Application to Demonstrate Substantial Equivalence between Saskatoon Berry (*Amelanchier alnifolia*) and Blueberry (*Vaccinium*)

(a) Administrative information

Name of the applicant; contact information (postal and email addresses, telephone and fax); name of the novel food or food ingredient; date of the application.

Prairie Lane
Petersfield, Manitoba R0C 2L0
Canada

John Ritz, President
Telephone: (204) 738-2476
Fax: (204) 738-2476
E-mail: psask@mb.sympatico.ca

Introduction

Although, saskatoon berry (*Amelanchier alnifolia* Nutt,. Rosaceae) and blueberry (*Vaccinium corymbosum* L., Ericaceae) belong to different species (**Appendix 1),** (and that the concept of substantial equivalence may better apply to foods that are from the same species), we have chosen this comparison because these two fruits are substantially equivalent in all characteristics that are important to the consumer, including fruit colour, shape, size, nutrition, texture, and uses. In addition, both fruits are native to North America, and they have practically identical historical uses (**Appendix 2**) and known health benefits.

The saskatoon (*Amelanchier alnifolia* Nutt.) is a fruit bearing shrub native to the southern Yukon and Northwest Territories, the Canadian prairies and the northern plains of the United States (Mazza and Davidson, 1993). Saskatoon berries belong to the Rosaceae family, and the Amelanchier genus. Other fruits belonging to Rosaceae family include apples, pears, prunes, plums, cherries, apricots, strawberries, raspberries, and blackberries.

Blueberries are members of the Ericaceae family, and are related to other small fruit of economic importance including the cranberry (*Vaccinium macrocarpon* Ait.) and the lingonberry (*Vaccinium vitis-idaea* L.). Both saskatoon berry and blueberry are members of the dicotyledons class.

Blueberries are successfully grown in Canada, United States, Australia, New Zealand, Chile, and throughout Europe.

Saskatoon fruit has been grown on the Canadian prairies commercially, since the mid 1960's. The current annual production is about 5-6 million kilograms. The cultivars of saskatoon berries grown in orchards commercially were selected from wild plants for their resistance to diseases, high yields and fruit quality, especially flavour, colour and texture of the berries.

The mature fruit is a purple berry-like pome, 1-1.5 cm in diameter, practically identical to a blueberry. A serving (a cup) of mature fruit weighs approximately 130-135 grams, and a single berry commonly contains 1-5 very small seeds (Rogiers and Knowles, 1998). A serving of blueberries weighs about 140 grams.

The use of both saskatoon berry and blueberry fruits has roots in North American food traditions that date back to the Native People of North US and Canada who used sun- and smoke-dried blueberries and saskatoon berries to flavour foods. Also, Canada's aboriginal people used the fruit in soups, stews, meat dishes, pemmican and dried cakes. Juice was used to cure stomach ailments, and eye and eardrops were made from mature berries.
When the European settlers arrived in Western Canada, they enjoyed and benefited from this native berry in all seasons. The presence of vitamins and minerals in saskatoon berries augmented the annual diets of those explorers and pioneer settlers and likely prevented malnutrition-related diseases such as scurvy**.**

In Canada, the fourth to eighth generation European descendants in rural and urban prairie families are the ones most familiar with saskatoon fruit. The families and museums still have and use the recipes for saskatoon berries that were picked from the wild, then from gardens and now from commercial orchards. The fruit was eaten out of hand and fresh with cream and sugar in July and August. Homemakers dried and made preserves to add both interest and nutrition to winter menus. Preserves included canned saskatoon berries (sugar or honey added), jams, conserves and jellies. Other fruit such as rhubarb were enhanced by saskatoon berries on occasion, but for winter meal enhancement, whole berry preserves became pies, sauces, compote base, and accompaniment to meat dishes. Saskatoon juice was added to beverages both warm and cold. Dried saskatoon berries, whole or as a fruit leather or pemmican type product (added to dried meat), have a long shelf-life and are easier to transport. Reconstituted, dried saskatoon berries can add colour and flavour to any meal. (Note: fruit leather is pureed fruit which is dried and rolled into a chewy fruit taffy or made into fruit bars. It is manufactured by dehydrating fruit puree which has been spread evenly to a depth of 3-6 mm on trays).

In the pioneer era of Canada, saskatoon berries were the easiest native fruit to transform into European type recipes. It took no effort to do with saskatoon berries as had been done at home with other fruits. As with fruit such as grapes and apples which were much harder to cultivate, settlers made saskatoon berry cider, wine, beer and teas. For further information on history of use of saskatoon berries, please see a partial list of recipe/cook books at the end of this document.

As a product native to Canada, saskatoon berries have been used by Canadian chefs to fΛte visiting dignitaries including royalty, politicians and rock stars. Chefs have also used them in every course for the meals prepared at international culinary events, often winning impressively. In addition, Canadian officials have taken the products to international conferences and meeting to add a special flavour to those events. International airlines and hotels have included saskatoon berries in their meals and special gifts to clients.

In the more recent past, saskatoon berries and blueberries were mostly consumed fresh, baked in pies, or processed into jams and spreads. Today, new and innovative methods of processing, freezing and packaging have greatly increased berry uses. Improved harvesting and climate controlled environments have enabled distributors to significantly extend the shelf life of fresh berries.
In recent years saskatoon berries form Canada have been exported to Japan (Agriculture and Agri-Food Canada, 2003), and one Alberta, Canada, supplier of seedlings reports shipments of 15,000 plants to Finland (Joonas), a few hundred to Great Britain, as well as Belgium (6000), the

Czech Republic, Germany and France. He also reports sales to Asia, South America and New Zealand.

(b) Composition

The application should contain a specification of the novel product, including information on the source organism, methods used for preparation of the novel product, the composition of the final product and maximum limits for the presence of known or potential contaminants. Comparisons should be drawn with only one existing product, which should be described in the same level of detail. If the applicant is not the manufacturer of the novel product, the application should indicate the intended supplier(s).
For products derived from natural sources, the novel and existing products should be derived from the same or very similar species. This requirement may be relaxed if the products are unless they are refined extracts that only contain only a limited number of defined chemical components. The novel product should not contain significant levels of substances that are not present in the existing counterpart – the presence of such substances requires a fuller evaluation that is not compatible with the simplified procedure.

The composition data for saskatoon berries and blueberries is presented in Tables1-8. The data in Tables 1, 3, 4, 5 and 6 for the blueberries is from the USDA Nutrient Database (2004). The data in Tables 1, 3, 4, 5 and 6 for the saskatoon berries is from POS Pilot Plant (2003). POS Pilot Plant is a highly reputable research and analytical facility, based at the University of Saskatchewan, in Saskatoon, Canada. The data in Table 2 for the saskatoons and blueberries is from Mazza (1982). The data for the saskatoons and blueberries in Tables 7 and 8 is from Mazza and Cacace (2003).
The USDA Nutrient Database (2004) does not specify the species or cultivar of blueberry. The POS Pilot Pant (2003) data were derived from three representative 'Smoky' saskatoon berry samples taken from three different orchards. The sample weights ranged from 131-135 g.
The data from Mazza (1982) were from three representative samples of 'Smoky' saskatoon berries and 'Bluecrop' highbush blueberries produced in Alberta, Canada in 1981, and this data set (Table 2) is from analyses carried out at the same time, using the same methodology.

Table 1 presents contents of water, caloric value, total protein, total fat, total and specific carbohydrates and dietary fibre in blueberries and saskatoon berries. Water is the major constituent of saskatoon berries and blueberries, followed by carbohydrates. The values for the two fruits are very similar. The slightly higher levels of caloric value, proteins, carbohydrates and lipids for saskatoon berries reflect the marginally lower moisture content of these berries compared to blueberries.
Table 2 presents water, protein, fat, total fiber, minerals and carotene contents of three representative samples of 'Smoky' saskatoon berries and 'Bluecrop' highbush blueberries produced in Alberta in 1981 (Mazza, 1982). As noted above, these data are from analyses carried out at the same time, using the same methodology, and show that the moisture content of saskatoon berries was 80.0 ± 1.5% and lower than that of blueberries which was 83.3 ± 1.4%.
Saskatoon berries contain 15-20% sugar, small amounts of protein and fat, a fair amount of fiber and relatively large amounts of potassium, iron, magnesium and phosphorous (**Tables 1, 2 & 3**). Similarly blueberries contain 14-17% sugar and comparable levels of protein, fat, fiber and minerals. Thus, taken all together, the separate sets of data for saskatoons and blueberries indicate that the two types of berries have a proximate composition which is practically identical.

Table 4 presents the vitamin composition of saskatoon berries and blueberries. Vitamins found in blueberries and in saskatoon berries include vitamin C, thiamin, riboflavin, pantothenic acid, vitamin B-6, folate, vitamin A and vitamin E. Trace amounts (0.02 mg/100g) of biotin are found

in saskatoon berries and not in blueberries, and niacin (0.418 mg/100g) is present in blueberries but not in saskatoon berries. For the vitamins present in both fruits, the levels are very similar.

Table 5 presents the lipid composition of saskatoon berries and blueberries. Fatty acids present in both fruits include palmitic (16:0), stearic (18:0), palmitoleic (16:1), oleic (18:1), linoleic (18:2) and linolenic (18:3) acids. Detected in saskatoon berries were also traces of lauric (12:0), myristic (14:0), arachidic (20:0), behenic (22:0), lignoceric (24:0) and gadoleic (20:1) acids. It is suspected that these minor fatty acids were detected in saskatoons because a very sensitive gas chromatography-mass spectrometry (GC-MS) analytical methodology was used for the determination of fatty acids of saskatoon berries.

Table 6 presents the amino acids composition of saskatoon berries and blueberries. Amino acid found in both fruits include: tryptophan, threonine, isoleucine, leucine, lysine, methionine, cystine, phenylalanine, tyrosine, valine, arginine, histidine, alanine, aspartic acid, glutamic acid, glycine, proline and serine. Most amino acids were present in a higher concentration in saskatoon berries than in blueberries. This likely reflects the difference in the protein content of the two fruits, which is higher in the saskatoon berries, probably because of the presence of more protein-rich seeds.

Also, cultivar trials conducted by the Native Fruit Development Program at the University of Saskatchewan have indicated that orchard location has a substantial effect on saskatoon growth, development and fruit quality, and that differences associated with location can override any differences associated with cultivar. It=s unlikely that values for nutritional content for the other commercially important saskatoon berry cultivars, such as Northline or Thiessen, will differ substantially (Zatylny et al., 2002).

The predominant aroma component of saskatoon berry is benzaldehyde (Mazza and Hodgins, 1985) and the predominant acids are malic and citric (Wolfe and Wood, 1972)
In blueberries the predominant acid is citric and the aroma profile is more complex than saskatoon berries, and includes heptanal, octanal, nonanal, 2-decanal, 3-hexen-1-ol, ethyl acetate and 3-isopropyl-butyrate (Overton and Manura, 1999).
Also, citric, malic, and quinic acids are the major organic acids in lowbush blueberries, contributing 36%, 31% and 20% to total acidity; chlorogenic is the major phenolic acid (Kalt and McDonald, 1996). Citric (75%) and succinic (17%) acids are the most abundant acids in highbush blueberries (Ehlenfeldt et al., 1994). Each organic acid has its own distinctive taste, thus these differences can contribute to real flavour differences among species.

Phenolic compounds, particularly the anthocyanins appear to be the major functional components of blueberries and saskatoon berries. There are at least four anthocyanins in ripe saskatoon berries of which cyanidin 3-galactoside and 3-glucoside account for about 61% and 21% of the total anthocyanins, respectively. Other phenolic compounds characterized include cyanidin 3-xyloside, chlorogenic acid and rutin (Mazza, 1986). Anthocyanin content of saskatoon berries ranges from 25 to 179 mg/100 g of berries and total phenolics range from 0.17 to 0.52% **(Table 7**). Cultivar, maturity level and year of production, however, affect content of total anthocyanin and total phenolics of fruit (Green and Mazza, 1986).

In ripe blueberries there are 25 anthocyanins and several colourless phenolics, including those present in saskatoon berries (Gao and Mazza, 1995; Camire, 2000). In both fruit, the pigments are located primarily in the skin of the berries, and smaller berries have a greater surface area than large berries on an equal weight basis, and thus contain more pigments and other phytochemicals.

Processing. Fresh saskatoon and blueberries have a short shelf-life, even when refrigerated, but both fruits freeze very well and can maintain their quality for up to two years. Slow freezing produces microscopic cracks in berries through which the pigment-laden juice escapes (Sapers et al.,1985). Most of the freshly harvested berries are flash frozen within two hours which has allowed sales to be extended year-round. Prior to packaging and/or processing all leaves and twigs are totally removed from the berries.
Dehydration can cause anthocyanin browning. A relatively new process called infusion, involves drying the berry and infusing it with sugar to increase its stability and flavour. This process, developed for the cherry industry, is now used for blueberries, cranberries and saskatoon berries. This process allows processors to use the infused berry in baked goods without it disintegrating. In comparison to dried fruit, this process increases the flavour and the improved texture creates the potential for these berries to be used by the large cereal, snack food, and ice cream processors. For this and other commercial processing operations, the berries must have been cleaned, graded and frozen, and in Canada this is carried out according to the Canadian Food Inspection Agency (CFIA) and Health Canada regulations for fruit and vegetables **(**Canadian Food Inspection Agency , 2004). The CFIA has both construction and equipment requirements for federally inspected fruit processing plants. In addition, it requires a six part written document at the application stage and the follow-up record keeping including a minimum of annual inspection for maintaining the federal certificate.

In addition, Prairie Lane, the applicant, value chain for Saskatoon berries requires HACCP like procedures for food safety that use the federal requirements and add to them. These include:
1. monitoring and recording of temperatures and times throughout the harvesting and processing cycles and beyond,
2. purchase decisions and recording systems for all materials that might contact the fruit including, for instance, food safe lubricants, soaps, and packaging materials,
3. management and staff training in safe food handling (and safety for workers), including records of same, and
4. a recall protocol with the requisite records of batches, dates, employees.

(c) Nutritional value / (d) metabolism

If the composition of the product does not differ from its existing counterpart, it is unlikely that there will be significant differences in its nutritional value or metabolism. Nevertheless, the application should consider this possibility and provide results of any relevant studies. These might include the results of stability tests to show that the novel product does not degenerate during storage or use, or bioavailability studies.

Blueberries are marginally lower than saskatoon berries in protein, fat, fiber, calcium, magnesium, iron, and manganese but slightly higher in water content (**Table 2**). On a dry weight basis, there is no significant differences in the amounts of iron found in saskatoon berries and blueberries. Both saskatoon berries and blueberries are excellent sources of iron, respectively supplying 22.3% and 14.1% of the established Recommended Dietary Allowance (RDA) in a 100g serving, thus supporting the suggestion made by other authors that these berry fruits may be a natural source of iron for anemic persons.

The RDA for manganese is 5mg/day. Thus, the manganese content of 1.4 mg/100g found in saskatoon berries and 0.6 mg/100g found in blueberries supplies 33.8% and 15.0% respectively, of the estimated RDA.
The calcium concentration in saskatoon berries was 0.44 ± 0.06% and in blueberries was 0.08 ± 0.01% of the dry matter. Since the dry matter contents of saskatoon berries and blueberries were 20 and 16.9%, respectively, a 100g serving of fresh saskatoon berries will supply 88mg of calcium and a 100g serving of fresh blueberries will supply 13.5 mg of this mineral. The RDA for adults is 800 mg of calcium/day (Anon 1974) with 100g saskatoon berries supplying 11% of RDA.

The zinc content of saskatoons and blueberries is 0.16-0.33 and 0.17-0.35 mg/100g of fresh fruit (Tables 2 and 3). This is about 2.6-2.7% of the RDA established for zinc.

The carotene content of saskatoon berries and blueberries is 29.7±5 and 29.3 ±4 g/100g, respectively (**Table 2**). This is about 20% of the RDA established for beta-carotene for 100g of fresh fruit (Osborn and Voogt, 1978).

In the case of dietary fiber, for instance, the USDA Nutrient Database (2004) lists a value of 2.4 g/100 g total dietary fiber for blueberries (**Table 1)**, and Jasper Wyman & Sons (1999) cites a value of 3.07 for fiber, with a range of 2.80-3.6 g/100g for lowbush blueberries.

Both fruits are relatively high in fat-soluble and water-soluble vitamins. The fat-soluble vitamins include A and E, and the water soluble vitamins include the B vitamins [B1(thiamin), B2 (riboflavin), B3 (niacin) B6(pyridoxine)] and vitamin C (ascorbic acid). The water soluble vitamins are absorbed directly into the blood stream and freely circulate. The fat soluble vitamins because they are stored by the body, are less readily excreted than water soluble vitamins.

Saskatoon berries and blueberries are both rich sources of flavonoids and have exhibited some of the highest recorded *in vitro* antioxidant capacities of various fruits and vegetables tested. Their *in vitro* antioxidant capacity has been attributed to their high concentration of phenolic compounds, particularly anthocyanins (**Table 7**). Anthocyanins have been found to be potent antioxidants compared to classical antioxidants such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), and alpha-tocopherol (**Table 7;** Fukumoto and Mazza, 2000). In accordance with this, Fukumoto and Mazza (2000) reported increased antioxidant activity

with increase in the hydroxyl groups and deceased antioxidant activity with glycosylation of anthocyanidins.

Wang and Mazza (2002a) demonstrated that phenolic compounds found in blueberries and saskatoon berries inhibited nitric oxide (NO) production in bacterial lipopolysaccharide/ interferon-γ-activated RAW 264.7 macrophages. Also, blueberry and saskatoon berry anthocyanin-rich extracts both induced tumour necrosis factor á (TNF-á) production and acted as modulators of the immune response in activated macrophages (Wang and Mazza, 2002b). This research provides evidence that phenolic compounds in saskatoon berries and blueberries are able to reduce the oxidative stress from NO, which increases the protective effects against cardiovascular and chronic inflammatory diseases.

Kay and Holub (2002) have demonstrated that supplementation with a freeze-dried blueberry powder increased serum antioxidant status following the consumption of a high-fat meal. Increasing the serum antioxidant status has been suggested as a possible method of reducing the risk of many chronic degenerative disorders (Kaplan & Aviram, 1999; Vendemiale et al. 1999). Although not yet reported in the literature, saskatoon berries are expected to have the same effect as blueberries.

The information about absorption, metabolism and excretion of individual flavonoids in humans is scarce. Rats given single doses of a mixture of 160 mg/kg cyanidin-3- glucoside (Cyg) and 20 mg/kg cyanidin-3,5-diglucoside (Cydg) had plasma levels of 907 nmol Cyg and 212 nmol Cydg thirty minutes after administration of the anthocyanins; rats given larger doses had correspondingly higher plasma levels (Miyazawa et al., 1999). Plasma and liver levels reached their peaks 15 minutes after ingestion of the mixtures. The aglycone was not detected in either type of sample. In a related human study, four volunteers given 2.7 mg/kg Cyg had plasma levels of 24 nmol, and another group had levels of 29 nmol of Cyg 60 minutes after ingesting the same dose.

Recently, Kay et al. (2004) have confirmed that humans have the capacity to metabolize cyanidin 3-glycosides, present in fruit including saskatoon berries and blueberries. Concentrations of anthocyanins and anthocyanin metabolites, in the urine reached levels of 8.14 ìg/ml within 5 h post consumption and persisted in 24h urine samples at level of 5-6 ng/ml. In addition, total levels of anthocyanins and anthocyanin metabolites detected in the serum were observed at 312.41 ng/ml within 2h post consumption. Cyanidin 3-galactoside accounted for 55.8% (4.46 ìg) and 64.7% (202.24 ng) of the detected anthocyanins, in the urine and serum samples respectively. The metabolites consisted of glucuronide conjugates, as well as methylated and oxidized derivatives of cyanidin 3-galactoside and cyanidin 3-glucuronide.

Optimal consumption levels. No recommended levels for saskatoon berry or blueberry consumption have been made, although consumers may want to include a daily serving of either fruit as part of the recommended five or more servings of fruits and vegetables.

(e) Intended use

The application should describe the uses of the existing product and explain which of those are relevant to the novel product. This may include use in food supplements, use as a food, and use as a food ingredient in a specified list of food categories. Where the application covers use in food supplements, it should include information on the recommended dosage of the new and existing products. In general applications cannot include new uses, particularly if they are likely to result in consumption of the product by a wider range of the population or at higher levels, compared with the existing product. In particular, the novel product cannot be assessed as "substantially equivalent" if it is intended for use as an ingredient in foods and the existing counterpart is only consumed in the form of food supplements.

Presently, approximately 10-12% of blueberries are sold fresh, but a significant portion of the highbush blueberries are frozen or canned (Moore, 1994). Lower quality fruit is used in jams and purees, where appearance is not critical. Purees can be added to yogurt, ice cream, and fruit smoothies. Combination of osmotic and air drying technology can produce shelf-stable berries that maintain a pleasant chewy texture (Mazza et al., 1998, International Symposium on Drying, Dallas, TX, April 1-3). These dried berries can be used as snacks, in granola, trail mixes, and hot and cold breakfast cereals. Bakery applications for blueberries are discussed by Villata (1998). About 20% of the cultivated blueberry crop is used in food service operations (Kenyon, 1997).

The anticipated uses for saskatoon berries will be practically the same as for blueberries (**Appendix 3**). It is also anticipated that they will be used to enhance colour and flavour of a variety of products, from specialty cheeses to nutritious snacks. Its dark colour with its high nutritional content and associated to antioxidants, will make it an attractive fruit to consumers. These are products made of or with saskatoon berries sold in Canada:
-baked goods including pies, muffins, biscuits, breads and cakes;
-beverages including juice, tea, ciders (liquid and dry concentrate, and fresh), beer, wine and liqueur;
-preserves such as jam, jelly, conserves, sauce, pie filling, syrups (whole berry and liquid only), and salad dressings;
-dried products including powder, whole berry, infused berries, fruit leather, pemmican (dried meat), snacks or trail mixes;
-sweets including chocolate coated, maraschino type, gelatin type;
-other foods such as meat stuffings and sauces for meat dishes, soups, ingredients in salads, cheese flavourings.
Obviously, these applications are also used for blueberries in Canada and around the world.

Photographs of fresh saskatoon berries and blueberries and selected processed products intended for the UK/EU market are presented in **Appendix 3**.

(f) Level of undesirable substances

The application should consider the potential presence of undesirable substances, such as environmental contaminants, mycotoxins, naturally occurring toxins and anti-nutrients, and undesirable microorganisms. Evidence should be provided that the levels of these substances are comparable between the new and existing products. The new product should obviously comply with existing EU legislation on contaminants, pesticides etc (g) other relevant data The application should also include any other relevant data on the novel product, including the reports of any safety studies that have been conducted on it. The application should also include a proposal for labelling, to demonstrate that consumers will be adequately informed of the nature of the novel ingredient

As of April, 2004, there had been no reported adverse events for products containing saskatoon berries (*Amelanchier alnifolia)* (see: Appendix 4; Allergy/Asthma Information Association of Canada, 2004; Health Canada, 2004; FDA, 2004). **Appendix 4** provides the description and results of an extensive literature search using four databases (CAB Direct, ERL Webspirs, Current Contents Connect, and Pub Med) for *Amelanchier* and allergies, and shows no reported adverse reactions for saskatoon berries or related species/genera.

Prunasin a cyanogenic glycoside found in trace amounts in prunes, plums, cherries, apricots, maize, beans, and lettuce has also been found in leaves and twigs of the saskatoon shrubs during the bloom stage (Majak et al., 1981). However, prior to packaging and/or processing all leaves and twigs are totally removed from the berries; and the prunasin levels in the mature fruit are very very low or not detectable, and consistent with the levels in fruits such as prunes, plums, cherries and apricots. Rodent research suggests anti-metastatic effects only occur at high injectable doses of prunasin (Newmark et al.,1981).

Conclusions

Saskatoon berry and blueberry fruits have been a major food source for the native people of the North American prairies for thousands of years. Early European settlers learned to rely on both saskatoons and blueberries as a staple ingredient in cooking. Vitamin C content and other vitamins and minerals augmented the diets of those explorers and pioneer settlers to prevent malnutrition-related diseases such as scurvy. In the last few decades there has been increasing interest in the commercial cultivation and utilization of blueberries, and relatively more recently saskatoon berries.

Saskatoon berries and blueberries are both very rich sources of flavonoids and exhibit some of the highest recorded *in vitro* antioxidant capacities of various fruits and vegetables tested. In addition, both fruits are native to North America, and both have a high antioxidant capacity. Increasing the serum antioxidant status has been suggested as a possible method of reducing the risk of many chronic degenerative disorders (Kaplan & Aviram, 1999; Vendemiale et al. 1999). Thus, although the two fruits belong to different species they are indeed substantially equivalent in all characteristics that are important to the consumer, including fruit colour, shape, size, texture and nutrition, and both berries have practically identical past, present and likely future uses.

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Note: This document was prepared by **Dr. G. (Joe) Mazza** in consultation with the applicant and other industry leaders. May 4, 2004

Email: mazzag@agr.gc.ca ; Tel. (250)-494-6376; Fax: (250)-494-0755

Table 1: Composition of Saskatoon berries and Blueberries - Proximate analysis

Nutrient	Units	Blueberry [1]			Saskatoon berry [2]		
		Value per 100 grams of edible portion	Number of Data Points	Std. Error	Value per 100 grams of edible portion	Number of Data Points	Range
Proximates							
Water	g	84.21	12	0.672	79.55	9	78-80
Energy	kcal	57	0	0	84.85	9	80-89
Energy	kj	240	0	0	356.51	9	335-371
Protein	g	0.74	12	0.019	1.33	9	1.23-1.44
Total lipid (fat)	g	0.33	12	0.018	0.49	9	0.40-0.53
Ash	g	0.24	12	0.005	0.63	9	0.59-0.67
Carbohydrate	g	14.49	0	0	18.48	9	17.1-19.7
Fiber, total dietary	g	2.4	4	0.124	5.93	9	5.45-5.79
Soluble Fibre	g				0.66	9	0.44-0.92
Insoluble Fibre	g				5.27	9	4.7-5.7
Sugars, total	g	9.96	8	0.55	11.36	9	10.4-12.7
Sucrose	g	0.11	8	0	0.17	9	0.16-0.18
Glucose (dextrose)	g	4.88	8	0.275	5.23	9	5.0 - 6.0
Fructose	g	4.97	8	0.276	5.94	9	5.0 - 7.0
Lactose	g	0	8	0	0	9	0
Maltose	g	0	8	0	0	9	0
Galactose	g	0	8	0	0	9	0
Starch	g	0.03	4	0.027			

[1] USDA - ARS Nutrient Data Laboratory; [2] POS Pilot Plant, SK; [2] "0" Not detected.
The saskatoon berry analyses were carried out using the following methods: Moisture - AOAC 934.06; Protein - AOCS-Ba 4e-93 ; Total Lipid - POS SOP OIL.4.2.7 (Swedish tube after freeze drying); Sugars - Fermentation Industry Method (using HPLC); Total Dietary Fiber - AACC-32-05; Soluble & Insol Fiber - AACC-32-21; Ash - AOCS-Ba 5a-49; Energy & Carbohydrate - calculated according to CFIA Guide to Food Labelling Advertising.

Table 2: Composition of Saskatoon berries and Blueberries - Proximate analysis[1]

Nutrient	Units	Blueberry		Saskatoon berry	
		Value per 100 grams dwb	Std. Error	Value per 100 grams dwb	Std. Error
Water	(% dwb)	83.3	±1.4	80.0	±1.5
Protein	(% dwb)	4.9	±0.9	9.7	±1.3
Fat	(% dwb)	2.4	±6.0	4.2	±0.5
Fiber	(% dwb)	8.8	±0.3	19.0	±3.0
Calcium	(% dwb)	0.08	±0.01	0.44	±0.06
Phosphorous	(% dwb)	1.44	±0.16	0.16	±0.02
Potassium	(% dwb)	0.54	±0.08	1.22	±0.16
Magnesium	(% dwb)	0.04	±0.01	0.20	±0.03
Sulfur	(% dwb)	0.03	±0.01	0.06	±0.02
Iron	(ppm)	50.1	±12.5	67.5	±11.7
Sodium	(ppm)	46	±8.4	31.8	±7.7
Manganese	(ppm)	35.2	±4.7	67.5	±11.8
Copper	(ppm)	11.4	±1.0	7.23	±0.7
Zinc	(ppm)	20.6	±3.0	16.5	±2.8
Barium	(ppm)	4.4	±0.2	34.8	±4.9
Molybdenum	(ppm)	nd		0.38	±0.0
Aluminum	(ppm)	26.7	±2.0	74.5	±13.2
Carotene	(ppm)	29.3	±4.0	29.7	±5.0

[1] Mazza G. (1982) J Food Sci. 47:1730-1731.

Table 3: Composition of Saskatoon berries and Blueberries – Minerals

Nutrient	Units	Blueberry [1]			Saskatoon berry [2]		
		Value per100 grams of edible portion	Number of Data Points	Std. Error	Value per100 grams of edible portion	Number of Data Points	Range
Calcium, Ca	mg	6	12	0.785	41.97	9	37.5-47.4
Iron, Fe	mg	0.28	12	0.011	0.96	9	0.55-1.41
Magnesium, Mg	mg	6	12	0.197	24.39	9	0.21-30.6
Phosphorus, P	mg	12	12	0.508	20.15	9	17.5-21.7
Potassium, K	mg	77	6	5.45	162.12	9	151-173
Sodium, Na	mg	1	6	0.353	0.48	9	0.19-0.77
Zinc, Zn	mg	0.16	12	0.017	0.17	9	0.15-0.21
Copper, Cu	mg	0.057	12	0.014	nd	9	
Manganese, Mn	mg	0.336	8	0	1.42	9	0.70-2.65
Selenium, Se	mcg	0.1	2	0	nd	9	

[1] USDA - ARS Nutrient Data Laboratory; [2] POS Pilot Plant, SK. AOCS Ca 20-99 method.

Table 4: Composition of Saskatoon berries and Blueberries – Vitamins

Nutrient	Units	Blueberry[1]			Saskatoon berry [2]		
		Value per 100 grams of edible portion	Number of Data Points	Std. Error	Value per 100 grams of edible portion	Number of Data Points	Range
Vitamin C, total ascorbic acid	mg	9.7	4	0	3.55	9	3.05-4.38
Thiamin	mg	0.037	12	0.006	0.04	9	0.03-0.04
Riboflavin	mg	0.041	12	0	3.54	9	3.03-3.79
Niacin	mg	0.418	12	0.089	0	9	0
Pantothenic acid	mg	0.124	12	0.008	0.31	9	0.29-0.34
Vitamin B-6	mg	0.052	12	0	0.03	9	31.1-34.8
Folate, total	mcg	6	12	0.123	4.55	9	3.79-6.06
Folic acid	mcg	0	0	0		9	
Folate, food	mcg	6	12	0.123		9	
Vitamin B-12	mcg	0	0	0	0	9	
Vitamin A, IU	IU	54	0	0	10.68	9	22.0-49.4
Vitamin A, RAE	mcgRAE	3	0	0	10.91	9	6.59-15.1
Vitamin E (alpha-tocopherol)	mg	0.57	4	0.097	1.12	9	1.00-1.31
Biotin(Vitamin H)	Mg				0.02	9	0.02-0.03

[1] USDA - ARS Nutrient Data Laboratory; [2] POS Pilot Plant, SK; "0" Not detected. AOCS Ce 8-89 method.

Table 5: Composition of Saskatoon berries and Blueberries – Lipids

Nutrient	Units	Blueberry[1]			Saskatoon berry[2]		
		Value per 100 grams of edible portion	Number of Data Points	Std. Error	Value per 100 grams of edible portion	Number of Data Points	Range
Fatty acids, total saturated	g	0.028	0	0	0.020	9	0.0005-0.0598
12:00	g	0	0	0	0.0007	9	0.0006-0.0009
14:00	g	0	0	0	0.0007	9	0.0007-0.0008
16:00	g	0.017	0	0	0.0302	9	0.0229-0.0381
18:00	g	0.005	0	0	0.0050	9	0.0048-0.0052
20:00					0.0051	9	0.0039-0.0061
22:00					0.0035	9	0.0030-0.0040
24:00					0.0015	9	0.0012-0.0016
Fatty acids, total monounsaturated	g	0.047	0	0		9	
16:1	g	0.002	0	0	0.0019	9	0.0016-0.0023
18:1	g	0.047	0	0	0.1053	9	0.0848-0.1220
20:1	g	0	0	0	0.0039	9	0.0026-0.0050
Fatty acids, total polyunsaturated	g	0.146	0	0	0.192	9	
18:2	g	0.088	0	0	0.186	9	0.1295-0.2258
18:3	g	0.058	0	0	0.006	9	0.0042-0.0095
18:4	g	0	0	0		9	
20:4	g	0	0	0		9	

[1] USDA - ARS Nutrient Data Laboratory; [2] POS Pilot Plant, SK. Fatty Acids (Saturated, Monounsat and Polyunsat - Preparation using AOCS Ce 2-66, GC by Ce 1e-91 and for a by weight basis analysis (using an internal standard) - method Ce 1b-89

Table 6: Composition of Saskatoon berries and Blueberries – Amino acids

Nutrient	Units	Blueberry [1]			Saskatoon berry [2]		
		Value per 100 grams of edible portion	Number of Data Points	Std. Error	Value per 100 grams of edible portion	Number of Data Points	Range
Tryptophan	g	0.003	0	0	0.0227	9	0.02-0.03
Threonine	g	0.02	0	0	0.0379	9	0.02-0.05
Isoleucine	g	0.023	0	0	0.0455	9	0.04-0.05
Leucine	g	0.044	0	0	0.0758	9	0.07-0.08
Lysine	g	0.013	0	0	0.0379	9	0.04-0.05
Methionine	g	0.012	0	0	0.0227	9	
Cystine	g	0.008	0	0	0.0076	9	
Phenylalanine	g	0.026	0	0	0.0455	9	0.04-0.05
Tyrosine	g	0.009	0	0	0.0303	9	
Valine	g	0.031	0	0	0.0530	9	
Arginine	g	0.037	0	0	0.0985	9	0.09-0.11
Histidine	g	0.011	0	0	0.0227	9	0.01-0.02
Alanine	g	0.031	0	0	0.0530	9	0.05-0.06
Aspartic acid	g	0.057	0	0	0.1894	9	0.18-0.20
Glutamic acid	g	0.091	0	0	0.2121	9	0.18-0.23
Glycine	g	0.031	0	0	0.0606	9	0.05-0.06
Proline	g	0.028	0	0	0.0530	9	0.05-0.06
Serine	g	0.022	0	0	0.0530	9	0.05-0.06

[1] USDA - ARS Nutrient Data Laboratory; [2] POS Pilot Plant, SK . Waters Pico-Tag method

Table 7: Composition of Saskatoon berries and Blueberries – Phenolic content[1, 2]

Nutrient	Units	Blueberry		Saskatoon berry			
		Bluecrop	Std. Error	Smoky	Std. Error	Northline	Std. Error
Total Phenolics	mg	393	±52	405	±21	498	±49
Tartaric Esters	mg	55	±8	73	±2	98	±9
Flavonols	mg	46	±8	54.0	±1	69.0	±5
Anthocyanins	mg	233	±34	153	±18	204	±29

[1] Mazza and Cacace (2003); [2] Value per 100 grams of edible portion

Table 8: Antioxidant and prooxidant activity of selected berries[1]

Berry		Antiradical activity[2]	Antioxidant activity[3]	Prooxidant activity[4]
Saskatoon berry	Smoky	-4.97 ± 0.20	228 - 457	+
	Northlline	-4.37 ± 0.44	281 - 562	+
Blueberry	Bluecrop	-3.63 ± 0.15	222 - 443	+
Bilberry		-2.79 ± 0.13	216 - 432	+
Standards compounds				
BHT		-3.17 ± 0.10	200 - 300	nd[5]
Cyanidin		-7.40 ± 0.22	200 - 300	+
Dephinidin		-8.86 ± 0.31	500 - 1000	+
Malvidin		-4.42 ± 0.16	1500 - 2000	+

[1] Mazza and Cacace (2003); [2] Values are calculated coefficients of the slope by linear regression ± standard errors in µM of compound tested. For berry extracts, the µM of compound tested was measured using the total phenolic content in µM of chlorogenic acid; [3] Antioxidant activity was defined by the concentration range of added sample needed to reach 0% malonaldehyde of the control; [4] Prooxidant activity was positive (+) if the malonaldehyde of the control was >100% in the concentration range tested; [5] Not detected.

Table 9: Composition of Saskatoon berries and Blueberries – Chemical and physical properties[1, 2]

Nutrient	Units	Blueberry		Saskatoon berry			
		Bluecrop	Std. Error	Smoky	Std. Error	Northline	Std. Error
Moisture content	(%)	80.9	±1.0	77.6	±0.5	76.9	±1.0
Total solids	(%)	19.1	±1.0	22.4	±0.5	23.1	±1.0
Soluble solids	(ºBrix)	14.8	±0.9	16.4	±0.4	16.7	±0.6
pH		3.51	±0.03	4.25	±0.02	4.07	±0.02
Tititrable acidity	grams citric acid/L)	5.09	±0.07	3.12	±0.03	4.84	±0.16

[1] Mazza and Cacace (2003); [2] Value of edible portion

Appendix 1. Taxonomy of saskatoon berry and blueberry

Family: Amelanchier alnifolia (Nutt.) belongs in the Maleae subfamily of the rose family, Rosaceae (USDA Forest Service, 1988).
Common name: A. alnifolia is commonly referred to as **saskatoon berry**, serviceberry, or juneberry.

Kingdom	Plants
Subkingdom	Vascular plants
Division	Angiosperms, flowering plants, phanérogames, plantes à fleurs, plantes à fruits
Class	Dicots, dicotylédones, dicotyledons
Subclass	Rosidae
Order	Rosales
Family	Rosaceae -- Roses
Genus	Amelanchier Medik. -- Serviceberry
Species	Amelanchier alnifolia (Nutt.) Nutt. ex M. Roemer -- juneberry, pacific serviceberry, saskatoon berry, saskatoon berries, saskatoon serviceberry, western serviceberry, western shadbush
Variety	Amelanchier alnifolia var. alnifolia (Nutt.) Nutt. ex M. Roemer -- Saskatoon service-berry, Saskatoon serviceberry

http://www.itis.usda.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=182033

Blueberry

Kingdom	Plantes
Subkingdom	Vascular plants
Division	Angiosperms, flowering plants
Class	Dicotylédones, dicotyledons
Subclass	Dilleniidae
Order	Ericales
Family	Ericaceae -- heaths
Genus	Vaccinium L. -- blueberries, blueberry
Species	Vaccinium corymbosum L. -- highbush blueberry

http://www.itis.usda.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=23573

Appendix 2 .Additional information on the history of usage of saskatoon berries in Canada.

The list of recipe/cook books provided below further documents the use of saskatoon berries by Canadians.

Barss; Beulah M., - 1931- The Pioneer Cook- A Historical View of Canadian Prairie Food. Detselig Enterprises Limited Calgary, Alberta, Canada. ISBN 0 - 920490-115

Excerpt from book - Subject: - Saskatoon berry
Page 18 (para 5)- "Raspberries, **saskatoons and blueberries** were preserved by drying them in a flat layer. When required for serving, the housewife would break off a piece from the cake and sweeten this with sugar.
Page 42 (para 2) –" The berries were picked along the banks of the Saskatchewan River by fur traders with the Hudson's Bay Company and Northwest Company. They were gathered by early settlers and baked in pies, roly poly puddings, eaten fresh covered with thick fresh farm cream, dried, or canned for the long prairie winters when fruit was scarce".

Food - a la canadienne, Food Advisory Division, Agriculture Canada, Ottawa, 1970. (ISBN: 0-660-00231-0)
Saskatoon Berry Pie

Recipes compiled by the Farm Women's Union of Alberta, 1952
The women of the Farm Union of Alberta, (FUA) "A good cook contributes more to the health and pleasures of human beings than does any other effort or profession."
Saskatoon Jam – Mrs. J. H. Kelly, Lloydminster
Saskatoon Jelly – Mrs. E. L. Russel, Athabasca
Saskatoon & Rhubarb Jam

Hand written into the book by the senior owner Mrs. Betty Welter, Grande Prairie are:
Saskatoon and White Currant Jelly – great also as a pancake syrup
Saskatoon and Rhubarb Jam – of Betty's own.

Cooking the Co-op Way, Federated Co-operative Limited, 1957 (First Printing), 1960, 1963, 1970, 1972
Saskatoon Pie
Saskatoon Jelly
Saskatoon-Rhubarb Jam

Women of Unifarm Cookbook, an Alberta farm co-operative, 1971
Saskatoon Pickle – Very good with cold turkey, chicken or pork

Favorite Recipes from our Parish, Immaculate Conception Catholic Women's League, Sexsmith, Alberta, 1989
Wild Saskatoon Pie

Nellie Lyle Pattinson's Canadian Cookbook, Helen Watie & Elinor Donldson Whyte, McGraw Hill Ryerson, 1977 (ISBN 0-07-082612-9 (This is a reprint of a 1923 cookbook touted as a basic cook book for homemakers and students since 1923. It describes saskatoon jelly thus: "The search for this berry, resembling a red blueberry, was once the reason for all-day outings on the Prairies. Like the blueberries in the Eastern provinces, these berries are eaten raw, made into pies, or into jam."
Saskatoon and Apple Pie
Saskatoon Jam
Raspberry Saskatoon Jam
Saskatoon Jelly

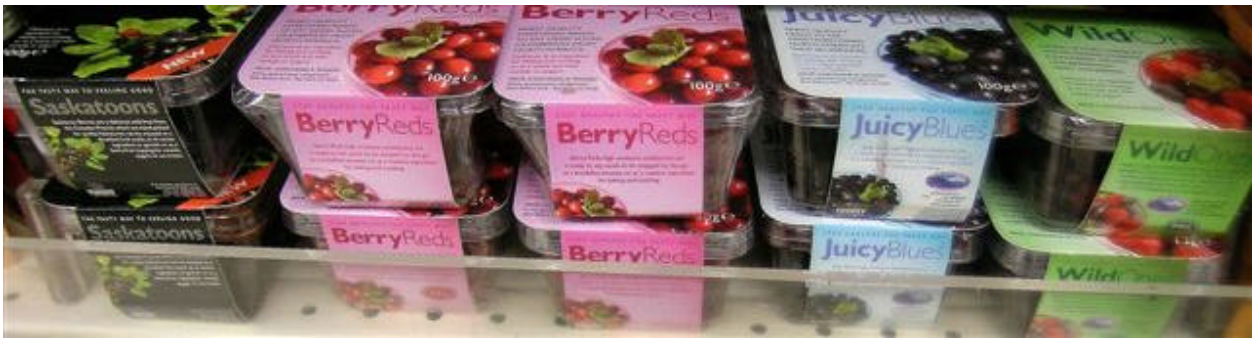
From our Kitchens, St. Paul's United Church, Fairview, Alberta, 1987
Saskatoon Pie – Jean Bartlett
Saskatoon Jelly – Vi Evans

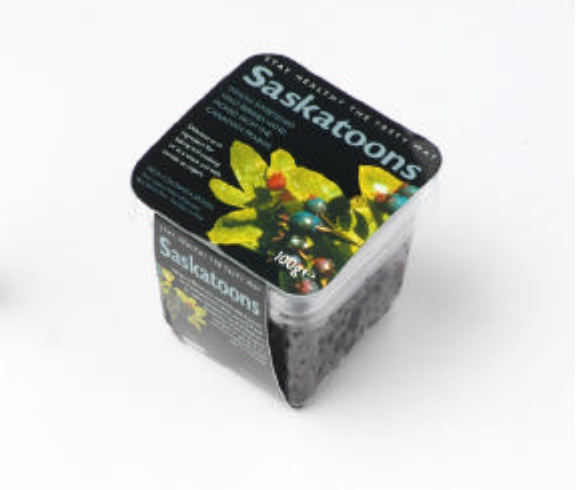
Edible Wild Fruits and Nuts of Canada, Nancy Turner & Adam Szczawinski, National Museum of Natural Sciences, 1979. (ISBN: 0-660-00128-4)
This manual for the public says this: "In comparison with other dried and fresh fruits, saskatoon berries contain unusually high concentrations of iron and copper. The amount of iron is three times that contained in dried prunes and four times that in raisins."
Saskatoon-Cranberry Dessert
Saskatoon Pie
Saskatoon Surprise – a cracked ice drink with orange juice & ice cream
Pickled Saskatoon berries
Spiced Saskatoon berries
Saskatoon Pemmican – with dried beef or venison

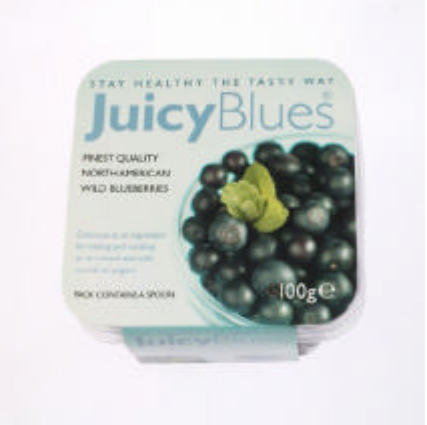
Appendix 3. Selected blueberry and saskatoon berry products

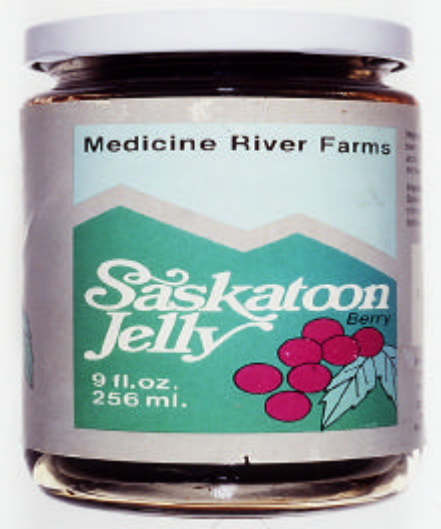
Saskatoon berry products

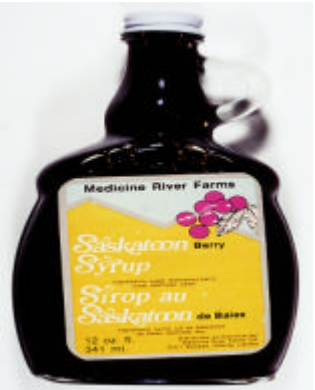
Blueberry berry products




Saskatoons


STAY HEALTHY. THE TASTY WAY.
JuicyBlues
FINEST QUALITY
NORTH AMERICAN
WILD BLUEBERRIES
100g


Medicine River Farms
Saskatoon
Berry
Jelly
9 fl.oz.
256 ml.


Medicine River Farms
Saskatoon Berry
Syrup
Sirop au
Saskatoon de Baies

Appendix 4. Literature search for Amelanchier and allergies – May 4, 2004

1. CAB Direct

Coverage: 1972 – 2004
Search: (saskatoon or saskatoons or amelanchier) AND (allergi* or allerge* or allergy or reagin* or react*) produced 35 hits, none of which related to human reactions.

Most relevant document:
Maturation and ripening of fruit of Amelanchier alnifolia Nutt. are accompanied by increasing oxidative stress

Rogiers, S. Y. , Kumar, G. N. M. , Knowles, N. R.
Department of Agricultural, Food and Nutritional Science, 4-10 Agriculture/Forestry Center, University of Alberta, Edmonton, Alberta, T6G 2P5, Canada.
Annals of Botany, 1998, Vol. 81, No. 2, pp. 203-211, 60 ref.
Saskatoon (A. alnifolia) fruits were collected at various stages from immature to fully mature and ripe from 4-year-old pot-grown shrubs in a controlled environment (cv. Pembina) and from a commercial orchard in Spruce Grove, Alberta, Canada (cv. Northline). Concentrations of ethane and substances which reacted to 2-thiobarbituric acid (TBARS) increased during fruit development. The concentration of polar lipid fatty acids and free fatty acids decreased by 27 and 53% on a dry weight basis, respectively, as fruits matured from class 4 (mature-green stage) to class 9 (fully ripe purple stage). To determine whether increasing oxidative stress during maturation and ripening of fruits was associated with reduced ability to catabolize active O_2 species, changes in activities of superoxide dismutase (SOD), catalase (CAT), peroxidase (POX), glutathione reductase (GRase) and glutathione transferase (GTase) were measured. SOD and CAT activities were highest in class 4 fruits, but de
clined 4-fold and 18-fold, respectively, by the class 9 stage. POX activity increased 8-fold from class 8 (dark red stage) to class 9, while lipoxygenase (LOX) activity increased 2.5-fold on a protein basis as fruits ripened from class 5 to class 9. It is concluded that higher LOX activity, in conjunction with a decline in SOD and CAT activities and increased respiration during ripening, contributed to an increase in cellular oxidative status, and that increased production of lipid hydroperoxides and other active O_2 species during development induced higher POX, GRase and GTase activities during the later stages of ripening.

2. ERL Webspirs
Search:
#2 (saskatoon or saskatoons or amelanchier)and(berry or berries)and(allergi* or allerge* or allergy or reagin* or reaction)(2 records)
#1 (saskatoon or saskatoons or amelanchier)and(allergi* or allerge* or allergy or reagin* or reaction)(766 records) (Did not have time to review 766 records, so added “berry or berries” to reduce the size of the set) Produced only 2 results as indicated above.

Databases and Coverage:

AGRIS 2003/10-2003/12, AGRIS 1999-2003/09, AGRIS 1997-1998, AGRIS 1995-1996, AGRIS 1993-1994, AGRIS 1991 - 1992, AGRIS 1989 - 1990, AGRIS 1986 - 1988, AGRIS 1981 - 1985, AGRIS 1975 – 1980;
AGRICOLA 1998-2004/03, AGRICOLA 1992-1997, AGRICOLA (1984 - 12/91), AGRICOLA (1979 - 1984), AGRICOLA (1970 - 1978);
Biological Abstracts 2003/07-2003/12, Biological Abstracts 2003/01-2003/06, Biological Abstracts 2002/07-2002/12, Biological Abstracts 2002/01-2002/06, Biological Abstracts 2001/07-2001/12, Biological Abstracts 2001/01-2001/06, Biological Abstracts 2000/07-2000/12, Biological Abstracts 2000/01-2000/06, Biological Abstracts 1999/07-1999/12, Biological Abstracts 1999/01-1999/06, Biological Abstracts 1998/07-1998/12, Biological Abstracts 1998/01-1998/06, Biological Abstracts 1997/07-1997/12, Biological Abstracts 1997/01-1997/06, Biological Abstracts 1996/07-1996/12, Biological Abstracts 1996/01-1996/06, Biological Abstracts 1995/07-1995/12, Biological Abstracts 1995/01-1995/06, Biological Abstracts 1994/07-1994/12, Biological Abstracts 1994/01-1994/06, Biological Abstracts 1993/07-1993/12, Biological Abstracts 1993/01-1993/06, Biological Abstracts 1992 Part 2, Biological Abstracts 1992 Part 1, Biological Abstracts 1990 Part 2, Biological Abstracts 1990 Part 1, Biological Abstracts 1989 Part 2, Biological Abstracts 1989 Part 1, Biological Abstracts 1987-1988, Biological Abstracts 1985-1986, Biological Abstracts 1983-1984, Biological Abstracts 1980-1982, Biological Abstracts 1975-1979, Biological Abstracts 1969-1974;
FROSTI 1972 - 2004/03;
FSTA 1990-2004/06

2 records:
Record 1 of 2 in FROSTI 1972 - 2004/03

AN: 630507
TI: Nuts about fruit.
AU: Langham-M
SO: Kennedy's-Confection; 2003. (December), 32-34 (0 ref.)
PY: 2003
IS: 1461-4324
DT: J-Journal-article
AB: Consumer interest in healthy eating has created a growth in demand for snack products containing fruit and nut ingredients. It is noted that, for the first time, US manufacturers can put a health claim on products containing nuts. Nuts are also increasingly replacing high-carbohydrate ingredients, and are attracting those people on low-carbohydrate diets. It is reported that Nimbus Foods is developing a range of nut-free ingredients that have the same taste and texture as nuts, in response to concerns about allergies and intolerances. Golden Peanut Co. is building a new factory for the production of peanut flour, roasted aromatic peanut oil and peanut extract. Fruit ingredients are also benefiting from the growing awareness and interest in health and nutrition. A trend towards the addition of novel and exotic ingredients, such as Saskatoon berries, boysenberries and tropical fruit, is said to be shaping the market. The article mentions some of the snack ranges containing fruit ingredients that have been developed by Nimbus Foods and JO Sims.
UD: 200402

Record 2 of 2 in FSTA 1990-2004/06

TI: Effect of catechin and acetaldehyde on colour of saskatoon berry pigments in aqueous and alcoholic solutions.
AU: Green,-R-C; Mazza,-G
SO: Canadian-Institute-of-Food-Science-and-Technology-Journal. 1988; 21(5): 537-544 ; 24 ref.
IS: 0315-5463
DT: Journal-Article
PY: 1988
AB: The influence of acetaldehyde and catechin on aqueous solutions of cyanidin 3-glucoside and aqueous and alcohol extracts of saskatoon berry [Amelanchier alnifolia] was investigated. Pigment systems were analysed periodically during storage at 23°C in the dark for absorbance spectra, HPLC profiles and Hunterlab colour values. Presence of acetaldehyde in the fruit extracts and both acetaldehyde and catechin in the cyanidin 3-glucoside model system caused a marked increase in colour intensity during storage. Visible spectra of the colour-intensified samples showed both a bathochromic shift and an increase in absorbance. The HPLC profiles of the acetaldehyde-treated berry extracts revealed the appearance of a new peak and the decrease of 2 anthocyanin peaks. Chromatograms of the cyanidin 3-glucoside solution containing acetaldehyde and catechin displayed 6 new peaks and loss of the anthocyanin. Addition of catechin alone had no significant effect on colour of the model of pigment extract systems. Results indicated that colour intensification was due to molecular condensation involving catechin, acetaldehyde and anthocyanin as well as other phenolic compounds in the berry extracts. Hue angle of the extracts accurately measured the colour intensification reaction.
UD: 199006
AN: 1990-06-J0032

3. Current Contents Connect:

Coverage: Approximately 1 year

Search: Same as the other databases

Results: No hits

4. Pub Med:

Coverage: Over 12 million MEDLINE citations back to the mid-1960's

Search strategy: Same as the other databases

Results: 33 citations, only 2 of which relate specifically to saskatoons and most of which cover much broader botanical families because of the MESH indexing used to create PUB MED. None cover specific human allergic reactions.

SEARCH RESULTS: Files of citations produced by the search strategy applied to each of these database sources are available on request. Lynne Boyd, Librarian
Pacific Agri-Food Research Centre – Summerland (250) 494-2100
boydl@agr.gc.ca

PS. A more comprehensive list of saskatoon and blueberry product photographs has been provided as a separate pdf file.