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Abstract: Soluble fibers pull in water to create a gel in the digestive system, and are important to health, digestion, and disease prevention. Pectins are naturally occurring soluble fibers found in plants, and are comprised of linked galacturonic acids, or carbohydrates. Pectin strengthens the cell walls in fruits and other plant parts and binds the cells together. Pectin also attaches to water molecules and contains elastic properties that enable plants to bend flexibly in windy weather. Commercially available in natural and synthetic forms, pectin is found in all plants and fruits to some degree. Although pectin is not digestible in its natural form, it is modifiable, and is mainly used in the food industry as an ingredient in jams and jellies. The jelling and thickening agent in pectin is derived from fruits.

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Pectin (in powder form) By FrozenMan at English Wikipedia [Public domain], via Wikimedia Commons

Background

The history of jams and jellies goes back to at least the eighteenth century, when recipes describing jellies made from fruits rich in pectin were published in the *London Housewife's Family Companion* of 1790. Initially isolated in the 1820s, pectin was said to be the key to producing jams and jellies. People gradually began to mix fruits that were rich in pectin or fruit extracts with fruits that do not solidify jams properly. For example, a common combination was strawberry which has little pectin, and red currant which has plenty of pectin. Extracts of apple skins and cores were also used for hard-to-set jams. In searching for sources to produce pectin, apple juice producers in Germany began drying pomace (apple) residue that was left over after pressing juice to sell to jam makers. To make a jellying juice, jam makers cooked the pomace in water, with or without fruit juice.

The first liquid pectin extract was commercially produced and recorded in Germany in 1908. The United States quickly caught on, and a classic patent was obtained in the United States in 1913. The U.S. pectin industry grew rapidly thereafter, with Europe following suit. Europe and citrus-producing countries, such as Mexico and Brazil, have become the center of pectin production. Although there are continuous structural and geographical changes within the industry, those changes are restricted by the significant capital investment needed to establish a reliable plant and the need for sources of raw materials.

The process for commercially producing pectin varies by company. Generally, juice producers send the pectin factory the raw material, such as pomace or citrus peel. The raw material is washed and dried so that it can be shipped and stored without spoiling. The pomace or citrus peel is mixed with a processing agent, such as mineral acid or enzymes, as water alone will not extract enough pectin. Upon extracting the pectin, the left-over solids are separated and the solution is clarified and concentrated by eliminating some of the water. Pectin is then precipitated—meaning it forms an insoluble solid—by combining alcohol, typically isopropanol or ethanol, with the concentrated liquid. After the precipitate has been separated, more alcohol is used to wash away the impurities. When the pectin is dried, it is ground into powder, tested, and mixed with sugar into a standard gelling or stabilizing agent.

Overview

Pectin is a fibrous carbohydrate that helps plants, including fruits, maintain their structure. It is found in the rapidly growing areas of plants, particularly in the cores and peels of fruits. As fruits ripen, pectin develops. Under-ripe fruits have pectose, or protopectin, which eventually turns into pectin. Some fruits are high in pectin, others are low in pectin. For example, blackberry, black currant, quince, green apple, Concord grape, blueberry, cranberry, red currant, and ripe citrus fruits have high pectin levels. Fruits low in pectin include cherry, fig, pear, peach, pineapple, apricot, nectarine, and kiwifruit. When unripe, all fruits have pectin. However, when they turn ripe, many retain some pectin while others lose almost all of their pectin. Because overripe fruits have very little pectin, jam and jelly makers tend to avoid overripe fruits, using just-ripe fruits, and under-ripe fruits in a minimal capacity.

The best way to extract pectin is through heating. In this case, pectin is activated when it is mixed with sugar in an acid concoction over high heat, generating a gel set for jellies and jams. When pectin is extracted through heating, the pectin itself can be tasted. Though flavorless, it has a mucilaginous, or gummy, feel on the tongue and covers the roof of the mouth. The gooey substance can also be spotted by twirling heat-extracted fruit juice in a glass. Although sugar is present in all fruits, more is needed to produce a gel. Refined or granulated sugar can be used, but refined sugar is usually preferred because its simple flavor adds sweetness without stifling the flavor of the fruit. Similar to sugar, acid is instrumental to extracting pectin. If enough acid is not included, the gel

might not form at all. For this reason, and to balance out the flavor, citric acid or citrus juice is normally added to jams and jellies.

Commercially, pectin is extracted from plants with higher levels of pectin, such as citrus and apple, and serves as a thickener, gelling agent, stabilizer, emulsifier—which helps unmixable ingredients work together—and medication vehicle in the food and pharmaceutical industries. Pectin is mostly used as a thickener for jams and jellies, but it can also be found in yogurt, commercial drinks, other food items, medications, and supplements. Pectin molecules cause thickening because they are long and easily intertwine with each other, making pectin very useful in enhancing the texture of low-sugar drinks.

Pectin can be grouped under "natural flavors" on commercial products. For this reason, it might not be listed individually as an ingredient. In these cases, it is likely that the pectin comes from an unripe source, in which case, the pectin might not be pure—though it can be blended with preservatives or other chemicals to enhance its functioning. From a medicinal standpoint, people use pectin for diabetes, high cholesterol, gastroesophageal reflux disease, and to prevent prostate and colon cancer. Not many allergic reactions to pectin have been reported, but there appears to be an elevated risk for individuals with pistachio or cashew allergies.

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