

SPREAD THE MUSTARD

An Ancient Spice That Packs a Punch

Did you know?

- Mustard seeds composition and functional characteristics make mustard ideal for a plethora of food and food processing applications
- Mustard is a natural antimicrobial preservative with unique emulsifying and binding properties and contributes pungency, heat, flavour and nutritive value to foods
- Mustard is a versatile food ingredient available in many forms: whole seeds, flours, meals, and brans
- Mustard is used in packaged meat products, condiments, sauces, baked goods and even beverages
- Canada is the world's largest exporter of condiment Yellow and Brown mustards

Mustard is one of the oldest spices according to records dating back to 3000 BC. It was recognized for its therapeutic and condiment value, historically being used to treat scorpion bites, entomb kings and as a flavouring agent to disguise degraded food.¹⁰

Globally, three types of mustard seeds are used as condiments: Yellow or White mustard (*Sinapis alba* syn. *Brassica hirta* or *B. alba*); and Brown and Oriental mustard (*B. juncea*). Mustard greens is widely used as a salad, as an oilseed crop in India, for green manure, or as a fodder crop or for industrial oil purposes. In Canada, *Sinapis alba* is approved as a traditional Chinese medicine (Bai Jie Zi).⁸

Canada is the world's largest exporter of mustard seed supplying both Yellow and Brown/Oriental mustards to the world trade market.⁵

Figure 1. Canadian mustards²



Yellow
Sinapis alba



Brown
Brassica juncea



Oriental
Brassica juncea

Mustard Composition

Mustards seeds are composed of protein, oil, carbohydrates, and micronutrients (Table 1). Brown and Oriental mustards tend to have a slightly lower protein content and higher oil content than Yellow mustard. Mustard also contains

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bioactive compounds such as glucosinolates, phytate, and phenolics, once thought to be antinutritional factors, which are now being investigated for their potential health benefits.

Glucosinolates are important natural, functional components in mustard as the hydrolysis by the enzyme myrosinase produces isothiocyanates (ITC), the agents responsible for the heat, pungency and antimicrobial properties of mustards. Hydrolysis of the glucosinolate sinalbin in Yellow mustards produces non-volatile p-hydroxy benzoic isothiocyanate (p-HBITC) giving Yellow mustards their characteristic heat and mouth sweetness. Hydrolysis of the sinigrin glucosinolate in Brown/Oriental mustards produces volatile allyl isothiocyanate (AITC) giving these mustards their strong olfactory and pungent properties.

Mustard protein has an excellent nutritional profile being rich in lysine with adequate amounts of sulphur-containing amino acids (methionine & cysteine) which are limiting amino acids in most cereals and oilseed proteins.¹⁰ Due to its high biological value, mustard as a protein source could be of great interest to human nutrition.¹

Table 1. Chemical composition of mustard seed^{2,4}

Mustard, Whole Seed	Glucosinolates		Composition					
	Sinigrin ^a	Sinalbin ^b	Oil	Protein	Phytate	Crude Fibre	Moisture	Ash
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Yellow	-	2.3	27-32	29-32	2-3	9	6	4
Brown	0.80	-	36-40	25-27.5	2-3	7	6	4
Oriental	0.78	-	37-45	24-28	2-3	6	6	4

^a Sinigrin hydrolysis results in AITC; ^b Sinalbin hydrolysis results in p-HBITC

Mustards are low in saturated fatty acids and high in mono- and polyunsaturated fatty acids.² Mustard oil is high in erucic acid and while its use is prohibited for human consumption in North America and Europe, it is consumed as a cooking oil in India and the Middle East. Mustard oil's lubricant qualities and erucic content are suited for the emerging bio-based industrial market.

Table 2. Fatty acid composition (%) of Yellow and Brown mustard^{3,9}

Seed Type	Palmitic (16:0)	Stearic (C18:0)	Oleic (C18:1)	Linoleic (C18:2)	Linolenic (C18-3)	Eicosenoic (C20:1)	Erucic (C22:1)
Yellow	2.6-2.7	1.0-1.1	23-25	7-10	9-12	6-11	33-51
Brown	2-4	1.4-1.6	20-25	20-23	10-20	6-14	18-23

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Mustard is a Multi-Functional Food Ingredient

Mustard has unique functional properties that can be applied to many foods including baked goods, packaged meat products, condiments and emulsion-type dressings (Table 3). Depending on the type of mustard ingredient used, mustard provides emulsification, stability, water and fat binding, preservative and nutritive properties to foods. Mustard flours (bran removed) provide emulsifying capacity for use in salad dressings, sauces and processed meats. Ground mustards and mustard flours can be used as a protein source.

Mustard can be processed into various forms including whole seed, cracked seeds and finely or coarsely ground seeds. It can be milled to produce a flour and a bran product, and de-oiled to produce an oil fraction and a high protein meal (cake).

Mustards subjected to a heat treatment are commonly called de-heated, cold, deodorized or deactivated mustards to produce bland flavoured mustard flours, brans and ground mustards. Heating inactivates the myrosinase enzyme in the seed and prevents the conversion of the glucosinolates into the pungent, hot isothiocyanates.

Yellow mustard bran (seed hull) is a unique co-product of the flour milling process. Yellow mustard bran contains about 5% mucilage compared to less than 1% in the Brown and Oriental mustards. This mucilage (hydrocolloid) has unique emulsifying, water binding and shear thinning properties that contribute to the use of mustard bran as a thickening agent in sauces and dressings.

Applications: De-heated (cold) Yellow mustard flours are commonly used in sauces and mayonnaises and due to their binding ability, can be used as a substitute for gums or starches. It can also partially replace egg yolks in mayonnaise formulations. Mustard (when de-heated) is primarily used in the meat industry as an emulsifier, a water-binding agent, and a filler in cooked, cured meats. Regular mustard (without de-heating) is used as a flavouring agent or as preservative in various meat products such as hot dogs, bologna, sausages and salami.

Natural Antimicrobial Agent: Mustard has inherent antimicrobial properties due to the presence of the glucosinolates and isothiocyanates. These bioactive compounds inhibit the growth of pathogens and spoilage organisms thus contributing to the microbial safety of processed foods and increasing shelf life.

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Table 3. Mustard products, applications, uses and functional attributes

Product Form	Seed	Application	Functional Attributes
Oil	Brown/Oriental	Edible oil (India) Industrial uses	Pungency and taste High erucic acid content makes it an excellent lubricant
	Yellow	Mayonnaise (Sweden) White mustard oil extract (WMEO)	Lubricant Potential antimicrobial agent
Mustard Powder	Yellow flours or Yellow/Oriental blends	Retailed as flour Ingredient in salad dressings, mayonnaise, BBQ sauce, pickles, processed meats	Flavour Emulsifier Various flavour profiles offered (from mild to hot & pungent)
Ground Mustard (whole seeds, ground)	Yellow Or Oriental Or Yellow/Oriental blends	Meat products Seasoning for frankfurters, bologna, salamis, luncheon meats Salad dressings, pickled products, condiments	Flavour Emulsion stability for oil/water emulsions Water binder Bulking agent Reduces product shrinkage during cooking Low cost vegetable protein in meat products Antimicrobial activity as ITC inhibit microbial growth As an antioxidant preserves colour and freshness in fruit pies, tarts and quiches.
	Brown	Brown mustard used primarily for preparation of hot, spicy table mustards (e.g. Dijon)	
Cracked mustard seeds	Yellow or Brown	Mustards, salad dressings Seasonings and topical blends	Specific granulations achieved Emulsification Thickener
De-heated mustard (cold) (Myrosinase enzyme deactivated)	Yellow	Finely ground: Myrosinase enzyme deactivated Processed cheese slices, bakery products and beverages Meat products Sauces Mayonnaise (can partially replace egg yolk) Tomato-based products (e.g. ketchup)	Bland tasting High protein source Water binder Antioxidant which retards lipid oxidation Stabilizer Thickener Potential as reducing agent in bakery mixes to break down gluten matrix, relaxing the dough and improving stretchability
De-oiled ground mustard (partial oil expelled)	Yellow & Brown	Meat products (hot dogs, sausages, bratwurst, and processed deli meats) Creamy dressings Mayonnaise Applications include hot Chinese mustard, wasabi paste/powder, and Asian cuisine	Fixed oil component is cold-expelled concentrating the protein (minimum 40%), mucilage, phospholipids and fiber.
Mustard Bran	Yellow	Coarse flakes or ground to fine powder	Water binding/holding capacity Thickener
	Yellow/Oriental blends (50/50)	Natural thickener in sauces	Low cost filler Oriental mustard bran has hotter flavour, only small amount of mucilage present.

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Mustard as an Allergen

Mustard, like wheat and soy, is considered a priority allergen in Canada and Europe and like these other ingredients must be identified as a food allergen in the food label ingredient list. The food industry, through proper labelling, can adequately inform consumers.

To answer questions about mustard as an allergen, consumers and the food industry are directed to Health Canada's fact sheet "Mustard-A Priority Allergen".⁷

Mustard Opportunities - Uses and Applications

- Mustard is a natural antimicrobial agent which contributes to the microbial safety of foods and increases shelf life
- Unique characteristics of mustard (protein value, mucilage, functional attributes, flavour) make it a good replacement for additives and preservatives
- Mustard can be used as a filler, protein enhancer and as a spice or flavouring agent

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