"Find new uses for the product" – that's one of the basic tenets of marketing. With the effort that's going into finding new ways to use plant material from agricultural production, food products may soon become only one of the end uses for what we grow. Bioplastics is almost certain to be another.

Plastica

Garbage bags may often be green, but Dr. Suresh Narine wants to make them green in ways more than just colour. The potential to turn Canadian oilseeds into biodegradable polymers could mean that garbage bags and other plastics may soon come from green prairie fields and be "green", as in environmentally friendly too. With the world becoming increasingly aware of the need for conservation and sustainability, the time is ripe for developing an industry that will provide everyday necessities while reducing the demand on petro-chemicals. Bioplastics – plastics made from chemicals derived from agricultural products rather than fossil fuels – offer just such an opportunity.

"In Alberta, so much of our economic activity in the materials and plastics area focuses on petroleum derivatives," says Narine, Associate Professor at the University of Alberta. "As well, so much of our agricultural value is shipped out of the province as commodities. Through this type of research, these two seemingly isolated facts can result in the greening of the plastics and materials industry, and the diversification and elevation up the value chain for the agricultural industry."

The methods to produce bioplastics vary: chemical modification of agricultural feedstock (meaning the raw materials supplied to a process); fermentation of feedstock; or genetic engineering of plastic-producing traits right into the plants themselves. Narine, who is a physicist, is a crucial member of a team of experts working together to look at the whole concept, from plant breeding right through to marketing, and are excited about the profound effect such research could have on everyday life – creating a renewable resource and reducing landfill.

There is much to be done, but the benefits to Albertans and to agriculture are clear. For a start, farmers could have access to lucrative new markets, and increased demand for canola and flax will boost prices. Further, making Alberta a world leader in the production of biodegradable polymers from renewable agricultural oilseeds will result in an increased ability to attract researchers and other highly skilled personnel from within and outside Canada. Of course, success will further increase Alberta's competitiveness in attracting and retaining processing companies.

"The Alberta Bioplastics Network (ABN) was formed to engage in activities to promote the use of Alberta's agricultural commodities as feedstock for the production of specialty chemicals and polymers," according to Narine. He serves as the Director of the ABN, which

is a multi-institutional research network. Narine explains that there are, in fact, four principal areas of Network activity: fundamental science; scale-up; marketing and investment; and policy, regulations, and environmental impact.

Dr. Randy Weselake, a bio-chemist at the University of Lethbridge, is one of the scientists working with Narine and others on a project to investigate the feasibility of using flax to produce bioplastics. His task has to do with the molecular genetic aspect and analysis of changes in seed biochemistry. Weselake's background includes extensive work on oil formations in genetically modified canola and flax, and he is quick to point out the advantages of flax in a project like this. "Flax is ideal for working on modifications," he says. "It doesn't outcrop readily, so it's easy to isolate. And it already has a track record as an industrial crop – it's been used for years to make linseed oil and linoleum for example." With Canada a world leader in flax production, any genetic modification that increases its suitability for biopolymer production is a worthwhile goal. "The long-term market for petro-chemical alternatives such as biolubricants, biodiesel fuel, and bioplastics can be made more efficient through modifications in seed oil metabolism," Weselake claims.

Narine and Weselake share research interests with scientists across Canada. In fact, the Green Chemistry Network was formed to encourage and enable dialogue between people working to develop new chemical processes that use renewable materials and do not pollute, thus protecting the environment – green chemistry. The two men represent Alberta on the national network, which is gaining momentum.

John Christiensen heads up a new program designed to assist with strategic direction in bioproduct research and development. A major thrust of Bioproducts Alberta is to identify barriers which interfere with the advancement of the bioproducts industry, such as access to capital and access to markets, and to develop strategies to overcome them. Christiensen also intends to ensure that the industry perspective on priorities is considered.

A veteran of both the industry and research sectors, Christiensen has been involved in bioproducts for more than a decade. "Plants have more chemicals than petroleum-based products," he notes, "and that increases the possibilities." He says there's a sizable market looming for biocomposites, driven by the need for recyclable, biodegradable products, and that bioplastics are key, making it an exciting R&D area. Christiensen believes that it's important to keep research focused on industry needs: decreasing the cost of products while increasing performance.

Citing the auto industry as an example, Christiensen explains that the European Union mandate for greater use of renewable materials has that industry searching for products that meet the biodegradable/recyclable criteria while still offering good performance and less weight.

"Germany is leading in this area, while work in Canada is relatively new," Christiensen says, adding that Alberta's bioplastics R&D is probably the most advanced in this country. "The biggest challenge with plastics is what to do with them when their product life is over, an issue that's not going away," Christiensen explains. "There are more opportunities for renewability within bioplastics, and a lot of different options now exist."

Ed Phillipchuk, Unit Leader for Alberta Agriculture, Food and Rural Development's Agri-Industrial Development Unit, agrees that the involvement of industry is critical to the commercialization of R&D activities. Phillipchuk's group is focused on domestic and international business and market development and they provide market research assistance from concept to commercialization. Two major challenges will have to be overcome before bioplastics will be a market success: cost and functionality. While customers may be willing to pay slightly more for a product they believe has additional value, i.e. less of an environmental footprint, it is essential that the cost of producing plastics from agricultural sources is competitive with traditional methods, and that the end products have comparable or enhanced attributes.

The possibilities for bioplastic products are endless, matching the gamut of uses for traditional plastics. Narine explains that end uses depend on the type of agricultural plastics being produced. Already a number are being used in the food packaging industry. "The impact on ordinary everyday life is that potentially very soon, farmers will think nothing of growing crops to produce plastics, and consumers will grow accustomed to everything from car panels, toys and packaging, to I.V. tubes and catheters, to colostomy bags being made from material which derives from agriculture," says Narine.

It would appear that creating new uses for the product is a world of virtually limitless possibilities and significant benefits, so in a few years that garbage bag may be greener than you think. r&d

Did you know?

- The world consumes about 140 million tons of plastic every year.
- Annual consumption of fossil fuels for primary processing of plastics is about 150 million tons.
- In most homes upwards of 75% of contents are made of plastic materials.

"…potentially very soon, farmers will think nothing of growing crops to produce plastics."

- Dr. Suresh Narine, University of Alberta