar Bio™ Copolyester 14766	Polyester made of conventional diacids and diols	–	[5]
EPI	DCP™	Polyethylene + additives (not a Masterbatch)	Technicoat; Symphony Environmental Ltd.; Sera Trade	[6]
Indaco	Bio-Solo™	Recycled PE + activators	Indaco Mfg. Ltd.	[7]
Monsanto	Biopol™	Polyhydroxy butyrate/ valerate copolymer [8]	WalkiWisa (Europe) Monsanto Japan (Japan)	–
Novamont	Mater-Bi™	Cornstarch + polycapralactone	Biocorp, Inc. (N. America)	[9]
Novon Intl.	DegraNovon®	Polyolefine + additives	CES, Inc. (MA) Petoskey Plastics (MI) Compost 2000 (Canada)	[10]
Planet Polymer Technologies	EnviroPlastic® C	Polycaprolactone-based resins (no starch or polyethylene)	–	[11]
Showa Highpolymer	Bionolle®	Aliphatic polyester	Showa Denko	[12]
Technicoat	Tech-No-Bag™	Polyethylene + additives	Technicoat Ltd.	–
Union Carbide	TONE® P-787	Polycaprolactone	–	[13]
Willow Ridge	Polystarch®	Polyethylene +starch	–	[14]

**Unless otherwise noted, polymers are commercially available in U.S., Europe and Japan.*
[1]Bayer has several products in testing and another polyester amide (BAK 2195) in development.; [2]ECOPLA is only commercially available in the U.S.; [3]Chronopol is not actively marketing; [4]DuPont is working on commercializing products such as agricultural mulch film; bags to protects fruit on trees and coated paper for packaging; [5]Eastman has products under development; [6]EPI also has landfill covers made with DCP; [7] Indaco also is working on agricultural mulch film; [8]The polyhydroxybutyrate/valerate copolymer sometimes is more broadly referred to as polyhydroxyalkanoate. [9]Biocorp also has cutlery and other products; [10]Polyolefines are "any of a group of thermoplastic, stiff, light and hard polymers obtained from the polymerization of simple olefins." Olyethylene and polypropylene are the two leading polyolefines; [11]Planet Polymer has products under "commercialization development" for its several polymers that are designed for "personal hygiene, agro-technology and medical disposable markets."; [12]Bionolle resin is available globally, but bags are only available in Europe and Japan.; [13]Tone is used as a raw material by around half a dozen manufacturers worldwide.; [14]For availability of trash bags, mulch and agricultural films, golf tees, bottles, etc., contact Willow Ridge.
Note: This listing is not intended to be exhaustive but is based primarily on responses to a BioCycle survey of known companies. Thanks to Judy Purman of The Linden Group for research and organizational assistance.

that special attention should be given to how the end product looks and that "the visual contamination of the compost may not be significantly increased by residues of the packaging material after composting."

In terms of environmental toxicity, ASTM guidance states that "the plastic product (being tested) should not cause any negative ecotoxicological effects on the resulting compost," and suggests a series of terrestrial and aquatic tests that can be performed. CEN requires analytical and biological quality control testing on the resulting compost that would fulfill European and/or national requirements, but the current draft standards also note that "...it may be necessary for a better evaluation of any possible environmental risk attaching to the compost produced to establish more or better criteria on compost quality in the future... Test methods for this special purpose and the pass levels required .... are, however not yet established and need to be elaborated."

Just as the DPC agreed to accept ASTM standards, significant support for the CEN standards has been indicated by the International Biodegradable Products Manufacturers Association (IBPMA) in Brussels, an organization incorporated as a nonprofit in 1996 to represent the industry and assist with the commercialization of products made with biodegradable polymers. Members include companies and research groups in Europe, Japan and the U.S. "The IBPMA will support the CEN methodology for the assessment of compostability in Europe," says the association, noting that even though the CEN standard will still have to go through a number of lengthy administrative processes before it will end up in legislation, the close collaboration between the CEN and various national standardization institutes in Europe has "led to a very high degree of agreement already. ... The biodegradables industry wants to give a clear signal to legislators, waste management, industry, retail and the consumers that [it] accepts voluntarily one standard, one set of criteria and test methods, one certification system and one logo for biodegradable and compostable products."

POLYMER PRODUCERS

Such movement towards uniformity and agreement may be one of the factors that has been encouraging a number of new players to get involved, but the industry itself also is maturing. Products are getting more sophisticated and applied research seems to be picking up rather than slowing down. Whatever the reasons, it's been a busy couple of years for the companies involved. As reported previously (see "Unraveling the Biodegradable Plastics Maze," *BioCycle*, Nov. 1995), mergers, partnerships and acquisitions still are common. Since 1995, even more multinational corporations appear to be surfacing with long standing research and development efforts that are moving into commercialization.

Bayer Corporation, for instance, announced in September, 1997 that it was making its new polyester amide BAK 1095 available in the United States, Europe and Japan. Developed by scientists at Bayer AG, the worldwide chemical and pharmaceutical company based in Leverkusen, Germany, the polymer was tested in Europe and at municipal composting sites in Pennsylvania, according to Josef Hirschmann, technical marketing specialist for Bayer. Bags for yard trimmings collection are one of the company's initial applications, but cutlery and trays also are being tested. Another similar polymer, BAK 2195, is under development but only is available in sample quantities at present.

Standardized testing procedures for assessing the degradability of polymeric materials suggest a combination of quick screening, lab and pilot-scale tests, and full-scale field trials.

Likewise, DuPont, which has a 200 million lbs/yr production facility in Tennessee for its Biomax polyester copolymer, is establishing its presence in the field. Although the company is not currently looking at the lawn/leaf bag market, products under development include agricultural mulch film, coated paper for packaging and other applications.

In Milan, Italy, the agrochemical company Montedison (The Feruzi Group) sold its Novamont unit to a group of commercial banks including Banca Commercial Italiana and Investori Associati II in 1996. Novamont is the creator and manufacturer of Mater-Bi polymer, which entered the marketplace in 1992 and is used in bags, cutlery and other products. According to the company, its production capacity doubled in 1997 to meet "continued growing demand," and it created Novamont GmbH in Germany to expand its European market. In a related consolidation move, Novamont recently announced that it had reacquired all of the pioneer patents related to its "starch-based thermoplastic material technology," some of which had been jointly held with Warner-Lambert and subsequently were

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POLYMER DEVELOPERS AND TRADEMARK NAMES

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Cargill Dow
Polymers LLC
Steven A. Mojo
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Minneapolis, MN 55440
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(EcoPLA, Renewable
Polymers)

Chronopol, Inc.
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(Heplon)

Dupont
Customer Service
1002 Industrial Rd.
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Eastman Chemical B.V.
Flexible Plastics EMEA
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jberting@eastman.com
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(Eastar Bio copolyester)

EPI Environmental
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(Degradable Compostable
Plastic-DCP)

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sold by Warner-Lambert to Novon International in 1995. Biocorp, Inc., based in Redondo Beach, California, became the exclusive North American distributor for Mater-Bi in 1997 and has been aggressively promoting its reSource bags, cutlery and other products. In January, 1998, Biocorp opened seven regional offices throughout the United States as well as a Canadian subsidiary with two locations.

A significant development in the past year is the November, announcement that The Dow Chemical Company and Cargill formed Cargill, Dow Polymers LLC, a 50/50 limited liability company, to develop and market polylactic acid (PLA) polymers. "We are excited about our alliance with Cargill and the potential this new polymer offers," says Kathleen Bader, vice president of polystyrene with Dow. Pete Hawthorne, general manager of emerging businesses at Cargill, adds: "Cargill brings process technology and a low cost manufacturing position for lactic acid and PLA resins, as well as a strong patent portfolio of critical technology. Dow's polymer science, applications technology and access to a global customer base will help accelerate the commercialization of these new materials." Key application areas targeted for PLA polymers include cast films, fibers, blown films, rigid containers and paper/board coatings.

Cargill Dow Polymers says it plans to double its capacity for PLA polymers to 16 million pounds by the end of 1998 at a PLA resin manufacturing facility near Minneapolis. If justified by market demand, the company hopes to have a "world-scale production facility" by 2001.

PRODUCTS ON THE PROGRAM

The various producers of polymers are summarized in Table 1. There are two broad categories of products on the market. "First generation" degradable polymers start with polyethylene and build in a degradability factor that can be either sensitive to light (photodegradable), heat (thermodegradable) or water (hydrodegradable). Starch may be added between the long polymer chains through grafting or other bonding methods. With technological advances, some of these products are quite sophisticated today, combining timed release of photo- and thermodegradable components with starch-filled attributes and other additives that trigger and/or accelerate the degradation process. Products for the marine environment, agricultural films, disposable six-ring can holders and numerous other applications are available. When the product in question is a bag containing material to be composted, the starch component of bags made with these technologies can be broken down by microorganisms and mineralized. However, most scientists agree that any polyethylene contained in the bags — while it may be reduced to minute fragments — will not biodegrade at all in an amount of time considered relevant by the ASTM and CEN standards mentioned above (see Table 1 in "Assessing the Degradability of Polymeric Materials," p. 74).

"Second-generation" biodegradable polymers — unlike their petrochemical-based cousins — do not contain polyethylene and unlike traditional commodity plastics are engineered to completely degrade in a microbial environment. These new materials can be made from synthetic formulations or natural feedstocks, such as plants or cornstarch. Several broad categories of these polymers have received most of the attention so far: 1) Aliphatic Polyesters, such as Union Carbide's caprolactone, which is used in several commercially available formulations; and polylactide (or polylactic acid) polymers such as EcoPLA from Cargill Dow, derived from renewable agricultural resources like corn; and 2) Microbial Polyesters, such as Biopol from Monsanto, which is a polyhydroxybutyrate/valerate copolymer produced through fermentation of glucose and corn starch. There are other variations and formulations commercially available and under development, but the key difference is that second generation polymers like these have been shown to be "inherently biodegradable" (to use CEN's terminology).

PROOF AND THE LEGISLATIVE PUDDING

The importance of being able to prove that a collection bag does in fact break down in a properly maintained composting environment comes into clear focus when considering legislation introduced in Michigan last year. Noting that he was interested in cleaning up compost sites that had become overly contaminated with the remains of plastic bags, Rep. Kirk Profit (D-Ypsilanti) introduced House Bill 4730, which would have prohibited sites from accepting material in plastic bags of any kind. The bill reads: "(1) A person shall not place yard clippings in a plastic bag for collection and management at a facility that receives yard clippings for composting. (2) The owner or operator of a solid waste transfer facility or a facility that receives yard clippings for composting shall refuse to accept yard clippings contained in a plastic bag at that facility."

When informed that there were bags that would decompose in a composting environment, Rep. Profit agreed to examine such

RESOURCES
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(Bio-Solo)

Monsanto Company
Devang Shah
800 N. Lindbergh Bldg.
St. Louis, MO 63112
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fax: (413) 694-9058
(Biopol)

Monsanto Europe S.A.
Malcolm Forsyth
Technical Center
Parc Scientifique,
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Novamont SpA
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(Mater-Bi)

Novon International
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www.novoninc.com/
index.htm
(DegraNovon)

Planet Polymer Technologies, Inc.
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Showa Denko America, Inc.
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evidence. "I consider the burden of proof to be on the advocates of biodegradable bags," he told *BioCycle* in November, 1997. After weighing input from plastics manufacturers, composters and others, the bill was amended to exempt "a bag that when closed, allows access of oxygen to the contents of the bag sufficient to deter anaerobic decomposition, and has been certified by the Department as meeting applicable American Society of Testing and Materials biodegradability and composting standards, or other standards approved by the Department. A manufacturer that wishes to have its bags certified by the Department shall provide ... documentation and testing results that the manufacturer's bags meet the standards."

In January, 1998, Michigan HB 4730 passed a vote in the full House and was referred to the state Senate's Natural Resources and Environmental Affairs Committee. As of mid-February, 1998, it had yet to be considered for a committee hearing, but it was still alive. Before becoming law it would have to passed by the full state Senate and then signed by the Governor, but the fact that it was introduced at all has gained a significant amount of attention.

MASSACHUSETTS STUDY

To date, Michigan is the only state we know of even considering a statewide plastic ban at composting facilities. New Jersey recommends (and mentions in permits) that leaves and yard trimmings be removed from plastic bags before composting either at the site or in transit, but the state doesn't have an outright ban. Individual communities, however, already have taken the step. In Massachusetts, for example, around 80 percent of the municipal composting sites in the state no longer accept yard trimmings and leaves in plastic bags. "Most communities let residents know that leaves only will be collected in barrels or kraft paper bags, but not plastic," says Sumner Martinson of the Massachusetts Department of Environmental Protection (DEP). He explains that the DEP worked with kraft paper manufacturers to help make paper bags available in hardware stores and supermarkets, and then individual towns let their collection contractors know that they could only accept materials in kraft bags, cardboard boxes or loose in barrels.

Regarding a statewide ban on plastics, Martinson says that it's unlikely to be considered in Massachusetts until there's a stronger infrastructure for degradable bags. "Obviously, you don't ban anything until there's an alternative," he says, "so until the degradable plastic bags are in place and have been there for awhile and people have access to them on a full-scale basis, we wouldn't even consider a ban."

To gather more information about degradable alternatives, the DEP commissioned a study in 1997 from the NSF-Biodegradable Polymer Research Center at the University of Massachusetts-Lowell. Researchers monitored the degradability of eight different polymers and evaluated their performance. A paper ("Biodegradable Bags Comparative Performance Study: A Multi-Tiered Approach to Evaluating the Compostability of Plastic Materials") recently was completed and a report on the results will be featured in an upcoming issue.

"There's been a lot of work done on degradable film plastic and it would have an impact on organics collection if it's successful," Martinson says. "We wanted to be able to help municipalities deal with their collection and evaluate the options from a purchasing perspective. Assuming the bags work, we'd also like to help design the infrastructure to get them in place so that communities can start utilizing them. We're certainly interested in a successful product if it exists."

IN THE REAL WORLD

Even with the range of bags available in the marketplace, manufacturers continue to be challenged by the variability of composting technologies and collection methods. What works well in one situation may not measure up in another (see "Breaking Down Biodegradable Bags," *BioCycle*, Dec. 1997). Some bags do very well in warm climates, but as soon as the weather gets cold, difficulties can arise. Others are designed to break down at slower speeds than a given trial run allows and appear to be ineffective. Still others may degrade exceptionally well, but are not produced in large enough quantities to meet demand in a timely manner.

A pilot program in Hutchinson, Minnesota can serve as an example of both the potential utility of degradable bags and their use in a real world situation. Hutchinson started collecting food residuals from schools and supermarkets in July, 1997 (see "Improving Collection for Food Residuals," *BioCycle*, Sept. 1997). Since then, around 150 tons have been recovered. Materials are intensively composted in four NaturTech in-vessel composters for around five days and then cured in windrows. Residential curbside collection of organics is expected to start later this year. Commercial and school collection hinges on the use of wheeled carts lined with a DegraNovon plastic bag. "The liners keep the bins clean so that people don't have to spend a lot of time hosing them out," says Lawrence Winter, resource recovery coordinator for Hutchinson. "When the mechanical arm on our collection truck picks that cart up and tips it out, the bag liner has a tendency to just flop right in, making the process go faster."

The community uses around 2,000 liners per week, and so far is pleased with the results. Winter has tested several bags on the market and plans to test others. He emphasizes that this is a pilot program and the community is interested in working out the logistics of a model that conceivably could be used by other communities in the state. "In terms of degradable bags, it comes down to a few basic questions," he says. "Can I be supplied in a timely manner? Can I get the

RESOURCES
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(Polycaprolactone-TONE)

Willow Ridge Plastics, Inc.
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Erlanger, KY 41018
ph: (606) 578-7400
fax: (606) 578-7404
(Polystarch, PDQ, UH-V Masterbatch additives)

BAG MAKERS AND MARKETERS

Biocorp
2619 Manhattan Beach Boulevard
Redondo Beach, CA 90278
ph: (888) 206-5658
fax: (310) 643-1622
info@biocorp.com
www.biocorpusa.com
(Mater-Bi bags)

Comprehensive Environmental Solutions (CES)
317 Meadow Street, 6A
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ph: (413) 533-0001
(DegraNovon bags)

Duro Bag Mfg. Co.
Davies & Oak Streets
Ludlow, KY 41016
ph: (800) 879-3876
fax: (606) 581-8327
www.durobag.com
(EcoPLA bags)

Grand River Technologies
c/o BioPlastics, Inc.
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(Mater-Bi and DegraNovon bags)

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size that I need, or do I have to use what's currently under production? My early decision to use a DegraNovon bag was partly based on production issues. When I would call them and say that I need 10,000 30-gal. bags in two weeks, they would say, 'OK, they are on the way.' Whether those are the best bags on the market, and whether their claims have been verified by whoever verifies claims, I don't know. There's some really great claims out there, but you've got to get the bags here when we need them. Otherwise I can't do the program. And if I can't do the program, then it falls apart."

Price is another issue for Winter. "I just met with the head of buildings and maintenance for our school district. They still will be involved with the collection program next year, but they will have to pay for their own bags. His biggest concern was how he could justify spending the 50 cents a bag that some of the degradables cost when he only pays 11 or 12 cents for a 2-mil. polyethylene bag. The price on some is down to around 22 cents a bag now and we're working in all sorts of ways to somehow subsidize that cost, but it will kill a program faster than anything if people don't want to spend that extra money."

Hutchinson has yet to screen any of the compost made since July. That will come in the spring, and will provide Winter with additional criteria to judge the performance of all the bags tested. That factor becomes even more significant considering the plans underway to expand. "We have applied for another grant to put together quite a large regional facility for yard trimmings and food residuals," Winter says. Current plans are to add additional NaturTech units and expand the curing and finished compost storage areas. There also are plans for a bagging facility. "We think that we can market quite a bit of it," he adds.

Winter comments that he's just about to start testing a bag made with polyethylene and various additives that the manufacturer claims leave no harmful residues, only carbon dioxide and water. "Can we believe that?" Winter asks. "I don't know, but I'm willing to try them. They've done winter testing on the bags, which helps in this climate. The cost is fairly good and they seem to have a fairly good infrastructure. When I call and order, they can get me things."

POLYETHYLENE QUESTIONS

Although the most recent attention in degradable polymers mostly has been focused on research and commercialization developments of multinational corporations, there are still niche manufacturers of degradable bags containing polyethylene that have demonstrated over a number of years that they have a viable product. Indaco Manufacturing Limited. in Scarborough, Ontario has been making and marketing its Bio-Solo bags since the early 1990s and cites customers that include city governments, municipalities, correctional facilities and the Green Workplace composting program in Ontario. "We're in the business of making compostable film for organics collection and that's all," says Gary Naylor, vice president of Indaco.

He agrees that some companies made false claims about their products in the 1980s and that the formulations being used left large pieces of plastic particulates in finished compost, but believes most of that has been cleaned up now. "I've worked in composting and waste management since 1989," he says, "and know how important it is for our bag to 'go away' like we say it will. A negative image doesn't help anyone. The buyer should always beware, but this is 1998 and there are a lot of good products and manufacturers on the market making claims that can be substantiated."

Indaco markets its bags as being "compostable," and its literature says that their degradation time is adjustable, that they are heat and oxygen activated, nontoxic and leave no visible residue. They do not claim biodegradability because, as Naylor says, "Until a lab tells me that the polyethylene turns into carbon dioxide and water and there is actual biodegradability, then I can't and won't advertise that."

He still feels comfortable with the word "compostable," however. "When we were starting out, we were simply trying to relay to the buyer that you can compost this bag — which you can. If our bags go to a composting facility, they will compost along with the contents of those bags, as long as the contents are compostable. We used to say our bags were '100 percent compostable,' but we decided to go with 'fully compostable' instead because there still is a microscopic residue left at the end of the composting process. These residues are nontoxic and virtually nondetectable in finished compost."

For others, there are concerns. In Massachusetts, Martinson believes that although bags made with polyethylene can be designed to break apart into little tiny pieces that are very hard to distinguish, that may or may not be a long term problem. "We don't know what the fate of that polyethylene is in the soil, or how it affects soil biota because there have been no long term studies done. If some community decides on their own that they'd rather use polyethylene-based degradable bags, then that's their decision. But until we see evidence to the contrary, we're not going to promote anything from a state perspective that would fit into that category."

In the end, these questions again come back to issues of testing and standards providing enough information so that individual composters can make up their own minds about the best collection tools for their particular program, composting technology and intended end use for the finished product. "The pieces are starting to come together," says Steve Mojo of Galatech in Clifton, NJ, consultant to Cargill Dow. "The industry is beginning to develop a consistent set of guidelines, and hopefully we can expand our position into other areas so that they do become standards for people to judge degradability against." ■

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