

# LARCH ARABINOGALACTAN IN FOOD INDUSTRY



**Application of Larch arabinogalactan in the Food Industry is regulated by the following normative documentations in the Russian Federation:**

- According to the Decision of the State Chief Medical Officer dated November 14, 2001 No 36 “About the application of the Sanitary and Epidemiological Conclusion (SEC) 2.3.2.1078-01”, arabinogalactan is classified **as thickener, stabilizer, emulsifier**;
- The Methodical Recommendations of the State Sanitary and Epidemiological Regulation No 2.3.1.1915-04 “Recommended norm of consumption of food and biologically active supplements” has determined the appropriate and the highest allowable level of arabinogalactan consumption: **10–20 g per day**.

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## BRIEFLY ABOUT THE PRODUCT

### PROPERTIES OF LARCH (ARABINO GALACTAN)

#### ✓ *High solubility in water*

Larch arabinogalactan is well soluble in both hot and cold water. 14 – 50 grams of arabinogalactan could be dissolved in 100 ml of water at temperature 0 – 90°C. The dissolution of 150 mg of arabinogalactan in 100 ml of water doesn't influence on color and turbidity of the solution. Arabinogalactan is also soluble in aqueous-alcohol solutions, insoluble in oils and weakly soluble in pure ethanol.

#### ✓ *Moisture-retaining power*

This property of arabinogalactan is especially important in production of farinaceous invalid confectioneries. The water-retaining ability of arabinogalactan solutions different concentration (10, 20, 30, 40%) was on average 99% (*Mulin A.B.*).

#### ✓ *Fat-binding properties*

The ability of arabinogalactan to bind fats was described in Works of the Moscow State Extension Institute of Food Industry as well as in Sechenov Moscow State Academy. Thus, the fat-binding ability of larch arabinogalactan was on average 85% (*Цыганова Т.Б., Ильина О.А. и др.*).

#### ✓ *Bactericidal properties*

Larch arabinogalactan stimulates antiinfectious resistance of organism at the expense of increasing function activity of cells of cytophagous system in the case of infecting by *Yersinia pseudotuberculosis* I-716. It activates all cytophagous processes including chemotaxis, adhesion, absorption bactericide ability of peritoneal macrophages. Arabinogalactan also inhibits the reproduction of pseudotuberculous microbes inside microphages. Arabinogalactan increases the activity of NADPH – oxidase and superoxide scavenger, activates oxidative metabolism of cells and, thus, activates bactericide effect as respect to absorbed microorganisms (*Medvedeva S.A., Alexandrova G.P., et al.*).

#### ✓ *Acting as prebiotic*

Arabinogalactan is an all natural soluble prebiotic dietary fiber that has a beneficial impact on the gastrointestinal system. Arabinogalactan promotes better disintegration, nutritive absorption and digestion in the gastrointestinal tract and could be recommended as a functional dietary supplement in the daily diet. Arabinogalactan promotes to increase the production of short-chain fatty acids, which are extremely important for normal functioning of the organism.

### *Use of Larch Arabinogalactan in food industry*

Physico-chemical and biological properties of arabinogalactan determine the spheres of application in food industry. Thus, arabinogalactan is used in food industry in following directions:

#### **1) As thickener, stabilizer and emulsifier:**

For this direction the most important properties of arabinogalactan are highly water solubility (larch arabinogalactan readily disperses in a hot or cold beverage, remains clear in solution and does not precipitate out of solution); larch arabinogalactan produces low-viscosity solutions that have minimal impact on mouthfeel and viscosity; the ability of arabinogalactan to bind fat and hold water as well as to influence on gluten quality.

#### **2) As the source of soluble dietary fiber:**

Arabinogalactan is the source of dietary fiber and soluble cellulose. Due to its hygroscopicity (the ability to absorb water) arabinogalactan has a beneficial influence on digestible food that could avoid number of large intestine diseases. Prebiotic fibers, such as larch arabinogalactan, provide the benefits of traditional fibers, with the ability to increase beneficial microflora, thus improving gastrointestinal health. The dietary fibers create the favorable conditions for the growth of probiotic bacteria such as *Lactobacilli* and *Bifidobacteria* in the intestines, which are important for GI Tract health.

#### **3) As food dietary additive for production of food product with pharmaceutical properties**

In past years the development of so called functional foodstuffs (products having the additional prophylactic properties) holds the particular position in food industry. Arabinogalactan as a prebiotic promotes the growth of "friendly" bifid bacterium and short-chain fatty acids, required for the maintenance of the normal function of gastrointestinal tract.

# APPLICATION OF ARABINO GALACTAN

## ***Application of larch arabinogalactan in production of confectioneries***

### *Sugar cookies*

The study on influence of arabinogalactan on quality of sugar cookies was carried out on the basis of Moscow State University Extension of Food Products and Confectionary Factory "Yaroslavconditer". The study shows that the addition of arabinogalactan in the receipt of sugar cookies has the positive influence on extension of freshness of cookies as well as on taste and assimilation of a product. After two months of storage the sugar cookies with larch arabinogalactan has the higher amorphous components than the control samples. The addition of arabinogalactan into sugar cookies promotes the increase in content of soluble dietary fibers in twice (*Mulin A.B.*)

### *Bakery products*

The Institute of Cytology and Genetics together with Irkutsk Institute of Chemistry has been studied the influence of arabinogalactan on technological properties of wheat flour and bread quality. Bread quality was evaluated according to 8 parameters: loaf volume, bread appearance, surface, loaf form, crust color, porosity, elasticity, crumb color and taste. The fortification of flour with 1% of larch arabinogalactan improves significantly all qualitative parameters of bread. The bread with 1% larch arabinogalactan has small and homogeneous porosity. Arabinogalactan increases slightly the loaf volume and decreases the crumb firmness (*Ermakova M.F., Chistyakova A.K., 2009*).

The fortification of flour mass with 3% of larch arabinogalactan improves the bread quality and its organoleptic properties. Larch arabinogalactan increases dough elasticity, improves homogeneous porosity. The addition of arabinogalactan enriches bread with dietary fibers (*Reshetnik E.I., Derzhapolskaya Yu.I., et al., 2009*).

In an experiment comparing soft tortillas with and without 3% arabinogalactan, the fortified tortillas retained the highest percentage of the initial moisture. Moisture retention relates to better-tasting product and increased product shelflife. In another experiment of arabinogalactan additions of 1, 2, 3 and 5%, the 2% dough produced the less sticky dough and was easier to handle and divide at griddling (*Rodriguez, B., et al.*).

Moreover products containing larch arabinogalactan at an additional level of 102% by weight of flour, had a higher total quality score than product not containing larch arabinogalactan. Dough make-up (25% improvement), external symmetry (6.25% improvement) and internal grain (2.0% improvement) of white pan bread were all improved upon adding larch arabinogalactan at an addition level of 1% based on weight of flour.

## **The efficiency of larch arabinogalactan in production of biscuit dough products**

The quality of biscuit dough depends mainly on properties and quality of egg-sugar mass. The study on influence of larch arabinogalactan on the quality of egg-sugar mass showed that the higher the content of arabinogalactan, the more intense is the saturation of the sponge mass. Egg mass became more stable. Arabinogalactan has the significant influence on the process of the structure formation of egg-sugar mass. The fortification of biscuit products with larch arabinogalactan increases the swelling capacity. Acting as a moisture-retaining agent, arabinogalactan inhibits the process of evaporation from the surface of the product (*Mulin A.B.*).

## **Application of arabinogalactan in production of dietary products**

The intestinal tract performs many different functions; in addition to absorption and digestion it is also the body's largest organ of host defence. The intestine also contains a microbial ecosystem with a large body of microbes. The microbes and their activity have a major impact on the development and functioning of the intestinal immune system. The death of "friendly" bacteria and under the influence of antimicrobial preparations, especially antibiotics, leads to disturbances in the intestinal microflora. Prebiotics are the energetic material for bifidobacteria and lactobacillus. Thus, the use of prebiotics to correct the imbalance in intestinal tract and modulate the immune activity has received increasing scientific importance.

Arabinogalactan is a prebiotic that stimulates the growth and activity of normal microflora in intestines. The study on influence of addition of arabinogalactan in dietary dairy products (yoghurt) enriched with bifidobacterium and lactobacillus showed that arabinogalactan assisted in growth of "friendly" bacterium in 10 times and short-chain fatty acids, required for normal functioning of intestines. Arabinogalactan as the ingredient of a dairy product may also help promote a healthy immune system.

# APPLICATION OF ARABINOGALACTAN

## *The recommended dosage of arabinogalactan in food products*

Products	Dosage of introduction	Benefits of arabinogalactan
Sugary cookies	The substitution of 4% flour to equal quantity of arabinogalactan	<ul style="list-style-type: none"> <li>- Binds fat and hold moist;</li> <li>- Improves the organoleptic characteristics and dough plasticity;</li> <li>- Keeps the freshness of products for a long period of time;</li> <li>- Increases the absorbency;</li> <li>- Enriches the product with dietary fibers</li> </ul>
Products made of biscuit dough	The substitution of 4% flour to equal quantity of arabinogalactan	<ul style="list-style-type: none"> <li>- Increases the density of products;</li> <li>- Keeps the freshness of products for a long period of time;</li> <li>- Prevents moist evaporation;</li> <li>- Improves the organoleptic characteristics;</li> <li>- Enriches the product with dietary fibers;</li> <li>- Promotes the dough raise</li> </ul>
Bread and bakery products	1-3% to mass of flour	<ul style="list-style-type: none"> <li>- Improves the organoleptic characteristics and dough plasticity;</li> <li>- Has the influence on quality of gluten;</li> <li>- Enriches the product with dietary fibers</li> </ul>
Protracted cookies	4% to mass of flour, preliminary dissolved in estimated value of water	<ul style="list-style-type: none"> <li>- Improves the organoleptic characteristics and dough plasticity;</li> <li>- Has the influence on quality of gluten;</li> <li>- Enriches the product with dietary fibers;</li> <li>- Binds fat and hold moist</li> </ul>
Dairy products	1-3 % to mass of product	<ul style="list-style-type: none"> <li>- Stimulates the growth of "friendly" bifidobacterium and lactobacillus;</li> <li>- Enriches the product with dietary fibers</li> </ul>
Butter, margarine, spreads	1-3 % to mass of product	<ul style="list-style-type: none"> <li>- Improves the organoleptic characteristics and consistence of products;</li> <li>- Stabilizes the water-fat emulsion;</li> <li>- Increases the density of products</li> </ul>
Beverages	3-4g./1 liter	<ul style="list-style-type: none"> <li>- Improves the organoleptic characteristics;</li> <li>- Enriches the product with dietary fibers</li> </ul>

## Application of arabinogalactan in production of spreads, butter, margarine

The application of arabinogalactan in these kinds of products improves the organoleptic indices as well as the texture of the ready-to-use products. The application of arabinogalactan in low fat spreads stabilizes the consistence, prevents the butter crumb formation, increases the density of a product. Having the moisture-retaining properties, arabinogalactan promotes the stabilization of fat-water emulsions, improving the plasticity of products.

## Application of arabinogalactan in beverages

Highly water soluble, larch arabinogalactan readily disperses in a hot or cold beverage, remains clear in solution and does not precipitate out of solution. In addition, it is non-reactive and heat stable, making it an ideal candidate for beverage mixes, and refrigerated or shelf-stable, ready-to-drink beverages. It will not hydrolyse at a low pH, and it has a high thermal stability, which allows it to be pasteurised. Neutral in taste, and also odour and colour free, it provides low sensory impact.

Beverages with arabinogalactan have advantageous qualities beyond the flavor-enhancing cooperation between arabinogalactan and the high intensity sweetener. For one, arabinogalactan acts as an immunostimulant to activate the immune system. Moreover, as a soluble fiber, arabinogalactan present in the beverage is operative to promote intestinal health (*Fitzpatrick A., Roberts A., et al*).