Traditionally used as functional ingredients to control texture, bind water and stabilize emulsions, polysaccharides are gaining in popularity as a healthy food ingredient. These useful polysaccharides can offer health benefits as prebiotics, dietary fibre and fat mimetics.¹,²

Polysaccharides are comprised of a diverse group of carbohydrates and can be categorized based upon origin (i.e. animal, plant); whether they are storage (i.e. starch) or structural (i.e. cellulose) polysaccharides; whether they are a non-starch polysaccharide (NSP); or whether they are soluble in water or digested in the human gastrointestinal tract.³

Polysaccharides are made up of long-chained, straight or branched molecules of simple sugars. Chain length, the number and type of side units and the molecule’s chemical charge influence such functional characteristics as viscosity and the ability to bind water and form networks.⁴

Polysaccharides are derived primarily from plants but also come from algae, bacteria and animal sources.
Gums and mucilages, storage polysaccharides and cell walls from plants can be used as prebiotics, dietary fibres or fat mimetics. Galactomannans from fenugreek, pectic polysaccharides from apple pomace, resistant starch from peas and water-soluble β-glucans from oats and barley are just some examples.

New research into cleavage enzymes for plant polysaccharides is leading to the development of smaller non-digestible oligosaccharides (NGO) such as arabinogalacto- and fructo-oligosaccharides and pectic oligosaccharides. There is potential for these novel NGOs to act as prebiotics, stimulating the growth of beneficial bacteria in the colon.5-8

### Examples of Common Polysaccharides

<table>
<thead>
<tr>
<th>Source</th>
<th>Polysaccharide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal</td>
<td>Hyaluronate</td>
</tr>
<tr>
<td>Bacteria</td>
<td>Pullulan</td>
</tr>
<tr>
<td>Plant</td>
<td>Xanthan</td>
</tr>
<tr>
<td>Plant</td>
<td>Oligosaccharides</td>
</tr>
<tr>
<td>Plant</td>
<td>Starch</td>
</tr>
<tr>
<td>Sea Plants</td>
<td>Carrageenan</td>
</tr>
</tbody>
</table>

### Health Benefits

**Prebiotics**9-12,14,15
- Enhanced resistance to invading pathogens
- Improved bowel function
- Reduce incidence and severity of infant diarrhea
- Anti-colon and anti-prostate cancer properties
- Improves bioavailability of minerals and trace elements
- Osteoporosis management
- Alleviation of menopausal symptoms
- Beneficial for cardiovascular disease associated with metabolic syndrome
- Improvement of vitamin supply
- Effect on defecation and flatulence

**Dietary Fibre (DF)**9-13,16-19
- Soluble DF
  - Plasma cholesterol reduction
  - Modulation of blood glucose levels
  - Reduce risk of coronary heart disease
- Insoluble DF
  - Laxation and promotion of regularity

**Fat Replacers**1,20,21 (carbohydrate based)
- Replace fat and lower calories in foods
- Formulation of low fat foods to serve dietary needs
- May promote feeling of satiety and regulate food intake
- May help with weight loss and maintenance

**Resistant Starch**22-25
- Enhances bowel health
- Controls bacterial infections
- Lowers risk of colorectal cancer and inflammatory bowel diseases
- Potential to manage obesity by promoting satiety
- Prebiotic fibre

*Source:*(8)
Acadia University
Wolfville, NS
- Interfacial behaviour of proteins, lipids and carbohydrates important to food processing (S. Roscoe)

Agriculture and Agri-Food Canada
Cereal Research Centre
Brandon, MB
- Cereal proteins and starches and physical factors that affect baking, pasta and noodle making, and oat quality (N. Ames)
- Identification of wheat components beneficial to human health and wellness; development of wheat-based food products; evaluation of consumer preferences to wheat-based foods (O. Lukow)

Guelph Food Research Centre
Guelph, ON
- Natural polysaccharides: processing technologies, structural and functional properties, bioactivities and applications in food and non-food systems (S. Cui)
- Starch structure modification of nutritional and industrial applications (Q. Liu)
- Linkages between dietary fibre and human health (S. Tosh)
- Molecular characterization of polysaccharide; study of structure - function relationship of polysaccharides as dietary fibre and texture modifiers of foods; extraction, characterization of novel polysaccharides from natural products (Q. Wang)
- Cereal polysaccharides and dietary fibre functionality and health benefits (P. Wood)

Food Research and Development Centre
St. Hyacinthe, QC
- Production and purification of exopolysaccharides from lactic acid bacteria and other microbial polysaccharides; extraction, isolation and purification of natural plant-based compounds (M.-R. Van Calsteren)
- Chemical modification of polysaccharides (chitosans) with proteins for production of emulsifiers; structure and interactions of biopolymers in agri-food systems (A. Bégin)

Saskatoon Research Centre
Saskatoon, SK
- Processing and functional characterization of carbohydrates and proteins from renewable agricultural material (P. Chang)
- Oilseed crops as a source of bio-diesel, lubricity agents, bio-pesticides, natural health products, phytocompounds (phenolics, alkaloids, sterols.) proteins and polysaccharides (N. Westcott)

Dalhousie University
Halifax, NS
- Structure function of food polymer/colloid systems (A. Paullson)

Health Canada
Ottawa, ON
- Impact of dietary fibre and fermented material on bacterial populations in the GI tract (S. Brooks)

Memorial University of Newfoundland
St. John’s, NL
- Cereal and legume starches (R. Hoover)

University of Alberta
Edmonton, AB
- Isolation and physicochemical characterization of grain carbohydrates and interaction of grain carbohydrates with other bio-molecules (T. Vasanthan)
- Recovery and evaluation of functional properties and product applications of grain fractions (F. Temelli)

University of Guelph
Guelph, ON
- Novel resistant starches and evaluation of human health benefits (M. Emes)
- Enrichment of dietary fibre into dairy products (H.D. Goff)
- Dietary fibre and gut health (M. Fan)

Université Laval
Quebec, QC
- Development of new protein/polysaccharide functional ingredients (S. Turgeon)

University of Manitoba
Winnipeg, MB
- Molecular origin of functionality of plant polysaccharides (M. Izydorczyk)
- Linkages between dietary fibre and human health (S. Tosh)

University of Saskatchewan
Saskatoon, SK
- Grain and legume fractionation, processing and characterization (B. Tyler)

Canada Research Chair in Crop Quality
- Biochemical and molecular characterization of genetic determinants of grain quality in cereal and pulse crops; structural and functional genomics strategies for grain quality improvement (R. Chibbar)

Canadian Suppliers
- Acadian SeaPlants
  Dartmouth, NS | www.acadianseaplants.com
- Best Cooking Pulses
  Portage La Prairie, MB | www.bestcookingpulses.com
- BioNeutra Inc.
  Edmonton, AB | www.bioneutra.ca
- Casco Inc.
  Etobicoke, ON | www.casco.ca
- Ceapro Inc.
  Edmonton, AB | www.ceapro.com
- Emerald Seed Products
  Avonlea, SK | www.emeraldiseproducts.com
- Flax Council of Canada
  Winnipeg, MB | www.flaxcouncil.ca
- G.S. Dunn
  Hamilton, ON | www.gsdundun.com
- Natraceuticals Canada Inc.
  Edmonton, AB | www.viscofibre.com
- Nutripea Inc.
  Portage La Prairie, MB | www.nutripea.com
- Parrheim Foods
  Saskatoon, SK | www.parrheim.com
- Sunopta Inc.
  Brampton, ON | www.sunopta.com
Applications

Polysaccharide gums and starches are highly functional ingredients in snack foods, beverages, salad dressings, confections, cereal products and meat products due to viscosity, water-binding and gelling properties. Their role as a prebiotic, dietary fibre or fat mimetic offers additional opportunities for use in formulating healthier foods.

Unique to Canada and being introduced by Emerald Seed Products as a new food gum is Canfen®, a polygalactomannan derived from fenugreek seed. Canfen® has U.S. GRAS (Generally Recognized as Safe) status and can be used to provide viscosity, stability and texture to foods.

Best Cooking Pulses, NutriPea and Parrheim Foods are capitalizing on the unique functional properties of fractionated pea starches and dietary fibres to supplement the growing interest in healthy ingredients.

Soluble beta-glucans derived from oats and barley and produced by Natraceuticals Canada and Ceapro meet the requirements for the U.S. health claim for soluble dietary fibre and coronary heart disease.

Agriculture and Agri-Food Canada’s “Polysaccharide Research Group” at the Guelph Food Research Centre is taking advantage of this global interest in plant polysaccharides. The discovery and characterization of new functional attributes and health benefits of novel polysaccharides derived from mustard, flax, pulses, oats and barley will open new market opportunities for Canadian specialty crops.

References