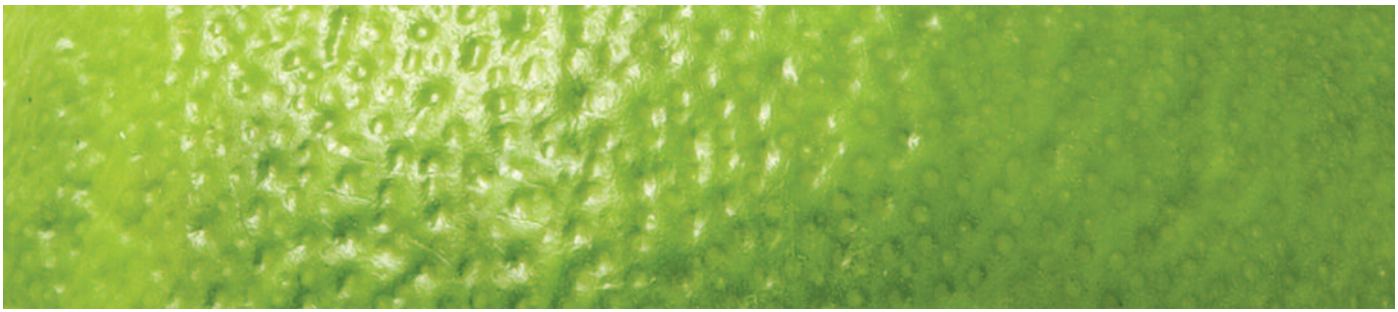
Apple and Citrus Pectins



naturally gelling

obipektin
inspired by nature

requiring high quality for our products and ourselves

Since 1936, at Obipektin we have prided ourselves in setting the international standard for consistently high quality natural food ingredients in concordance with our Swiss origins.

Our R&D and Application teams are continuously advancing an exciting range of speciality pectins and fruit and vegetable powders, that have been inspiring the world's leading food and beverage manufacturers to develop great consumer products for over 70 years.

Contents

our products

Apple and citrus pectin

We offer a wide range of tailor-made high-methoxyl, low-methoxyl and amidated pectins based on stringently selected apple and citrus raw materials.

Our expert application team is ready to work with you to develop individual solutions to fit your unique needs. Fast and flexible service is our core competence.

Fruit and vegetable powder

Using four drying technologies (vacuum, drum, cold spray and low temperature spray) we offer a complete range of fruit and vegetable ingredients in three different forms; granules, flakes and traditional powders.

We operate the tallest spray drying tower in the world at our facility in Burgdorf, Switzerland. This unique tower is used to produce 100% pure tomato, apple and carrot-powder; with no added carrier we are able to retain all of the flavour, colour and quality of the original raw materials.

Baby food

We supply ingredients to all sectors of the food and beverage industry, but we are particularly proud of our position as a leading supplier to baby food manufacturers – possibly the most demanding and sensitive food and beverage market.

Here we aim to exceed even the strictest parent's standard and are in accordance with the EC directives:

- Commission Directive 2006/125/EC of 5 December 2006 on processed cereal-based foods and baby foods for infants and young children in its legal version.
- Commission Directive 2006/141/EC of 22 December 2006 on infant formulae and follow-on formulae in its legal version.

Natraceutical Group S.A.

Since 2005 we have been a proud member of the Natraceutical Group S.A., a leading enterprise in the research and development of active principles and 100% natural functional ingredients, for the food, cosmetics and nutraceutical sectors.

www.natraceuticalgroup.com

Accreditation and certification

In addition to routine audits by food manufacturers from around the world, we are proudly accredited and certified by the following authorities and institutes:

SQS (Swiss Association of Quality and Management Systems), Zollikofen, Switzerland

- Quality Management System according ISO 9001:2000
- Food safety Standard according BRC (British Retail Consortium)

IMO (Institute for Market Ecology), Weinfelden, Switzerland

- Swiss-Organic-Legislation
- EC-Organic-Legislation
- USA-Organic-Legislation

OK (Kosher Certification), New York, USA

- Kosher requirements for fruit- and vegetable powder production

IRG (Rabbinate of the Israelite Religious Society), Zurich, Switzerland

- Kosher requirements for pectin production

Islamic Food Council of Europe, Brussels, Belgium

- Halal requirements according Islamic law for fruit and vegetable powder production as well as pectin production

SAS (Swiss Accreditation Service), Bern, Switzerland

- Laboratory accreditation according ISO 17025

All products by Obipektin AG are produced based on a defined HACCP Concept (Hazard Analysis and Critical Control Point).

Obipektin AG meets all requirements to sell its products in accordance with GMP (Good Manufacturing Practice) and is constantly supervised by the Official Swiss Food Inspectors.

We also carry out our own routine and random audits on our raw material suppliers from around the world to ensure consistent high quality and full traceability is maintained within our supply chain.

pectin, our core competence

By combining over 70 years of experience with the finest raw-material apple pomace or citrus peel, we are proud to extract, purify, modify and distribute one of the most powerful naturally occurring gelling and thickening agents available today – PECTIN.

In the established food and beverage markets within Europe, pectin is the only approved gelling agent for jams and sugar preserves. Furthermore, pectin is used in a wide range of other food and beverage applications such as fruit spreads, fruit preparations, confectionery products, dairy drinks, glazes and fruit juices.

Special pectin types are even used as a source of soluble fibre to create healthier food and beverages. It has been shown that pectin has a beneficial effect, in reducing cholesterol and lowering blood pressure.

Through this brochure we will talk about the technical and beneficial properties of pectin, provide you with application advice and explain the seven golden rules for working with pectin. More information can be found on our website www.obipektin.com or by contacting us directly.

No matter what your final product is, our food and beverage application centre is ready to assist you in working with pectin. We want to help you create the next generation of innovative and exciting food and beverages.

“Requiring high quality for our products and ourselves.”

introduction into chemistry

Pectin is a natural substance present in the cell walls of all higher land plants. It works as intercellular adhesive holding plant-cells together. Additionally, it is actively involved in balancing the availability of water in the plant.

Chemically-speaking, pectin is a macromolecular carbohydrate compound with a molecular weight of about 60'000 to 150'000 g mol-1. Pectin's backbone consists primarily of galacturonic acid which forms a linear chain of several hundred monomers. The carboxyl groups (acid groups) of the polygalacturonic acid are partly esterified by methanol. From the backbone, chains of neutral sugars branch away (Figure 1).

The detailed structure of pectin is much more complex than this rough sketch and depends on the origin, time of harvest of the fruit and extraction-conditions. Thorough selection and testing of raw-materials and final formulation we guarantee excellent stability.

The most important raw materials used for pectin production are press residues obtained from the production of apple juice (apple pomace) or citrus fruit juice (citrus peels). Pectin is won by extraction in dilute acid and subsequent precipitation with alcohol followed by drying. By controlled deesterification, some of the ester groups get converted into free acids, or in the presence of ammonia some are turned into acid amide groups.

Fine tuning in the production process enables us to create different degrees of esterification and amidation which show tailor-made characteristics. Pectins are divided into three typical groups, according to their degree of esterification and amidation (Figure 2):

- High methoxyl pectins contain more than 50% ester groups (HM).
- Low methoxyl pectins contain less than 50% ester groups (LM).
- Amidated pectin is usually a low methoxyl pectin additionally containing up to 25% amide groups (LMA).

The Obipektin product range offers these three classical groups in apple and citrus varieties. All pectins are standardized to fulfil exact needs of the customer's application.

Figure 1: Functional groups of pectin

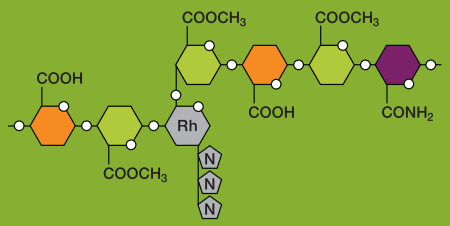
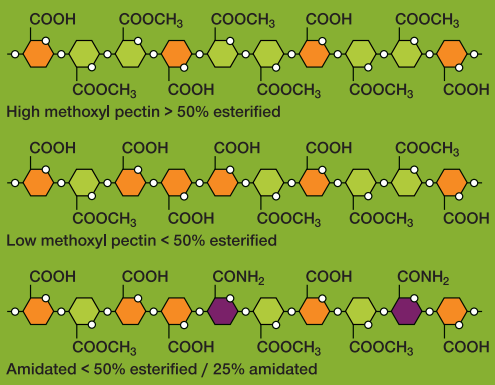


Figure 2: Classification of pectin



Gel strength standardization

We guarantee performance! We know that consistent and reliable performance of pectin is critical. That is the reason why Obipektin offers a full guarantee on functionality at application level.

Legal regulation

All three pectin groups are successfully applied in foodstuff all over the world. At the FAO/WHO joint Expert Committee on Food Additives and in the EU, no numerical acceptable daily intake (ADI) has been set, as pectin is considered safe. In the US, pectin is GRAS – Generally recognized as safe. In numerous countries, the addition rate of pectin is limited solely by GMP (Good Manufacturing Practice).

In the International Numbering System (INS) pectin has the number 440. In Europe E440 (i) stands for non-amidated pectins and E440 (ii) for amidated pectins. Specifications in all national and international legislation define its quality and regulate its use. It is within the customer's full responsibility to use the product according to their current legal standards.

“Pectin was first isolated and described in 1825 by Henri Braconnot, though the action of pectin to make jams and marmalades was known long before. Worldwide, approximately 40,000 metric tons of pectin are produced every year.”

gelling properties

Essentially the degree of esterification and amidation of the pectin molecule defines the gelling mechanisms and characteristics:

pectin groups	structure	gelling conditions	calcium demand
high methoxyl	> 50% ester groups	soluble solids over 60% pH 2.8–3.6	no
low methoxyl	< 50% ester groups	soluble solids > 10% optional pH 3–3.5 high calcium demand	40–60 mg calcium ions per g pectin (Figure 6)
amidated	< 50% ester groups 1–25% amid groups	soluble solids > 10% optional pH 3–3.5 low calcium demand	15–25 mg calcium ions per g pectin (Figure 6)

Figure 3: Sugar acid gelling mechanism

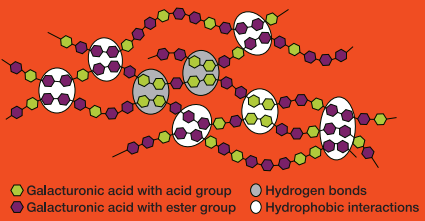


Figure 4: Gelling range of high methoxyl pectins (mod. from Pilnik, 1980)

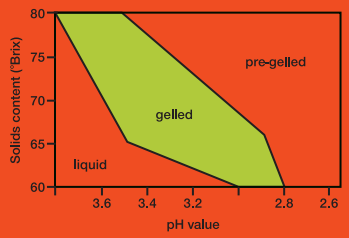


Figure 5: Creation of bonding zones with low methoxyl pectins

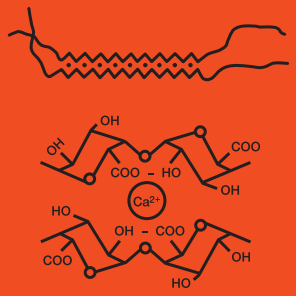
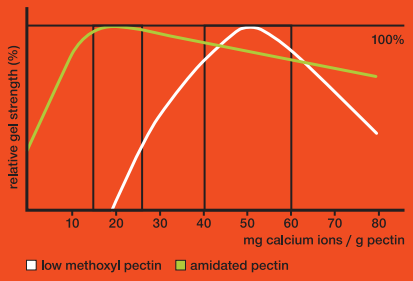


Figure 6: Relative gel strength as a function of calcium dosage



gelling mechanism	texture	reversibility after 2nd boiling step	regeneration after mechanical stress	heat resistant	typical applications
sugar acid model (Figure 3)	firm	no	no	no	high-sugar jams, jellies and confectionery products, dairy drinks (protein protection), health products
egg box model (Figure 5)	spreadable	yes to a certain degree	yes to a certain degree	yes	baking stable fruit preparations, fruit preparations for yoghurt, low-sugar fruit spreads
egg box model (Figure 5)	spreadable	yes	yes	no	glazing, low-sugar fruit spreads, bakery fillings, fruit preparations for yoghurt

High methoxyl pectins

High methoxyl pectins form a gel according to the so called “sugar acid gelling mechanism” (Figure 3). Gelation is formed by hydrogen bonds between the carboxyl groups and by hydrophobic interactions between the ester groups.

The classical representation of the gelling range of high methoxyl pectins according to Pilnik shows the strong correlation between pH value and solids content (Figure 4):

- Only under optimal conditions a gel will be formed (light-green area).
- Both raising the solids content or reducing the pH value promote gelation. The gelling speed increases and in extreme cases may result in pre-gelation.
- A decrease in the solids content or increase in the pH value may reduce the gelling properties of pectins to the extent that gelation fails completely.

Furthermore, the degree of esterification controls the relative speed of gelation. The higher the degree of esterifcation, the faster the gelling speed and the higher the setting point. HM pectins are generally divided in ‘slow set’, ‘medium set’, and ‘rapid set’ pectin types.

Low methoxyl pectins

For high methoxyl pectins, the solids content and the acidity are crucial for the gelation. For low methoxyl pectins, another parameter is involved: the reactivity with bivalent cations, mainly calcium ions. An illustrative image for this gelling mechanism is the “Egg box model” (Figure 5). The calcium ions create junctions between the carboxyl groups of two chain sections. The calcium dosage is crucial for the gelling. It depends on a number of different parameters, for example the degree of esterification, the solids content, the pectin dosage and the concentration of buffer salts. The lower the degree of esterification, the lower the requirement for calcium and the higher the calcium reactivity. The optimal calcium dosage is maintained within relatively narrow limits. Usually, a calcium under-dosage leads to weak gelation or none at all. In contrast to this, an excessive calcium dosage leads to pre-gelation and syneresis in the final product (Figure 6).

Amidated pectins

Amidated pectins basically react according to the model as the low methoxyl pectins do, but require significantly less calcium for gelation. It is usually not necessary to add calcium, as the calcium from fruit and water is sufficient. Amidated pectins are more tolerant towards calcium overdosage and it is the only pectin type which offers complete thermo-reversibility (Figure 6).

working with pectin

Seven golden rules for working with pectin

1. Application fields

The central property of pectin is its ability to gel under appropriate conditions. Beside that, pectin is also used as a thickening and stabilizing agent.

- High methoxyl pectins need a minimum of 60% soluble solids and a pH value between 2.8 and 3.6 to gel.
- Low methoxyl pectins need a controlled amount of calcium ions to gel.

2. Dosage

A dosage between 0.5 and 1.0% can be considered as a guideline.

- Using high methoxyl pectins, gel strength can be controlled by dosage.
- Using low methoxyl pectins, gel strength can be controlled by concentration of calcium ions. An over-dosage leads to syneresis.

3. Dispersion

Pectin needs to be dispersed carefully and has to be dissolved completely. In practice two methods can be used:

- Add pectin in hot water using a high shear mixer.
- Premix pectin powder with saccharose or any other dry substances in proportion 1:5 and disperse this mix in water.

4. Solubility

Pectin dissolves slowly in cold water. Boiling water suits best for fast solution.

- Pectin has to be dissolved before adding the total amount of saccharose or any other soluble solids. The reason is that pectin dissolves completely at soluble solids content below 25%.
- Low methoxyl pectins dissolve poorly in hard water or fruits rich in calcium like apricots or oranges. The excess of calcium ions can be buffered with buffer salts.

5. Cooking

Long cooking times lead to loss of gel strength.

6. Gelling temperature and gelling rate

Pectin gels at a certain temperature depending on solids content, pH value, calcium content and buffer system. To avoid pre-gelation the product must be filled above gelling temperature and within a certain time.

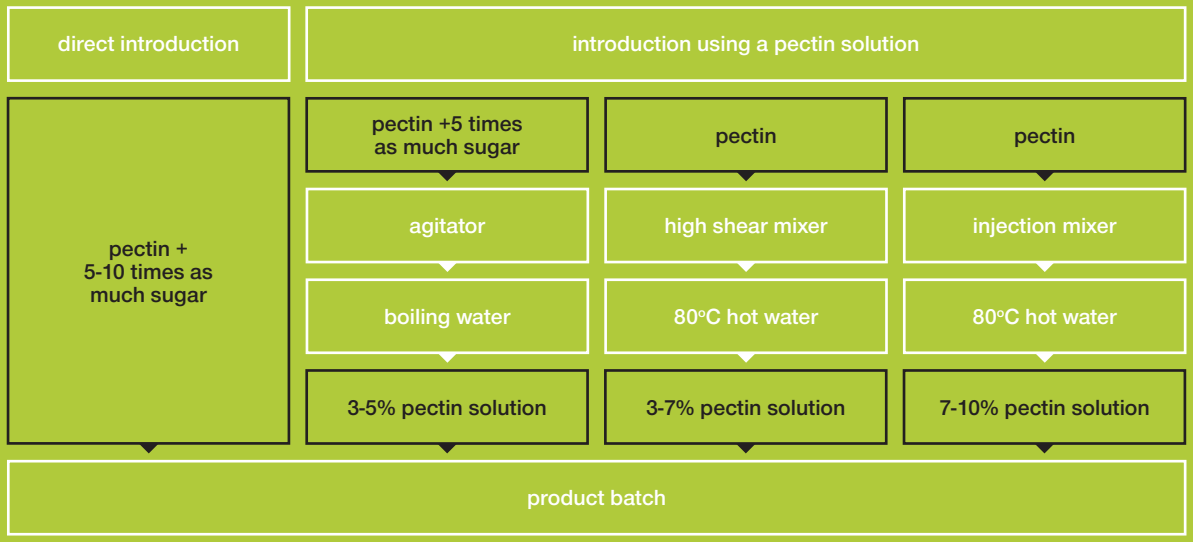
- pectin gels faster at higher solids content or lower pH values

7. Thermo-reversibility and thixotropy

Gels made with amidated pectins are thermo-reversible. Depending on the calcium ions concentration, low methoxyl pectins create thixotropic (able to regenerate) gel-like structures.

> “Appearance, taste and texture are crucial; the customer defines the requirements.”

Dispersing and dissolving of pectins



The use of calcium salts

- required to form gel structure when low methoxyl pectin is used
- have to be added at the end of the boiling step
- slowly dissolving salt (e.g. tricalcium dicitrate tetrahydrate) is recommended to form a firm and strong gel
- rapidly dissolving salt (e.g. calcium lactate pentahydrate) is recommended to stabilize fruit fragments in the product matrix

These calcium salts are generally used:

Name	Ca-content	Solubility
tricalcium dicitrate tetrahydrate	211 mg/g	low
calcium lactate pentahydrate	130 mg/g	medium
calcium chloride dihydrate	272 mg/g	high

The use of buffering salts

- required to control gelling speed, filling temperature and filling time
- delays the reaction with acid and calcium (in case of low methoxyl pectins)
- have to be dry-mixed with pectin or added to the fruit/water mixture
- is recommended if the solid content is very high or in combination with calcium-reactive pectins

The following buffering salts are commonly used:

Name	Effect
disodium dihydrogen diphosphate	delays the calcium reaction
sodium hexametaphosphate	delays the calcium reaction
trisodium citrate dihydrate	delays the acid release
potassium sodium tartrate tetrahydrate	delays the acid release

Common reasons for failure

Error	Cause
gelation too weak or absent	• pH value too high • solids content too low • pectin quantity too low • unsuitable pectin type • calcium dosage too low for low methoxyl pectin
gelation too strong	• pH value too low • solids content too high • pectin quantity too high
floating fruits	• filling temperature too high • gelation too slow: – pH value too high – solids content too low – unsuitable pectin type
coarse texture (pre-gelation)	• filling temperature too low • filling time too long • pH value too low • solids content too high • calcium dosage too high for low methoxyl pectin
syneresis	• pre-gelation (see above): – filling temperature too low – pH value too low – solids content too high – calcium dosage too high for low methoxyl pectin • cooking time too short (incomplete sugar exchange)
heat damage with large batches	• filling temperature too high

application areas

Over the past two decades, the traditional focus on pectin applications (jams and fruit jellies) has expanded to an extraordinary extent. Consumers' wishes for sugar-reduced fruit preparations, fruit yoghurts, yoghurt fruit drinks, "wellness" and "health" drinks have boosted the demand for speciality pectins. The following applications overview will enable you to select the correct pectin type suiting your products.

Jams and fruit spreads – High brix jams, fruit jellies, marmalades, fruit spreads for diabetics

We offer a range of pectins for solids contents from 15%–75%, each standardised to a specific gel strength, leading to optimal textures at low dosage.

Main properties	Solids content in %	Product name	Calcium required	Contains buffer salts	Type
rapid set, firm	60–65	Brown Ribbon 150° US-SAG			HM
slow set, firm	60–75	Green Ribbon 150° US-SAG			HM
medium set, firm	60–65	Blue Ribbon R 150° US-SAG			HM
spreadable to firm	55–65	Blue Ribbon 150° US-SAG			HM
	40–60	Purple Ribbon AA	•		LM
	30–50	Purple Ribbon pure	•		LM
spreadable	50–65	Purple Ribbon D-120 AT			LMA
	45–55	Purple Ribbon D-075 AN			LMA
	30–50	Purple Ribbon D-075			LMA
	20–40	Purple Ribbon D-110 AM			LMA
	15–30	Purple Ribbon D-110 AR			LMA
home-made fruit preparations	35–65	Purple Ribbon WT			LMA
guide-line dosage 0.5–1%					

Gelling properties – see page 10 and 11

Fruit preparations for bakery products – Fruit filling, pastry filling, baking-stable fruit preparations for diabetics

Get an outstanding pumpable and pasty texture by using our baking stable pectins:

- very good baking stability with high form stability
- pumpable texture with uniform gel strength
- high regeneration of the texture after dosing
- excellent flavour release

Main properties	Solids content in %	Product name	Calcium required	Contains buffer salts	Type
firm	70	Brown Ribbon J			HM
pumpable and pasty	50–75	Purple Ribbon BA			LM
	40–70	Purple Ribbon B	•	•	LM
	40–65	Purple Ribbon D-075 X		•	LMA
	50–65	Pink Ribbon A	•		LM
guide-line dosage 0.5–1.5%					

Fruit preparations for yoghurts – Stirred and bottom-laid yoghurts

Our special pectins for fruit preparations for use in yoghurt provide excellent properties:

- smooth texture with an excellent regeneration after stirring
- consistent calcium reactivity and flow properties
- ability to fill at low temperatures and to stabilize fruit pieces
- excellent sensory properties

Fruit preparations are either stirred into yoghurt during production or placed at the top or bottom of the glass.

Main properties	Solids content in %	Product name	Calcium required	Contains buffer salts	Type
stirred yoghurt, viscosity increase	40–60	Purple Ribbon AK		•	LMA
	30–50	Purple Ribbon AM		•	LMA
	30–50	Purple Ribbon AW		•	LMA
	20–55	Purple Ribbon BD			LM
bottom-laid yoghurt, viscosity increase	30–50	Purple Ribbon AA	•		LM
bottom-laid yoghurt, slightly gelling	40–50	Purple Ribbon pure	•		LM
guide-line dosage 0.5–1%					

Gelling properties – see page 10 and 11

Confectionery – Jellies, pâtes de fruits, fillings for chocolates, zefir

Confectionery products are characterised by their colour, shape, flavour and texture. High methoxyl pectins are of particular importance in the production of high-sugar products. The usage of buffer salts controls the gelling point.

Main properties	Solids content in %	Product name	Calcium required	Contains buffer salts	Type
smooth and soft, ideal for a mild taste	68–78	Yellow Ribbon 1500		•	HM
smooth and soft, ideal for a sour taste	68–78	Yellow Ribbon 1500 M		•	HM
firm to rigid, ideal for a sour taste	68–78	Yellow Ribbon 1500 S		•	HM
firm to rigid, ideal for a mild taste	68–78	Yellow Ribbon 130 AL		•	HM
gummy-like, ideal for a mild taste	68–78	Yellow Ribbon 1700 AD		•	HM
solid and elastic	80	Yellow Ribbon 200 AG		•	HM
guide-line dosage 1–2%					

Glazes – Cold gelling, cold applicable, reversible, dilutable, sprayable glazes

Glazes protect cakes and pastries from drying out, prevent discolouring of the fruits and give them a glossy surface.

Depending on the processing possibilities and application technologies, different kinds of glazes are in demand: cold-, reversible-, dilutable-, and sprayable glazes.

Main properties	Solids content in %	Product name	Calcium required	Contains buffer salts	Type
reversible and dilutable	40–65	Purple Ribbon D-075 AH		•	LMA
cold applicable	50–60	Purple Ribbon D-075 AS		•	LMA
reversible	50–65	Purple Ribbon D-075 A		•	LMA
reversible and sprayable	30–45	Purple Ribbon D-075 AD		•	LMA
cold gelation	60	Brown Ribbon 150° US-SAG			HM
guide-line dosage 0.5–1.5%					

Gelling properties – see page 10 and 11

Desserts – Ripple sauce, toppings, water jelly, milk pudding

The whole range of our purple ribbon pectins are highly recommended for sweet sauces such as ripple sauce and toppings. They have excellent thixotropic properties and create the perfect texture – please, ask for specific recipes.

Main properties	Solids content in %	Product name	Calcium required	Contains buffer salts	Type
topping	50–65	Purple ribbon pure	•		LM
ripple sauce	50–65	Purple ribbon pure	•		LM
water jelly	25	Purple ribbon D 075			LMA
milk pudding, ideal for a higher pH	15–30	Red ribbon pure	•		LM
guide-line dosage 0.5–1%					

Beverages – Cloud stabilization in fruit juice drinks and syrups, mouthfeel in instant drinks

We offer particular pectins for beverages with a consistent viscosity and brilliant benefits:

- improved cloud stability
- increased mouthfeel
- excellent the taste-profile

HM Ultra Low Viscosity can also add an essential health benefit to your drinks. The fibre shows to be stable even in a sour low-pH environment and stable over a long shelf-life.

Main properties	Solids content in %	Product name	Calcium required	Contains buffer salts	Type
cloud stabilization, viscosity increase		Brown Ribbon high viscosity			HM
cloud stabilization, improved mouthfeel		Brown Ribbon AE			HM
		Brown Ribbon AL			HM
cloud stabilization, syrup		Green Ribbon AC			HM
instant applicable, improved mouthfeel		Brown Ribbon P-100			HM
pure apple pectin for dietary fibre enrichment		HM Ultra Low Viscosity			HM
guide-line dosage 0.1–1%					

Gelling properties – see page 10 and 11

Acidified dairy drinks – Milk drinks, soy drinks, yoghurt drinks, whey drinks

Particular high methoxyl pectins can prevent the aggregation of proteins by forming a protective layer around the protein particles. Our brown ribbon Q range is standardized especially for acidified dairy and soy drinks application. These pectins offer you perfect stabilization as well as an improved smooth mouth feeling even in low dosage.

Main properties	Solids content in %	Product name	Calcium required	Contains buffer salts	Type
acidified milk drinks, protein stabilization		Brown Ribbon Q			HM
guide-line dosage 0.2–1%					

Unique products – Fibre enrichment, pectin for new flavour reactions

Nutritional aspect: Pectin is a soluble fibre which offers many health benefits such as softening the increase of blood-glucose-levels or to lower total blood-cholesterol-levels as shown in several studies. Our unique HM Ultra Low Viscosity is made of pure apple pectin and has in average 80% soluble dietary fibre. It is standardised to a particular low viscosity. Beverages can ideally be enriched with dietary fibre without notably increasing their viscosity. Pectin HM Ultra Low Viscosity is a great and easy way to help close the fibre gap.

CreaPec DPP-2 is depolymerised citrus pectin containing a defined amount of mono-galacturonic acid. It has been especially designed to be used in flavour reactions and creations, leading to natural, harmonised and diversified flavour profiles. A variety of special flavours can be created (meaty, beef-like, chicken-like and vegetable-like). CreaPec DPP-2 can be used in seasonings, sauces and marinades to enhance or inhibit particular flavours.

Main properties	Solids content in %	Product name	Calcium required	Contains buffer salts	Type
pure apple pectin for dietary fibre enrichment		HM Ultra Low Viscosity			HM
taste-determining parameter in reaction flavours		Creapec DPP-2			
guide-line dosage 0.1–1%					

Combination with other food components

In widespread applications pectin can be combined with gelatine, starch, carrageenan, xanthan, carboxylmethyl cellulose etc. and contributes to the stabilization of the end product.

Gelling properties – see page 10 and 11

obipektin
Inspired by nature

We are continuously developing new market and customized products. If you would like advice or help in realising your Pectin ideas, our sales team will be pleased to assist you.

Please call +41 (0)71 424 73 00 or
email obipektin@natraceuticalgroup.com
www.obipektin.com

Industriestr. 8 9220 Bischofszell Switzerland | Fax: +41 (0)71 424 73 90

DRESCHER ASOCIADOS
REPRESENTACIONES
Zapiola 3535-Buenos Aires (1429) – Argentina
Tel: 0054-11-4701-6200
Fax: 0054-11-4702-2546
E-mail: andres@drescher.com.ar
www.drescher.com.ar

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