

BAGS, FOODSERVICE WARE, PACKAGING FILMS

WHAT'S WHAT AND WHO'S WHO IN COMPOSTABLE PRODUCTS

Demand for sustainable packaging, established standards for compostability and biodegradability, and increasing number of organics diversion programs are driving demand for compostable products.

Nora Goldstein and Cristina Olivares

THESE are, without a doubt, exciting times for companies in the compostable products industry — from the manufacturers of resins to the distributors of the end products. After close to 20 years of product and market development, a number of factors are converging to create demand for compostable bags, foodservice ware, packaging films and containers. These include retailer demand for sustainable packaging, rising cost of petrochemicals, expansion of food residuals composting and zero waste initiatives, and, most recently, passage of an ordinance in San Francisco to ban large grocery stores and pharmacies from giving out traditional plastic shopping bags, which is expected to catch on in other communities. Added to those factors are the well-established certification programs for resins and compostable products, which have boosted regulatory and consumer confidence that the products perform as advertised.

While interviewing various resin and product manufacturers for this article, we asked if anyone was observing a “critical mass” of interest and demand that will lead to rapid growth of the use of compostable



products over the next few years. “So many factors are influencing the direction of biomaterials,” says Bob Findlen, Vice-President of Sales and Marketing of the Natural Plastics polymer brand from Metabolix, Inc. “There is the concern around sustainability and the demand and activity that companies like Wal-Mart are bringing to the marketplace. There is the biodegradability part of the market to address issues like litter from traditional plastic bags. Environmental issues are another driving factor, e.g., carbon balance, along with the unsustainability of our thirst for oil. All these things are happening, all at the same time. But have we reached a critical mass? If that is defined as starting to have an effect on the use of petroleum, we are not there yet. But compostable products are on the shelves today and we do have sponsorship from major brand owners to use these materials. So we are definitely past the phase of not wanting

San Francisco’s ordinance to ban large grocery stores and pharmacies from giving out traditional plastic shopping bags opens up market opportunities for compostable bags such as the one manufactured with Novamont’s Mater-Bi resin (resin pellets in bottom photo).



BioBag manufactures a full range of bags for food waste and yard trimmings collection, as well as makes shopping bags for retail stores. An extruder in the BioBag production facility is shown above.

to be the first to use the products.”

Jeff Cole with Genpak — one of the major foodservice supplier “brands” using biodegradable and compostable resins for its Harvest Collection line — also believes considerable progress has been made in the industry, but still sees challenges in the marketplace. “Genpak is one of the biggest providers of quality single use products in the industry,” he says. “I would guess that 40 to 50 percent of the inquiries we get via our website these days are related to our Harvest Collection line. People want to learn more about these products, e.g., what their properties are. But the key question to ask — despite this tremendous interest — is ‘If traditional plastics went away today, are alternatives ready to step in?’ The answer is no. There are not enough suppliers to fill that demand, but it is growing.”

The price gap between single-use items that are compostable and those that are not is still significant, he adds. “Typically food-service operators want something that is

Cortec markets its compostable bags under the EcoWorks and EcoFilm brands. The company uses a corn-based resin blended with polyesters.



Table 1. Compostable bags only (all BPI¹ certified)

<i>Company</i>	<i>Brand</i>	<i>Products</i>	<i>Resin(s) Used</i>
Al-Pack	Al-Pack	Retail food and yard waste bags, shopping bags	Co-polyester compostable resins
Alte-Rego Corp.	Compost-A-Bag	Retail bags, commercial size food waste bags	n/a
BioBag USA	BioBag	Retail and commercial food and yard waste bags, commercial shopping bags	Novamont's Mater-Bi
BioBag Canada, Inc.	BioBag	Retail food and yard waste bags, commercial food waste bags, commercial yard waste bags	Novamont's Mater-Bi
Cortec	EcoWorks, EcoFilm	Commercial food waste bags, retail food waste bags in some markets, cyrogenic bags for commercial use	Corn-based resin with polyesters
Farnell Packaging, Ltd.	BioTrue	2, 30, 32, 45, 90 gallon bags	BASF Ecoflex
Fortune Plastics	Comp-Lete	Bags for retail, commercial, institutional use	Novamont's Mater-Bi
Heritage Bag Co.	BioTuf	Bags for commercial, institutional, industrial use	HB956 from Heritage Plastics, Inc.
Northern Technologies	Natur-Tec	Bags; films available to converters	Proprietary blend
Plastics Solutions	EcoSafe 6400 Compostable Bags	Commercial and retail food waste bags and bin liners, commercial and retail yard waste bags, specialty bags for trade shows, store use and packaging	Proprietary blend
Poly-America L.P.	Husky Eco-Guard Lawn & Leaf	Full line of lawn and leaf and food waste bags	Starch-based resin
W. Ralston Bag and Film Manufacturer	BioSak Compostable Brown Bag	Kitchen curbside (incl. organics bin liners), yard waste bags in various sizes for retail, ICI use	Novamont's Mater-Bi

¹BPI=Biodegradable Products Institute (www.bpiworld.org); all BPI-certified bags meet ASTM 6400 standard.

There are a handful of companies that blend resin pellets with other additives to give the end products the necessary properties.



Farnell Packaging Ltd. uses BASF's EcoFlex resin to make its line of BioTrue bags, which range in size from 2- to 90-gallons.

functional but won't drive up the price of their supplies. The charge for a hamburger with a bag of potato chips and a drink may be \$5. We want to be sure the packaging is not a significant portion of that \$5 bill. The trick is to find customers willing to go the extra step to have that zero waste ability — to bring in products that do what they are supposed to do, e.g., not melt, and then have the internal capability to capture that waste stream and bring it to a composting facility that will take care of it.”

Cole sees two types of customers in this particular market — one that has done all their homework and has figured out how to completely close the loop and not have it cost them more, and the other that wants to buy the Harvest line — with or without the ability to close the loop — because it makes them feel better about their purchasing decisions.

Frederic Sheer of Cereplast, which formulates resins used to make a range of compostable products, has been in the compostable and biodegradable plastics industry for many years. He believes the key factor to achieve a critical mass is to be able to deliver a large quantity of resin with consistent quality at competitive pricing with traditional petroleum-based resins. “At Cereplast, we primarily focus on resins that can compete with their petroleum counterparts,” he explains. “For example, we are focusing on injection molding and thermoforming resins that we offer at pricing as low as \$0.65/lb. In terms of production, we have increased our capacity from 14 million pounds to 55 million pounds in 2007, and we anticipate increasing it again.”

A BIT 'O HISTORY

BioCycle has been reporting on alternatives to traditional petroleum-based plastics for about 20 years. In the late 1980s, as growing numbers of municipalities began to roll out curbside collection and composting programs for yard trimmings, it quickly became evident that plastic bags competed with odors as Enemy #1 at the composting sites. They became entwined in the turning equipment and when shredded, were both a source of litter and an end product contaminant. The early generations of “compostable” plastics were essentially a blend of polyethylene and starch and/or other additives. Questions and concerns arose about the biodegradability of these products — primarily bags. A number of companies came and went during this time period, and it soon was recognized that in order for this market to develop, standards had to be established to verify the biodegradability and compostability of the resins and fibers and products being marketed.

A November 1995 article in *BioCycle*, “Unraveling The Biodegradable Plastics Maze,” provides a valuable snapshot of where the industry had evolved to, and where it need-



The Natur-Tec brand of lawn and leaf bags is made by Northern Technologies, which uses its proprietary blend of resins and additives.

ed to go. By this point, the resins used to make biodegradable bags fell into two general categories — natural and synthetic. Stated the article, “Natural (or biopolymers) are based largely on renewable resources and include polylactic acid (PLA), cellulose and starches, and polyhydroxyalkanoates. Synthetic polymers are made from petroleum-based feedstocks and include polyester and polyethylene polymers. An example of a biodegradable, synthetic polymer is polycaprolactone, a thermoplastic polyester resin. Most biodegradable plastic bags are made from a blend of natural and synthetic polymers.” This categorization still holds true 12 years later.

An ASTM (American Society for Testing and Materials) standard had been updated in 1994 (ASTM D-5488-94d) to establish terminology for compostable and biodegradable packaging. Eventually, the ASTM standards were refined into the current and widely accepted specifications — ASTM D6400 “Specifications for Compostable Plastics” and ASTM D6868 “Specification for Biodegradable Plastic Coatings on Paper and other Compostable Substrates.” The test methods and specifications found in ASTM D6400 and D6868 mimic what takes place in well-run municipal or commercial composting facilities. There are three key tests involved. All are referenced in the ASTM D6400 and D6868 standards. The first measures the ability of the product or material to be converted to carbon dioxide by the organisms found in a compost pile at an acceptable rate. The second test measures the ability of the materials to fragment, so that products do not clog the screening equipment or detract from the value of the finished compost. The third test measures the ability of the resulting compost to support plant growth and insure that the product does not contain high levels of regulated metals.

In 1999, the Biodegradable Products Institute and the U.S. Composting Council established a certification program for compostable products. Today, the BPI website (www.bpiworld.org) lists approved products in four categories: Resins (10 approved); Compostable bags (15 approved); Foodservice (7 approved); Packaging (4 approved). “From a product certification perspective, manufacturers need to meet the ASTM standard appropriate to the application,” explains Steve Mojo, BPI's Execu-

tive Director. “ASTM D6400 is for products that are made only of plastic, such as bags and cutlery. ASTM D6868 is for products that combine plastic with paper, cardboard, bagasse or some other fiber. We also use D6868 to approve products that do not contain plastic at all, e.g., the Chinnet brand, to ensure that they disintegrate and don’t contain metals or other contaminants. Both specifications have the same requirements for disintegration, biodegradation, metals and plant growth.”

In Europe, the equivalent standard is EN 13432, the European Union standard for compostable and biodegradable packaging. The United Kingdom adopted the standards as well (BS EN13432). There are a number of certification bodies across the European Union, including The Compost-

ing Association in the United Kingdom, which operates a certification program with the German certifier, Din Certco.

A number of composting facilities in the U.S. accept BPI-approved compostable products (see BioCycle’s www.findacomposter.com). Cedar Grove Composting, based in Seattle, Washington, requires that all products claiming compostability be tested in its composting process prior to accepting that material in compost feedstocks (see “Biodegradable Plastics Make Market Inroads,” May 2006). Cedar Grove uses the GORE cover composting system. To date, only compostable bags have been approved. Accepted brands include BioBag, Biosak, BioTuf, Cereplast, Complete, EcoFilm/EcoWorks and Marshall Plastic Film (all referenced in Table 1). To



Al-Pak, based in Canada, makes food, yard waste and shopping bags.

Table 2. Compostable serveware, films and bags

<i>Company</i>	<i>Brand</i>	<i>Products¹</i>	<i>Resin(s)/ Raw Materials</i>	<i>Certification²</i>
Biocorp, Inc.	Biocorp	Food serveware, e.g., plates, cups, deli containers, straws, cutlery	Biograde 300A; fibers; sugar cane	DIN-Certo for cutlery
Biosphere Industries, LLC	Biosphere	Various plates, trays, bowls, and other dishes	Starch-based Biosphere's PPM100	BPI
Cereplast	Nat-Ur	Cups, cutlery, straws, food containers	Proprietary blend; use NatureWorks PLA	ASTM 6400, 6868; BPI
Earthcycle Packaging Ltd.	Earthcycle	Fresh produce, nuts packaging; plates, food trays	Palm fiber	ASTM 6400, 6868; BPI
Fabri-Kal Corp.	Greenware	Retail and commercial cups and lids for cold drinks	NatureWorks PLA	BPI
Genpak LLC	The Harvest Collection	Plates, cups, and bowls, and a medium hinged container in both one and three compartments	Cereplast	ASTM 6400, 6868; BPI
Huhtamaki	Chinnet, Serveware, Strongholder	Chinnet molded fiber plates, bowls, platters, and school lunch trays; Serveware molded fiber trays; Strongholder cup carriers and trays	Recycled paper fibers and renewable resources	ASTM 6868; BPI
Innovia Films	NatureFlex	Films mainly used for wrapping produce, etc	Proprietary blend	ASTM 6400; BPI
Innoware, Inc.	Return To Nature	Thermoformed to-go containers	Cereplast	BPI
International Paper	ecotainer	Commercial hot cups and food containers; developing cold cups and lids	Modified NatureWorks PLA functionalized by DaniMer Scientific	ASTM 6400; EN 13432; BPI
Nature Friendly Products	Nature Friendly	Over 160 different types of table products, such as plates, cups, bowls, trays, carryout boxes, trash bags, cutlery	Tableware items are manufactured in China with sugar cane (bagasse); Cutlery made w/version of PLA	ASTM compliant ³
Penley Corp	Full Circle Cutlery	24-count cutlery	Cereplast	ASTM 6400; BPI

¹Compostable products in Table 2 include foodserveware, e.g., hot and cold cups, plates, cutlery; carryout (“to-go”) containers; and packaging films. Some companies also market compostable bags. ²Certification programs include Biodegradable Products Institute (BPI), EN13432—European Union regulation for compostable and biodegradable packaging (also adopted by the UK as (BS) EN 13432), and DIN-Certco (German standard); ³Company states products meet ASTM D6400 and D6868. Company applying for BPI certification.



be tested, compostable products need to be BPI-certified or pass the ASTM D6400 test. Foodservice ware and other items can be tested in addition to bags (details on the testing protocols can be found at www.cedar-grove.com).

WHAT'S WHAT, WHO'S WHO

All companies listed in the accompanying tables were contacted for this article and asked to review

the information provided. Table 1 lists companies marketing only compostable bags. Not listed in the table are manufacturers of kraft paper bags still used by some municipal programs for yard trimmings collection (e.g., Duro Bag, Resourceful Bag and Tag and Smurfit-Stone Container Corp.). Table 2 lists companies that make other compostable products; several companies in Table 2 also include bags in their product lines. The accompanying directory includes contact information and websites for all the companies listed in the tables.

BASF with its EcoFlex resins, Novamont, which makes the Mater-Bi resin, and NatureWorks PLA are the resin suppliers with the longest history in the market. Metabolix, Inc. is expected to start marketing its resin on a wide-scale basis by the end of 2008. In addition to the resin manufacturers, there are a handful of companies that blend the resin pellets with other additives to give the end products necessary properties. Blenders include Cereplast and Heritage Plastic. The "resins used" columns in Tables 1 and 2 indicate the resins and blends used to make the compostable products listed. A company such as Cereplast makes both blends for other companies and its own products. It takes one or more raw materials and extrudes them into new pellets that are used to make the finished products. Several companies make film coat-

ings that are adhered to paperboard, which then is used to make compostable products such as cups and plates. An accompanying article in this special report, "Paper Company And Coffee Roaster Launch New Product," describes a hot cup manufactured by International Paper that uses a formulation that includes NatureWorks PLA.

Genpak is using Cereplast's PLA-based resin to make its Harvest Collection line.

"Cereplast has modified our resin so that it has better thermal properties," explains Jeff Cole. "It can handle foods up to 130°F, which is probably its biggest limitation for foodservice single use items. That is good but not the brass ring. Harvest Collection is designed for cold and warm food applications only at this point. In general, I think all the resin suppliers are working feverishly to come up with better products for companies like Genpak to use. That is what the



The Harvest Collection from Genpak is targeted to the food service industry. The Cereplast PLA-based resin used in the product line has been modified to handle foods up to 130°F.

consumer wants — a product that works just like traditional plastics. They don't want to lose anything."

Novamont, which makes the Mater-Bi resin, is headquartered in Italy. The company's primary market is compostable bags that service source separated organics collection programs in Europe. Organics recycling is the market it also focuses on in North America. "Bags make the process of source separation in households and busi-

ASTM D6868 is used to approve compostable products that do not contain plastic at all, such as the Chinest brand of foodservice items, e.g., divided single use plates and drink holders.



The Fabri-Kal Greenware cup made for cold drinks is shown in various stages of decomposition during composting — from left to right, Day 1, 35 and 50.





Innovia Films introduced a metallized biodegradable film (above) for candy and snack manufacturers. Innovia's 120 NVS film is used with Earthcycle Packaging Ltd.'s palm fiber trays to provide produce packaging for major retailers like Wal-Mart (right).



nesses more acceptable," says Tony Gioffre, who works in Novamont's office in Ridgefield, Connecticut. "Bags address the yuck factor that people have when separating wet food waste."

Its market development strategy has been to find partners to work with to make the end products, such as BioBag in Canada and the U.S., as well as W. Ralston in Canada. "We seek to identify partners that have Novamont's vision, which is to replace fossil fuels with renewables," adds Gioffre. "That has been the driving force of our company since it started." He believes that the key to building markets for compostable products is having the proper infrastructure established to receive the products. "If communities have organics collection programs, then it makes sense to use the bags. If a company is making a compostable bottle, it is more likely it will end up at a recycled plastics processing facility versus a composting site, which can cause problems for the recycler. Introducing products prematurely gets more forces against their proper development and distribution."

PLANT-FIBER ORIGINS

A fairly new company in the compostable products industry is Nature Friendly Products (NFP), based in Beachwood, Ohio. Started about a year ago, NFP sells about 160 different consumer products that include tableware, cold cups and straws, and bags. Cutlery is expected to be introduced fairly soon. Bill Biggar, Managing Partner, comes to the compostable products marketplace from the frozen food and foodservice industry. "I spent 21 years with Nestle's frozen and refrigerated foods division, and left seven years ago to form a consumer goods business," he says. "We learned about a company in China that was making foodservice

products out of waste sugar cane fiber pulp that is pressed into pulpboard. In turn, that is combined with hot water and made into a paste that is then put into molds to make products such as plates and bowls. Our Chinese partners sold these products mostly in Asia and Australia. We became the exclusive marketing rep for the manufacturer in North America."

NFP sells to foodservice distributors that supply colleges, universities, hospitals, restaurants, etc. The products have met the ASTM D6868 standards, and the company is going through the certification process with the Biodegradable Products Institute, adds Biggar. "Our whole product line is designed to replace Styrofoam, plastics and coated paper that isn't compostable. We have put our products through all the standardized testing and comply." Bags sold by NFP use a polyester-based proprietary resin developed by Northern Technologies, Inc. The Nature-Tec bags are BPI-approved.

Innovia Films manufactures Nature-Flex, a line of biodegradable cellulose-based films derived from wood pulp and certified to meet ASTM D6400 and EN13432 standards for compostable packaging. The films are used in packaging of candy, bakery goods, produce, household products and personal care items. "Our films are stiffer and more oriented than many biopolymers currently on the market, which makes them ideal for use in standard flow-wrap and form-fill-seal equipment for confectionery packaging," says Malcolm Cohn, Market Manager-Americas, with the Nature Flex line. "They are glossy and transparent and static-free, making them suitable for twist wrap applications." He adds that the company introduced the first metallized biodegradable film (it meets ASTM criteria) on the market, which can be used by candy and snack manufacturers.

Innovia Films works with Earthcycle Packaging Ltd. in British Columbia to provide produce packaging for Wild Oats and Wal-Mart. The company's 120 NVS film is used to wrap produce in Earthcycle's palm fiber trays. Both are BPI-approved.

Earthcycle's product line, which includes packaging for produce and nuts, plates and food trays, is manufactured in Malaysia at an integrated facility that includes a palm plantation, fiber and pulp production and final manufacturing of the packaging. The company is the exclusive North American distributor. Other major retailers using the palm fiber packaging include Trader Joe's, Whole Foods, Safeway and Publix.

Shannon Boase, President of Earthcycle, has learned quite a bit over the past few years in terms of promoting compostability as part of the packaging's attributes. "Initially, we felt that the key benefit to our products was the ease, or as we say 'responsible' disposal of them," she recalls. "We emphasized the compostable angle. We had POP (point of purchase) stickers that many



Nature Friendly Products sells a full line of foodservice ware that is manufactured from a fiber pulp made out of waste sugar cane.

of our clients applied to the package, which read, 'Earthcycle Packaging:

Backyard Compostable.' Then we did some focus group work with one of our large clients. The overwhelming response from the consumer — aside from the fact that they loved the look and feel of the product — was that they would buy it simply because it is a renewable resource. The compostable angle was only marginally interesting. So we redid our label to now include, 'Renewable Resource, Backyard Compostable.'"

WHAT'S NEXT?

Demand is expected to continue to grow for compostable products and the raw materials from which they are made. "Right now we see more demand than we have product available," says Glenn Johnston, Global Regulatory Manager for NatureWorks LLC, a stand-alone company owned by Cargill that manufactures a polylactide polymer processed from plant sugars. "There is a definite pull from the industry to drive more volume." An article in the *Wall Street Journal* last April reported that Cargill's \$1 billion complex in Blair, Nebraska employs 530 people and is "the world's biggest maker of renewable plastics." The *Journal* noted that production is nearly 150 million pounds annually.

Companies interviewed for this article anticipate that the start-up of Telles' Natural Plastics resin production facility in Clinton, Iowa in late 2008 will accelerate the ability to manufacture more compostable products. Telles is a joint venture between Metabolix, Inc., a bioscience company based in Cambridge, Massachusetts, and Archer Daniels Midland (ADM), an agribusiness gi-

ant. The Iowa facility will start with capacity to produce 110 million pounds of Natural Plastics annually. Metabolix developed a "microbial fermentation platform" that genetically modified a "corn-eating strain of *E. coli* bacteria to make the polymer, PHA," explains the same *Journal* article. ADM will supply the corn using the Metabolix fermentation process.

Telles is operating a pilot plant that is producing 25,000 lbs/month of the raw material. It is used for product development purposes, and to work with customers on development of applications, says Bob Findlen of Metabolix. "Our strategy is to work with brand owners who will put products and packaging made from these materials on the shelves."

There is consensus among companies involved in compostable plastic products — from the resin manufacturers to the major brand foodservice suppliers — that con-



Four companies listed in Table 2 offer cutlery (sample above) for the foodservice market, including zero waste special events.

sumer education and a widespread composting infrastructure to process the end products are the keys to reaching a critical mass in the marketplace. "Bioplastics have a different reality than traditional petroleum-based plastics and need to be looked at differently and understood differently," says Frederic Sheer of Cereplast. "This is a different message to pass along and it is not easy. Another challenge is to make sure that consumers and converters understand what compostable means and why it is important to use ASTM standards." ■

Consumer education and a widespread composting infrastructure are keys to reaching a critical mass in the marketplace.

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