



## GLOBAL TRENDS

### Bioplastics – 2009/07

Bioplastics are a form of plastics derived from renewable biomass sources, such as vegetable oil, corn starch, pea starch or microbiota (a genus of evergreen coniferous shrub), rather than fossil fuel plastics which are derived from petroleum. The market for bioplastics has expanded vastly in recent years. From an international capacity of 150,000 tons in 2006 production is expected to rise to two million tons in 2011<sup>1</sup>.

This article will focus on recent developments in Canada and internationally and why bioplastics are a growth sector.

Bioplastics are ideal for use as medical implants, which dissolve in the body, or compostable mulch films for agriculture. However, the largest growth rates have been in the automotive and electronics industries. According to a report released in May 2009, by Ceresana Research, during the past eight years alone, consumption of biodegradable plastics based on starch, sugar, and cellulose has increased by 600%. Starch-based plastics currently dominate in Europe, and polylactic acid is considered to be particularly promising.<sup>2</sup>

### Alberta

An Alberta Bioplastics Network (ABN) was created specifically to shepherd the canola plastic technology through to commercialization. The Network included representation from the university, federal and provincial governments and industry.

The lead researcher for the program was University of Alberta's Dr. Suresh Narine who used material science, organic chemistry and polymer physics to turn agricultural lipids into industrial products (including high-value chemicals, functional edible material and cosmetics ingredients).

One of the biggest successes of the Network was the development of a process to transform seed oils into valuable bio-based industrial chemicals. This technology led to the recent creation of a \$2-million pilot plant where critical process development work will help scale up the technique. The plant is located in Agri-Food Discovery Place, a research centre which opened in 2006 on the University of Alberta's south campus and specializes in crop processing.



<sup>1</sup> European Bioplastics, "3<sup>rd</sup> European Bioplastics Conference Confirms Positive Climate for Bioplastics, November 10, 2008.

[http://www.european-bioplastics.org/media/files/docs/en-pr/081110\\_conference.pdf](http://www.european-bioplastics.org/media/files/docs/en-pr/081110_conference.pdf)

<sup>2</sup> Bioplastics24.com

<http://www.bioplastics24.com/content/view/1445/2/lang.en/>

One of the key products from the process is a chemical referred to as a polyol, which has been successfully evaluated for making polyurethanes. The biobased polyurethanes created can be used in a huge range of products, including: foams (for use in the automotive industry, construction, insulation, carpet), hard plastic sheets (for computer casings, for instance) and interpenetrating polymer networks (for use as dampening material in things like aircraft).<sup>3</sup> Alberta Agriculture and Rural Development's Bioindustrial Technology Division is now actively working to develop the commercialization strategy for the process and its products, with bioplastics as a primary target industry.

## Canada

Bioplastics research in Canada is well underway on several fronts, including at the National Research Council's Biotechnology Research Institute and Industrial Materials Institute. These efforts are getting a boost through the newly-created BioPotato Network, which will work on bioplastics from potatoes. This federally-funded network, led by Agriculture and Agri-Food Canada, brings together scientists from governments, academia and industry to collaborate on several priority areas including:

- commercializing potato extracts
- healthier potato varieties
- pharmaceutical uses
- new generation bioplastics
- biopesticides for insect control

The \$5.3 million investment in a BioPotato Network by the Government of Canada will work to develop and harness new markets for potato farmers.<sup>4</sup>

## North America

In North America, corn is currently the preferred source for starches used in bioplastics as the crop is produced in large amounts. The technologies for milling and fractionating the starches in corn are already well understood and available. In addition to starch polymers, fermentation of corn starch is being used to produce lactic acid, which is polymerized to polylactic acid (PLA),<sup>5</sup> and other microbes have been developed that produce a natural polymer known as polyhydroxyalkanoate (PHA).<sup>6</sup>

## International

In Europe, as the food industry comes under pressure to ensure both cost efficient production and sustainable manufacturing, an expert from European Bioplastics claims the economic downturn is not drastically affecting demand for packaging sourced from renewable materials.<sup>7</sup>

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<sup>3</sup> Biozine 2008, BioAlberta  
[http://www.bioalberta.com/upload/File/Biozine\\_2008.pdf](http://www.bioalberta.com/upload/File/Biozine_2008.pdf)

<sup>4</sup> New Agriculture and Agri-Food Canada Research Creating Environmentally Friendly Bioplastics from Potatoes, *Agriculture and Agri-Food Canada*, June 2009.  
[http://www.agr.gc.ca/cb/index\\_e.php?s1=tip-puce&s2=2009&page=06c](http://www.agr.gc.ca/cb/index_e.php?s1=tip-puce&s2=2009&page=06c)

<sup>5</sup> [www.natureworkslc.com](http://www.natureworkslc.com)

<sup>6</sup> [www.mirelplastics.com](http://www.mirelplastics.com)

<sup>7</sup> Meritt, Neil, "Bioplastics industry not fearing downturn packaging hit," *Food Production Daily*, May 27, 2009.  
<http://www.foodproductiondaily.com/On-your-radar/Sustainability/Bioplastics-industry-not-fearing-downturn-packaging-hit>

In China's beverage sector, plastic containers accounted for 42 percent of beverage containers in 2007. While its market share is estimated to plateau at 42.8 percent, unit numbers are set to rise from 84.5bn to 127.4bn. Plastic will also capture market share from traditional metal and glass containers<sup>8</sup>.

## Why Bioplastics? Bisphenol A - Concerns

Bisphenol A (BPA) is an industrial chemical used to make a hard, clear plastic known as polycarbonate, which is used in many consumer products, including reusable water bottles and baby bottles. Its use is the subject of intense debate. Studies have shown exposure for infants from bisphenol A migrating from the lining of cans into liquid infant formula and migrating from the polycarbonate baby bottles into the liquid inside following the addition of boiling water could cause health effects.

On June 19, 2009, Food Production Daily reported on study from North Carolina State University and the National Institute of Environmental Health Sciences (NIEHS) that found that exposure to levels of BPA that US authorities have currently judged to be harmless over the course of a lifetime triggered reproductive problems in female rats. Although the American Chemistry Council (ACC) has dismissed the study as being of "very limited relevance to human health," it adds to the safety concerns felt by the public<sup>9</sup>.

## Why Bioplastics? Plastic Trash

Plastic bags aren't biodegradable. They actually go through a process called photodegradation - breaking down into smaller and smaller toxic particles that contaminate both soil and water, and end up entering the food chain when animals accidentally ingest them. In fact, plastic bags as litter have even become commonplace in Antarctica and other remote areas. According to David Barnes, a marine scientist with the British Antarctic Survey, plastic bags have gone from being rare in the late 1980s and early 1990s to being almost everywhere in Antarctica.<sup>10</sup>



The Pacific Ocean is littered with plastic waste, with a vast expanse of floating plastic deposited in the middle of the ocean by circulating currents. It is estimated that 10 percent of the world's plastic waste finds its way into the sea and slowly but surely most of it ends up in the Pacific Ocean.<sup>11</sup> New research by the Sea Education Association also found plastic collected in a region of the Atlantic as well.<sup>12</sup>

<sup>8</sup> Harrington, Rory, "Plastic and paperboard big winners in China beverage packing growth," *Food Production Daily*, June 19, 2009.

<http://www.foodproductiondaily.com/Packaging/Plastic-and-paperboard-big-winners-in-China-beverage-packing-growth>

<sup>9</sup> Harrington, Rory, "BPA causes reproductive health defects at levels currently considered safe – study," *Food Production Daily*, June 19, 2009.

<http://www.foodproductiondaily.com/Quality-Safety/BPA-causes-reproductive-health-defects-at-levels-currently-considered-safe-study>

<sup>10</sup> West, Larry, "Paper, Plastic, or Something Better?," *About.com*, viewed June 22, 2009.

<http://environment.about.com/od/recycling/a/reusablebags.htm>

<sup>11</sup> Fitzgerald, Ed, "Pacific Ocean Plastic Waste Dump," *Ecology Today*, August 14, 2008.

<sup>12</sup> Chick, Kristen, "The Pacific Isn't the Only Ocean Collecting Plastic Trash," *Christian Science Monitor*, June 18, 2009.

<http://features.csmonitor.com/environment/2009/06/18/the-pacific-isnt-the-only-ocean-collecting-plastic-trash/>

## Why Bioplastics? Safer than Reusable Bags

Recently several news stories have focused on research conducted by a microbiology lab based in Toronto. The study indicated that reusable bags and packages can contain high levels of bacteria and molds. Although there are some (including the Toronto Environmental Alliance) who question the findings, it does raise some concerns. Consumers need to pay attention to risks associated with cross contamination of foods and the importance of cleaning and drying reusable bags and containers.<sup>13</sup>

### Events

The 4th European Bioplastics Conference will be held in Berlin, on November 10 and 11, 2009, at the Ritz Carlton hotel.

### See also:

- BioAlberta - the central voice and the organizing hub for the bioindustry in Alberta. BioAlberta is a private, not-for-profit industry association, representing Alberta's growing bioindustry. BioAlberta currently lists over 130 members, including producers, users and supporters of biotechnology activities in Alberta.  
<http://www.bioalberta.com/index.asp>
- Alberta Lipid Utilization Program, University of Alberta  
<http://www.lipid.afns.ualberta.ca/>

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<sup>13</sup> Stones, Mike, "Food Safety Threat from Reusable Food Bags and Packages, *Food and Drink Europe*, May 22, 2009.