

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



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A Guide to Dough Conditioner Ingredients

DOUGH CONDITIONERS contain functional ingredients that are used to improve processing and product quality in breadmaking. There are dozens of dough conditioner ingredients used in countless combinations, but they can be grouped by their composition and function into the following categories:

Vital wheat gluten is the insoluble protein portion of wheat flour that has been separated, washed, and dried so that it contains about 75 to 80 percent protein. Gluten is used to raise the protein content and absorption of flour, increase dough tolerance, and improve the volume and crumb texture of the finished product.

Yeast nutrients are inorganic salts that supply nitrogen or phosphorous. They were originally intended to make up for variations in the mineral content of dough water and to make sure that sufficient nutrients were present in a readily usable form for consistent yeast growth. In fact, little yeast growth occurs during breadmaking and sufficient nutrients are usually present, but yeast nutrients are still widely used because they accompany pH regulators and oxidizing agents as components of yeast foods.

pH regulators are most commonly inorganic calcium salts. They are used to adjust pH of acidic or alkaline water, provide buffering especially in water brews, and to counteract the adverse effects of soft water.

Oxidizing agents include natural ascorbic acid and chemicals like potassium bromate. They act on the gluten in flour to increase its strength and produce larger, more-uniform finished products. Potassium bromate works well alone because of its slow action, good oven spring, and high tolerance. Most other oxidizing agents act faster than bromate, requiring a combination of ingredients to control the amount and timing of oxidation.

Reducing agents include L-cysteine and nonleavening yeast, which is a natural source of glutathione. They act on the gluten in flour to increase extensibility, reduce

elasticity, and shorten mix time. Reducing agents can be used in combination with oxidizing agents to optimally develop gluten in no-time doughs.

Enzymes are proteins that act as natural catalysts to speed up reactions in dough or make reactions take place that otherwise

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DOUGH CONDITIONER INGREDIENT	FUNCTION	USE LEVEL	CONSIDERATIONS
Vital wheat gluten		2–10%	Increases strength and absorption
Ammonium chloride	Yeast nutrient	0.04%	Nitrogen source
Ammonium sulfate	Yeast nutrient	0.04%	Nitrogen source
Ammonium phosphate	Yeast nutrient	0.04%	Nitrogen and phosphorous source
Calcium carbonate	pH regulator	0.1–0.5%	Raises pH
MCP (Monocalcium phosphate)	pH regulator	0.1–0.3%	Lowers pH
Calcium sulfate	pH regulator	0.1–0.6%	Raises pH
Potassium bromate	Oxidizing agent	10–75ppm	Slow oxidizer
Ascorbic acid	Oxidizing agent	10–100ppm	Intermediate oxidizer
Calcium peroxide	Oxidizing agent	10–75ppm	Dries dough surface
ADA (Azodicarbonamide)	Oxidizing agent	10–45ppm	Fast oxidizer
Potassium iodate	Oxidizing agent	10–75ppm	Fast oxidizer
Calcium iodate	Oxidizing agent	10–75ppm	Fast oxidizer
L-cysteine	Reducing agent	10–90ppm	Chemical reducing agent
Nonleavening yeast	Reducing agent	0.25–1%	Natural source of glutathione
Protease	Enzyme		Increases extensibility
Carbohydrase	Enzyme		Improves oven spring and freshness
Oxidase	Enzyme		Forms oxygen via hydrogen peroxide
Enzyme active soy flour	Enzyme	0.25–0.5%	Lipoxygenase whitens crumb
Diastatic malt syrup	Enzyme	1–2%	Supplements flour enzyme activity
Malt flour	Enzyme	0.5–1%	Supplements flour enzyme activity
Lecithin	Emulsifier	0.25–1%	Natural softener
SSL (Sodium stearoyl lactylate)	Emulsifier	0.25–0.5%	Strengthens and softens
CSL (Calcium stearoyl lactylate)	Emulsifier	0.25–0.5%	Strengthens and softens
DATEM (Diacetyl tartaric acid esters of mono- and diglycerides)	Emulsifier	0.25–0.5%	Strengthens
EMG (Ethoxylated mono- and diglycerides)	Emulsifier	0.25–0.5%	Strengthens
Polysorbate 60	Emulsifier	0.25–0.5%	Softens
SMG (Succinylated mono- and diglycerides)	Emulsifier	0.25–0.5%	Strengthens and softens
Mono- and diglycerides	Emulsifier	0.25–1%	Softens
Distilled monoglycerides	Emulsifier	0.25–1%	Softens
Starch	Filler		

INGREDIENT TERMINOLOGY

Basic ingredients are absolutely required to make an acceptable product known as bread. These consist of only wheat flour, yeast, salt, and water.

Characterizing ingredients are normally used in addition to the basic ingredients to provide a specific product's taste, texture, and appearance. They include specialty flours, sweeteners, shortening, and dairy products.

Optional ingredients are usually added in small amounts to improve bread quality, to facilitate processing, and to produce bread of constant quality. They include preservatives, nutritional enrichments, and functional ingredients used in dough conditioners and yeast foods.

Dough conditioners such as yeast foods, crumb whiteners, dough stabilizers, shelf life extenders, bromate replacers, etc., are not rigidly defined. Usually they are concentrated mixtures of functional ingredients categorized as yeast nutrients, buffer salts, oxidizing and reducing agents, enzymes, and emulsifiers.

Bases are blends of ingredients, usually used at addition levels of 1 to 10 percent, which contain all the ingredients to prepare a certain type of bread except the basic ingredients yeast, salt, flour, and water. In Europe these are commonly referred to as bread improvers.

Mixes and premixes contain all the ingredients required to prepare a specific type of product by adding water, yeast, and flour. They are used at levels between 10 and 50 percent, thus including a considerable amount of flour. Complete mixes contain all the flour, and some also contain dry yeast.

Lallemand Dough Conditioners

OPTIMIZATION of a baking formula will likely include the use of dough conditioners. Reformulating with dough conditioners can be a challenge because of the way they interact and the variety of functions involved. Each time an ingredient is introduced, a new balance should be struck between the role of the existing ingredients and the function of the new ingredient.

Optimization can also provide some unexpected benefits. For example, using Essential® PBR, an enzyme-based dough conditioner and bromate replacer, often allows for the reduction or elimination of other enzymes and softeners in the formula. In most cases yeast reductions can be achieved. Other benefits may include improved machinability and reduction of cripples.

The following is a checklist to use when evaluating a new dough conditioner:

- Define the product or process need and choose a dough conditioner based on its primary function.
- Reevaluate the purpose for each functional ingredient in the existing formulation. Identify those that may interact.
- Determine any additional functions the dough conditioner can provide.
- Identify existing ingredients that may be reduced or eliminated and any process changes that may be beneficial.
- Optimize the formulation by testing each assumption one at a time to maximize the cost-to-benefit ratio.

Lallemand Inc. is a leading producer of yeast and dough conditioners, and supplies a full range of products to the baking industry through its subsidiaries Lallemand Distribution and American Yeast Sales.

Essential® Natural Dough Conditioners

- Essential® PBR potassium bromate replacers for conventional and frozen doughs
- Essential® LCR L-cysteine and sulfite replacer

Fermaid® Natural Dough Conditioners

- Fermaid® potassium bromate replacers for conventional and frozen doughs
- Fermaid® Relax and Fermaid® P L-cysteine and sulfite replacers

Eagle® Dough Conditioners

- Eagle® CM potassium bromate replacer for continuous mix

Yeast

- Lallemand fresh yeast blocks and bags
- American fresh yeast blocks and bags
- Eagle® fresh yeast blocks and bags
- Bulk liquid cream yeast and installations
- Fermipan® instant yeast
- Instaferm® instant yeast

Other Baking Ingredients and Products

- Chemical leaveners
- Yeast foods and oxidizers
- Preservatives
- Sugars and syrups
- Shortening
- Emulsifiers 

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would not. They include concentrated microbial enzymes in liquid, powder, or tablet form, and enzymes present in flour or malt syrup form. Individual enzymes are very specific in the reactions they catalyze, but the range of enzymes used in dough conditioners provides a wide variety of functions.

Emulsifiers (surfactants) include natural lecithin and a variety of "amphiphilic" chemicals that are soluble at low concentrations in both oils and water. Some strengthen the dough and improve finished product volume by interacting with gluten. Some soften the crumb and improve shelf life by complexing with the amylose starch in flour to keep it from firming after baking. Emulsifiers can be used individually or in combination to achieve both strengthening and softening effects.

Fillers are used to standardize the strength of dough conditioners and make concentrated ingredients easier to scale. Flour, starch, and calcium sulfate are most frequently used as fillers. 

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BAKING UPDATE

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