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Pectin

Pectin is a kind of water-soluble DF which is extensively used as a functional ingredient in food and beverage industries due to its thickening and gelling properties and as a colloidal stabilizer.

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Related terms:

Hemicellulose, Dietary Fiber, Polygalacturonase, Carbohydrates, Enzymes, Polymers, Cell Walls, Proteins, Polysaccharides, Cellulose

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Pectins

H.-U. Endreß, S.H. Christensen, in Handbook of Hydrocolloids (Second Edition), 2009

12.6.10 Sugar confectionery

Pectin confectionery jellies can be divided into two types: tender, fruity jellies made with high methyl ester pectin, and elastic jellies based on low methyl ester or amidated pectins blended with sequestering phosphate buffers, suitable for traditional turkish delight flavours, and also mint and other non-acid flavours (Formulation 12.15). High soluble solids contents (approx. 78%), usual in the production of gum and jelly products with high methyl ester pectins, require relatively high pH values to prevent pre-gelation and to achieve long depositing times. For taste reasons, a high product pH is not desired in confectionery jellies, but at the same time long depositing times are required for technological reasons. Therefore, for products with a high soluble solids content, a pectin with a very low setting temperature with simultaneously low viscosity during the boiling process or substances delaying gelation (retarders) is required. Such buffer salts make it possible to work at lower pH values without any risk of pregelation. Following there are two recipes with high methyl ester pectins, one recipe with a buffered pectin (Formulation 12.16) and one with a pectin without buffer salts (Formulation 12.17).

Formulation 12.15. Turkish delight jelly

Ingredients		Weight (g)
A	Buffered amidated LM pectin	24
Sucrose	100	
B	Water	220
Citric acid solution (50% w/v)	10 ml	
C	Sucrose	360
Glucose-fructose syrup	395	
D	Colour, flavour	as required
Citric acid solution (50% w/v)	20 ml	
Final batch weight	1000	
pH (as is at 20 °C)	4.0–4.1	
Soluble solids (approximately)	78%	

*Preparation*1.Dry mix ingredients A and stir into water and citric acid solution B. Heat to boil while stirring until the pectin is completely dissolved.2.Add sucrose and glucose-fructose syrup C and decoct to final soluble solids.3.Remove from the heat, mix in the colour, flavour and citric acid solution D and deposit into moulds by a depositing temperature of approx. 95 °C.

Formulation 12.16. Fruit flavoured confectionery jelly with buffered pectin

Ingredients		Weight (g)
A	Medium rapid set HM pectin, buffered, DE° ~ 56–60%	13
Sucrose	100	
B	Water	220
C	Sucrose	400
Glucose syrup	330	
D	Colour, flavour	as required
Citric acid solution (50% w/v)	13 ml	
Final batch weight	1000	
pH (as is at 20 °C)	3.2–3.4	
Soluble solids (approximately)	78%	

*Preparation*1.Dry mix ingredients A and stir into water B. Heat to boil while stirring until the pectin is completely dissolved.2.Add sucrose and glucose syrup C and decoct to final soluble solids.3.Remove from the heat, mix in the colour, flavour and citric acid solution and deposit into moulds by a depositing temperature of approx. 95 °C.

Formulation 12.17. Fruit flavoured confectionery jelly with unbuffered pectin

Ingredients		Weight (g)
A	Slow set HM pectin, DE° 56–60%	13

Sucrose		100	
Tri sodium citrate × 2H20		4	
B	Water		220
C	Sucrose		400
Glucose syrup		330	
D	Colour, flavour		as required
Citric acid solution (50% w/v)		18 ml	
Final batch weight		1000	
pH (as is at 20 °C)		3.2–3.4	
Soluble solids (approximately)		78%	

*Preparation*1.Dry mix ingredients A and stir into water B. Heat to boil while stirring until the pectin is completely dissolved.2.Add sucrose and glucose syrup C and decoct to final soluble solids.3.Remove from the heat, mix in the colour, flavour and citric acid solution and deposit into moulds by a depositing temperature of approx. 95 °C.

The lower limit for gelation of high methyl ester pectins is a soluble solids content of approx. 55%. At lower soluble solids high methyl ester pectins do not gel sufficiently, in this range low methyl ester pectins with the addition of calcium salts are used. For confectionery jelly production it is essential to include a proportion of glucose syrup to prevent crystallisation of the sugar.

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Plant compounds and fruit texture: the case of pear

T. Kojima, ... P. Sirisomboon, in Texture in Food: Solid Foods, 2004

11.3.4 Alcohol insoluble solids and solubilization of pectin

Pectin constituents in fruits and vegetables are extracted from alcohol insoluble solids (AIS). The AIS form the principal constituents of cell walls and may be partially associated with each other and with some phenolic compounds. They are composites of salts, proteins, starch and different non-starch polysaccharides such as pectin, hemicelluloses and cellulose (Reinders and Their, 1998). The changes in AIS and pectin constituents of the mature Japanese pear (Hosui) at different picking dates were intensively investigated by the Kojima research group at Saga University, Japan (Sirisomboon*et al.*, 2000b). While fruit weight and average diameter increased over the harvest period, the alcohol insoluble solids on fresh weight basis (AIS in FW) decreased. Change in AIS in fruit appears to be related to the change in the rate

of decline on a FW basis and the increasing weight of the fruit. The soluble solids (SS) in juice increased consistently during the fruit enlargement. While AIS in FW significantly decreased during fruit enlargement, WSP, OSP (oxalate soluble pectin), NSP (non-soluble pectin), and TP in AIS increased. The increasing rate of WSP was relatively high. There was no significant change in WSP in FW with picking dates, but the OSP, NSP, and TP in FW significantly decreased. There was an increase in the soluble pectin ratios (OSP/TP and WSP/TP) and a decrease in the non-soluble pectin ratio (NSP/ TP). These show the occurrence of the solubilization of pectin in the fruit.

Ben-Arie*et al* (1979a) reported that fruit softening was accompanied by the solubilization of the insoluble pectic substances to a soluble pectic fraction. Though the solubilization occurred, the NSP in AIS gradually increased because of the increase of TP in AIS. Similar patterns of soluble pectin ratios (WSP/TP and OSP/TP) and non-soluble pectin ratio (NSP/TP) changes have been reported byYamaki and Matsuda (1977). The correlations between AIS in FW and TP in FW were very high. Therefore, the decline in TP in FWcorresponded to the decline in AIS in FW. The decrease in AIS reflected in part the loss in the pectic substance (Ben-Arie*et al.*, 1979a). Furthermore, the correlation between AIS in FW with WSP/TP was very high compared to that with OSP/TP, which indicated that the loss in pectic substances was predominantly due to the solubilization of NSP to WSP and partially due to that of NSP to OSP. This indicated that the binding force of OSP with fruit tissue may be stronger than WSP.

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Pectin: Properties Determination and Uses

B. De Cindio, ... F.R. Lupi, in Encyclopedia of Food and Health, 2016

Abstract

Pectin is a high-molecular-weight heteropolysaccharide present in plant cell walls where it contributes to the firmness and structure of the vegetal tissue. Pectin is widely used as food ingredient owing, mainly, to its ability to impart texture and firmness to food products (hydrogels), even though recent interesting uses are also related to other pectin properties, such as interfacial activity. A general overview of pectin and pectin gels is presented, including the most recent experimental techniques used to characterize pectin properties and the texture–structure relationships in pectin hydrogels.

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PECTIN | Properties and Determination

L. Flutto, in Encyclopedia of Food Sciences and Nutrition (Second Edition), 2003

Introduction

Pectin is a high-molecular-weight carbohydrate polymer which is present in virtually all plants where it contributes to the cell structure. The term pectin covers a number of polymers which vary according to their molecular weight, chemical configuration, and content of neutral sugars, and different plant types produce pectin with different functional properties. The word 'pectin' comes from the Greek word *pektos* which means firm and hard, reflecting pectin's ability to form gels.

The gelling properties of pectin have been known for centuries, but the isolation of commercial pectin only started at the beginning of the twentieth century. In this document we highlight the chemistry, origin and production, and the functional properties of pectin.

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Pectin and Health

L. Wicker, Y. Kim, in Encyclopedia of Food and Health, 2016

Abstract

Pectin is a soluble fiber with a structural complexity and a multiplicity of beneficial health effects. Different domains of pectin structure reduce the risk of some cancers and cardiovascular diseases and moderate the glycemic index; pectin slows gastric transit and helps control energy intake. Pectin is fermented by colonic bacteria, generating short-chain fatty acids that contribute to favorable health outcomes. The interaction of pectin and polyphenolic compounds contributes to systemic anti-inflammation. Further, pectin is an effective delivery vehicle for exogenous nutraceuticals or drugs via either emulsion or hydrogel technology for targeted delivery to the colon.

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Sweet Potato Pectin

Taihua Mu, ... Cheng Wang, in Sweet Potato Processing Technology, 2017

5.3 Frozen Food

Pectin can slow down the growth rate of crystals, reduce the loss of syrup, and improve the quality of frozen products. Ca^{2+} and pectin have stabilize freeze–thaw effects on fruit. A low level of methoxyl pectin can improve the fruit quality in ice cream products. Pectin can improve the quality of frozen foods by controlling the size of ice crystals. In ice cream, pectin can prevent the reduction of flavor and pigment. When pectin is used for preparing gel pudding desserts, no freezing is needed to produce a sweet taste with a pudding consistency.

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JAMS AND PRESERVES | Methods of Manufacture

D.A. Smith, in Encyclopedia of Food Sciences and Nutrition (Second Edition), 2003

Pectin

Pectin is a group of substances which forms gels when dissolved in water under suitable conditions. It is derived from the protopectin found in the middle lamellae of plant cells. Protopectin is insoluble, but is converted to soluble pectin as fruit ripens or is heated in an acid medium. Pectin is a negatively charged colloid in an acid fruit substrate. As sugar is added to this colloid, the pectin–water equilibrium breaks down, and a fibrous network capable of supporting liquids is established. The fiber network forms the gel necessary for jams, jellies, and preserves. (*See* PECTIN | Food Use.)

One should always assume that juices will be deficient in pectin and supplement the jelly with commercial pectins. Pectin can be produced from many fruits, or other plant tissues such as beetroots, but most commercial pectins are derived from citrus peels by precipitating the pectin from solution with alcohol. Pectin is a reversible colloid. It may be dissolved in water, precipitated, dried, then redissolved without alteration of its physical properties. (*See* COLLOIDS AND EMULSIONS.)

Dry pectin does not readily go into solution. On the addition of water to dry pectin, paste-like lumps are formed. Solution is greatly facilitated by heating the water or juice, then adding a pectin and sugar mixture. Pectin which has been thoroughly mixed with 10 times its weight of sugar will readily go into solution in hot water, forming a nearly clear solution. Most commercial pectins contain dextrose to facilitate dispersion in solution. Vigorous stirring with a noncavitating impeller helps to insure proper dispersion.

Various pectins are produced for the preserving trade. These pectins may be classified as rapid-set, slow-set, or by the weight of finished jelly that one unit weight of pectin will produce. Rapid-set pectin forms gels at higher temperatures than slow-set pectin. Rapid-set is preferred for jams and preserves because it reduces the likelihood that the fruit component will rise to the surface before the gel is set. Slow-set pectin is often preferred for jelly production because handling of the jars after the jelly has firmly but not finally set is less apt to damage the jelly's texture and firmness. The grade value of a pectin refers to the weight of sugar that one unit weight of pectin will gel. The most common commercial pectin is 150-grade pectin, meaning that with water, sugar to give 65% solids, and acid to give the optimum pH, one unit weight of pectin will give a perfect jelly with 150 times that same weight of sugar. Pectin of 100 grade is also popular.

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Extraction Processes of Functional Components From Citrus Peel

Comprehensive Utilization of Citrus By-Products, 2016

2.1.7 Precipitation

Most pectin is sold in the form of pectin powder. Thus, pectin products should be precipitated from the solution. Ethanol precipitation is the first method used in industrial production of pectin. After 1.5% hydrochloric acid is added to the concentrated industrial pectin extract, 90% ethanol at the same volume (identical to the volume of industrial pectin extract) is added slowly with stirring at an interval of 1–2 min. Upon stirring four or five times, the mixture is allowed to stand for 20 min and pectin is precipitated. To ensure full precipitation of pectin, the ethanol content should be higher than 45–50%. Pectin is obtained through filtration in a spiral presser and washed with 95% ethanol two or three times (0.5 h each time).

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Classifications

Reginald H. Walter, in Polysaccharide Dispersions, 1998

1. The Pectic Substances

Pectin (unrelated to amylopectin) is the collective name of the galacturonans that are capable of gelling with water, sugar, acid, and/or calcium. High-methoxyl (HM) pectin has DE > 40–50% and low-methoxyl (LM) pectin has DE < 50–40%. HM pectin is the industrial precursor of LM pectin. Demethylation is effected by chemicals or enzymes. Ultrasonication improves the yield of deesterified pectin (Panchev *et al.*, 1994). Completely demeth-ylated pectin is pectic acid. In the wholly protonated form (strongly acidic media), pectic acid quickly precipitates from solution.

Aqueous dispersions of HM and LM pectin have very low viscosity (Walter *et al.*, 1985) and tolerate moderate amounts of ethanol (Walter and Sherman, 1983). HM pectin is unique among hydrocolloids in its ability to gel in acidic media (pH < 3) amid a high concentration of sugar (65%). The gelation mechanism is uncertain, but is known to involve stiffening of the primary chains through protonation, water inactivation by high soluble-solids content, and network coupling. LM pectin requires less sugar and gels by cooperative association through calcium bridges. In juice-milk beverages, HM pectin is preferable to LM pectin, because of its insensitivity to Ca^{2+}. HM pectin jelly is not ordinarily heat-reversible, whereas LM pectin jelly is. HM pectin gels prepared at no higher than 50°C are metastable (Walter and Sherman, 1986).

Gelation of sugar beet pectin is a coupling reaction of feruloyl groups with some oxidants in a way that releases free radicals (Thibault *et al.*, 1991).

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PECTIN | Food Use

L. Flutto, in Encyclopedia of Food Sciences and Nutrition (Second Edition), 2003

Fruit Beverages and Soft Drinks

Pectin is used as a viscosifier in beverages and soft drinks, and high-ester pectins may be used as a mouth-feel improver. This use has been widely developed for juice drinks with a reduced juice content or sugar-free soft drinks.

Low-concentration pectin solutions can be considered Newtonian and show a low viscosity. This is of great relevance for the use of pectin in fruit beverages and soft drinks as the concentration used rarely exceeds 0.5%. Indeed, the clean mouth feel imparted by pectin compared with the tendency towards a slimy mouth feel with some other gums could be related to the low viscosity of pectin solutions at the shear rate applied in the mouth. This property makes pectin an ideal choice when trying to replace the mouth feel lost by the reduction in sugar content.

As most juice beverages and soft drinks contain calcium, pectin with a high degree of esterification is usually recommended to minimize the calcium sensitivity of the pectin and avoid any risk of gelling. A slight gelling of the product changes the rheology of the solution, resulting in undesirable pseudoplastic behavior. For this reason, the most commonly used pectin is of the rapid setting type. Pectin manufacturers usually offer rapid-set pectins standardized to a viscosity instead of gelling properties, so as to guarantee a consistent performance in a beverage application.

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