

## BAKING UPDATE

## Cookies and Biscuits

Practical technology from Lallemand Inc., parent of American Yeast Sales, producers and distributors of Eagle® yeast, fresh and instant.



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## Structure Builders and Tenderizers

Ingredients used in baked goods such as cookies, biscuits, crackers, and cakes are sometimes categorized as “structure builders” or “tenderizers.” Structure builders are, in general, the ingredients that strongly interact to build the continuous structure in a product that keeps the product together and gives it its firmness. Tenderizers are ingredients that interrupt this structure, thus making the product more soft and tender. While the classification of ingredients into structure builders and tenderizers differs from one product to another, it can still be a useful concept when adjusting a formula to obtain certain product characteristics.

**Flour** is a structure builder in most baked goods (cookies, cakes, crackers, and bread). Gluten protein develops during mixing to form a continuous structure in the dough so the baked product can become very hard and tough when specific volume of the product or its moisture content is low. This is undesirable for cookies, crackers, and biscuits, and, therefore, tenderizers are added that interrupt the continuous gluten structure or prevent the formation of such a continuous gluten structure.

**Shortening (oil)**, when used at high levels, is the main ingredient used as a tenderizer. It shortens the gluten structure by preventing proper hydration of the flour particles, the first step in the development of a continuous gluten structure.

**Proteases** break down the continuous gluten protein and are used to improve tenderness of cookies and crackers.

**Sugar** lowers water activity, and high levels prevent a quick hydration of gluten protein. High sugar levels in cookies will also prevent the starch from gelatinizing during baking so it cannot set up a continuous structure in the product. Therefore, sugar usually acts as a tenderizer. In sugar-snap cookies, however, sugar (sucrose)

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## Cookie and Biscuit Production

**T**HE WORD *biscuit* is of French origin and means “twice cooked.” In earlier times some dough products were baked twice, once to set the structure of the product and again to further reduce the moisture content so the product acquired a long shelf life. This way travelers, soldiers, and sailors could use these storage-stable products as their principal food source. Nowadays, only a few products are baked twice (for example, rusks, biscotti, croutons, and Melba toast), while most biscuits and cookies are baked only once.

In Europe the word *biscuit* is used for low-moisture products that are made with high levels of sugar and shortening—products that are called *cookies* in the United States. In the U.S., *biscuit* refers to a unique American product that was introduced by eighteenth century colonists and has become especially popular in the South. The U.S. biscuit is a chemically leavened product with a moisture content similar to bread, but produced by a different process and with quite a different taste and texture. To avoid confusion, the U.S. terminology for biscuits and cookies will be used from here on.

### COOKIES

In general, cookies are made from soft wheat flour, contain high levels of sugar and shortening, and have a low moisture content.

All cookies are produced from low-protein soft flours, using gentle mixing to produce a dough without developing the gluten protein. Industrially produced cookies can be categorized into three general types by the way the cookie dough is divided and placed on the band of a long tunnel oven.

**Rotary-mold** cookies are produced from dough that is forced into the molds of a rotating drum. While the drum turns, the excess dough is scraped off, and the dough pieces with the imprint from the mold are extracted from the cavity and placed on the band of the tunnel oven for baking. The consistency of the cookie dough is critical for this type of operation and has to be carefully controlled. Rotary-mold cookie formulations contain intermediate levels of shortening and sugar, but low levels of water. These cookies do not expand much during baking, so the imprint from the mold remains visible after baking. Because of the low water content in the dough, less energy is required during baking. The low water content in the dough and the high output of the line make rotary-type cookies the most economical to produce.

**Cutting-machine** cookies are produced from dough with less sugar, less shortening, and more water than rotary-mold cookies. Therefore, some gluten is developed during mixing that holds the dough together

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### COOKIE FORMULAS

	ROTARY MOLD	CUTTING MACHINE	WIRE-CUT AND DEPOSIT
<b>Flour</b>	100%	100%	100%
<b>Sugar</b>	20–50%	25%	30–75% (varies)
<b>Shortening</b>	25–40%	25%	30–60% (varies)
<b>Water</b>	10% (varies)	10–20% (varies)	10–20% (varies)
<b>Baking powder</b>	5% (varies)	5% (varies)	5% (varies)
<b>Salt</b>	1.5%	1.5%	1.5%
<b>Eggs</b>	0–5% (varies)	0–5% (varies)	7.5–10%
<b>Flavoring</b>	varies	varies	varies
<b>Milk powder</b>	0–2% (varies)	0–2% (varies)	0–2% (varies)

## Cookies and Biscuits (Continued)

during sheeting, so the cookies can be cut out, with the scrap dough returning to the mixer. The partial development of gluten also prevents the cookie from spreading during baking and tends to make the cookie hard.

**Wire-cut** cookies are produced by extruding soft dough containing high levels of sugar, shortening, and eggs through an orifice and cutting disk-shaped cookies by a wire. Wire-cut cookies spread and increase in size during baking. When levels of sugar and water of a wire-cut cookie formula are increased further, the cookie dough becomes viscous so the dough can be deposited directly on the band of the oven so it will spread out before and during baking.

### BISCUITS

The U.S. biscuit uses a simple process to produce a dough that is sheeted, cut into disk-shaped pieces, placed on a sheet, and baked in an oven. Biscuit dough is quite different from bread dough. Low-protein soft wheat flours are preferred and chemical leavening is used for gas production, while a mixing procedure is used to optimize dough machinability and sheeting properties. This gives the finished product a much lower specific volume, thicker cell walls, and coarser grain. The taste is strongly influenced by the baking soda and the leavening acids of the baking powder.


High-quality biscuits are preferably consumed when fresh and have a soft and tender bite. Here are some recommendations for optimal biscuit quality:

- **Use a soft, low-protein flour and limit gluten development.** Gluten, when developed during mixing, becomes the continuous structure in the biscuit dough, making the bite firmer. The use of baking powder (soda) ensures that the

## TYPICAL BISCUIT FORMULA AND PROCESS

FORMULA		PROCESS	
Flour	100%	Mixing	Short time and dough temperature of 60°–65°F
Shortening	20 (10–40)%	Resting	15 minutes (varies)
Sugar	4 (0–15)%	Sheeting	3/8 inch (varies)
Baking powder	5 (4–6)%	Cutting	2–3 1/4 inch
Salt	2 (1–3)%	Baking	10–15 minutes at 475°F
(Butter)milk	65 (60–70)%		
Whole eggs	0% (varies)		


pH during dough mixing will be high enough to prevent rapid gluten development. Mixing times should be adjusted to optimize sheeting properties of the dough, not to develop the gluten protein.

- **Use shortening at relatively high levels.** Shortening will give the biscuit its desirable tender eating quality. Any type of hydrogenated vegetable shortening can be used, while oil is not recommended because it makes the dough sticky. Too high a level of shortening (greater than 30 percent) should be avoided because it reduces the volume of the biscuit and prevents proper setting of the biscuit structure during baking.
- **Control dough temperature.** This is important because dough temperature will affect sheeting properties, especially when high levels of shortening are used.
- **Use baking powder to optimize biscuit volume.** Usually baking powders with low levels of MCP work best, especially when buttermilk is used containing lactic acid as a fast-acting leavening acid. Baking powders used for biscuits usually contain SALP and/or SAPP to produce carbon dioxide gas mainly during baking. Optimal loaf volume will result in a less dense biscuit that is soft and tender. 

### Structure Builders and Tenderizers (Continued)

crystallization in the baked product causes the cookie to become hard and brittle over time.

**Baking powder or yeast** is used in many baked goods to increase specific volume, thus making a product less firm and dense. Baking powder also gives the dough an alkaline pH that interferes with a quick hydration and development of a continuous gluten structure.

**Water** is required to develop a continuous gluten structure during mixing and a continuous starch structure during baking, but it can also act as a plasticizer/tenderizer in the final baked product. For this reason, cookies become softer when stored outside the package in a humid environment. 

## Lallemand Baking Ingredients


**L**ALLEMAND Inc. is a leading producer of yeast, baking powders, and dough conditioners and supplies a complete assortment of baking ingredients distributed through Lallemand Distribution and American Yeast Sales. All Lallemand products are backed with problem-solving technical support from experienced baking technicians.

For producers of cookies and biscuits, the following products are of interest:

**Eagle® Double Acting Baking Powder** and **Eagle® Bakers Cream** are supplied in ten-pound pails and fifty-pound bags.

Special baking powders tailored to specific requirements of the particular product or bakery can be provided.

**LBI 2130** and **LBI 2133** are flavor products based on inactive yeast that are used for taste and flavor enhancement in baked goods such as biscuits and cookies.

**Fermaid®** is a range of enzyme-based dough conditioners for improving the product characteristics of baked goods including bread, cakes, crackers, cookies, and biscuits. 

### LALLEMAND BAKING UPDATE

*Lallemand Baking Update* is produced by Lallemand Inc. to provide bakers with a source of practical technology for solving problems. If you would like to be on our mailing list to receive future copies, or if you have questions or comments, please contact us at:

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