



Gluten-Free Problem Solving

What is gluten free baking?

Gluten-free baking means baked goods made without wheat or any other gluten-containing grain. Consumers who suffer from celiac disease, gluten allergies or experience gluten intolerances can safely consume gluten-free bread, gluten-free cakes and many other gluten-free bakery products. The term "gluten-free" is defined to mean that a food bearing this claim in its labeling does not contain any one of the following:

- An ingredient that is a prohibited grain
 - An ingredient that is derived from a prohibited grain and that has not been processed to remove gluten
 - An ingredient that is derived from a prohibited grain and that has been processed to remove gluten, if the use of that ingredient results in the presence of 20 parts per million (ppm) or more gluten in the food or 20 ppm or more gluten, according to the FDA
-

**Problems when baking
GLUTEN-FREE?** We have the answers.



 **nepra**
www.neprafoods.com

Learn More

What's Not Gluten-free?

Here's a list of grains to leave out of gluten-free products:

- Wheat flour (*triticum aestivum* or *triticum*)
- Ancient wheats (einkorn, spelt, emmer, spelt)
- Barley, meaning any species belonging to the genus *Hordeum*
- Rye, meaning any species belonging to the genus *Secale*
- Crossbred hybrids of wheat, rye or barley (e.g., triticale, which is a cross between wheat and rye)



Common Gluten-free Flours

Grains, Roots & Tubers	Pseudocereals	Legumes & Pulses	Other Flours
Rice flour Potato flour Oat flour Corn flour Sorghum flour Cassava (tapioca) flour	Quinoa flour Amaranth flour	Garbanzo bean flour Soybean flour	Hemp flour Coconut flour Flaxseed flour Almond flour

Benefits of Hemp Flour

Aside from being naturally gluten-free, flour made from hemp hearts is also highly nutritional and functional. It's rich in dietary fiber and protein, and adds essential fatty acids, vitamins, and minerals to the final product. Hemp flour helps retain moisture so it contributes to a moist and tender texture in baked goods.

Ready to tap into the boundless possibilities of allergen-free specialty ingredients? Enhance your products with Nepra Food's unparalleled range of ingredients, offering unmatched flavor, nutrition, and sustainability. [Find out more!](#)

Gluten-Free Bread Formula

Ingredient	Baker's % (based on flour weight)	Function
White rice flour	40	Product structure and crumb formation
Potato starch	30	Product structure and crumb formation
Corn flour	25	Product structure and crumb formation
Nonfat dry milk solids (NFDM)*	5	Nutritional enhancement, crust color
Water	90.0–110.0	Hydration, dispersion of solid ingredients Plasticization of functional polymers (proteins, starch, arabinoxylans, dietary fiber, hydrocolloids)
Egg powder (whole)**	10.0–20.0	Protein coagulation, structure setting, foaming agent, natural emulsification by presence of lecithin
Salt	1.5–2.0	Flavor enhancement
Active dry yeast (ADY)***	1.0–3.0	Product leavening during proofing and oven spring through CO ₂ production
Granulated sugar	1.5–5.0	Food for yeast, crust color and flavor enhancement
<u>Xanthan gum</u>	1.0–1.5	Higher batter viscosity
Hydroxypropyl methylcellulose (HPMC)	1.0–4.0	Gelling and water retention Higher foam stability (tighter crumb structure and higher product volume) Softer crumb
Enzymes (TGase, phospholipase)	Variable (parts per million)	Improve volume Tighter crumb grain Increase shelf life

*White rice flour, potato starch, corn flour and NFDM represent 100% flour weight.

**Amount must be increased if using liquid whole eggs. Water must be reduced based on egg solids content.

***Must be activated with water and sugar. Amount depends on batter-to-pan ratio and target product volume.

Processing Comparison

STANDARD WHITE BREAD

Wheat flour, water, salt, fat, yeast, dough conditioners

Mix to full gluten development

Panning

Proofing
104°F (40°C) | 80% RH

Baking



GLUTEN-FREE BREAD

Gluten-free flours, water, salt, hydrocolloids, yeast, dough conditioners, enzymes

Enough to incorporate and hydrate solids to obtain target batter viscosity

Panning: loose dough consistency
Depositing: batter consistency

Proofing
104°F (40°C) | 80% RH

Baking

PROTEIN IN GLUTEN-FREE BAKING

When removing gluten-forming proteins, such as glutenins and gliadins, it is mandatory to incorporate other sources of protein to replace some of the functions of gluten, namely:

- Formation of a cohesive polymeric network, necessary for gas retention, crumb formation and structure setting
- Gelling (both cold and hot)
- Water-binding
- Viscoelasticity

Plant-based proteins, natural fibers and gums, are capable of forming strong gels, binding water, emulsifying and stabilizing foams. Common commercial sources of gluten-free protein include egg solids, dairy/whey, soy, hemp, rice and pea protein.

Want to increase protein and nutrition? Explore the undeniable advantages of Nepra Food's allergen-free proteins, specialty flours, and functional starches that are reshaping the "free-from" market. [Check it out.](#)

Types of Starches in Gluten-free Formulas

Corn starch is the most widely used, commercially available gluten-free food starch, followed by tapioca (cassava) and potato starch. The unique properties and structure of each starch source (i.e. granule size, swelling temperature, ratio of amylose vs. amylopectin) create different effects.

It is very important to discern between native and modified (chemically or physically modified) starches. Native starch is the pure, extracted starch which requires heat to activate its gelling properties. Modified starches have undergone further processing to alter the performance. Common physical modification processes include pre-gelatinization (cold swelling), annealing and high shear milling which can improve the viscosity and stability of the starch in the dough system. Modified starches are especially useful in gluten-free baking.

“ How can I reduce the stickiness of batter-type, gluten-free doughs?

This is usually caused by excess water that is not absorbed by the gums and starches. Some of this water that is highly free or moving in between capillary spaces can be controlled by reducing total absorption, or just increasing the amount of gums in the recipe. It is typical that a gluten-free dough is sticky. Sometimes, this is an issue at the dividers or depositors. If reducing water is not possible, try spraying vegetable oil onto the contact surfaces.

There needs to be a balance between water-holding components and water; this creates enough viscosity in the gluten-free batter and still renders a cohesive network.

“ How can I reduce crumbliness and dryness in the finished product?

Crumbliness and dryness are both sensory perceptions of staled products. As gluten-free products are high in starches, starch retrogradation is a huge factor in the crumbliness of gluten-free products. To counter this, use shelf life enhancing enzymes like alpha amylase. In addition, you can fight starch retrogradation through the addition of sugars, oil and emulsifiers. Vegetable oil and sugars will provide a short moist bite, and emulsifiers will stabilize the system, making it less crumbly.

“ Does gluten-free flour have an impact on the shelf life of cake or bread?

Yes, indeed. Gluten-free flours mostly provide starch and lower amounts of proteins that do not contain gliadins and glutenins. The complex combination of starches from different sources that is commonly found in gluten-free flours creates a totally different staling behavior in baked products. Staling is actually one of the major challenges in gluten-free baking. Therefore, extended shelf life enzyme solutions are recommended for gluten-free cakes and bread.

“ My product lacks enough rise during baking. How can I fix this situation?”

Volume is based on two key points: the ability of the network to retain gas + an adequate gas source. Lack of oven rise could be the consequence of an unstable foam structure that tends to collapse upon heating. To stabilize a gluten-free batter or dough, a balance of starch, gums and/or proteins must be achieved, together with an emulsifier like lecithin. Once this network is stabilized, make sure that there is adequate baking powder or yeast.

“ How can I increase the humectancy or moistness of the finished product?”

Using hydrocolloids that tend to retain water throughout the baking process and having access to antistaling amylases, can give you an edge regarding moistness and crumb softness. Please contact enzyme suppliers and gum manufacturers to give you specific solutions for your shelf-life expectations.

The proper texture and moistness of the finished product can result from a combination of ingredients and even baking conditions. Sometimes you bake out too much water and get a very dry product that stales too fast. Checking the percent of moisture and water activity of the baked goods can help you identify improvement opportunities.

Using sugars like honey, invert sugar or fruit juice would help with humectancy. Glycerol, sugar alcohols and inulin (or other fibers) would also help with improved moistness of the product.



“ What preservatives can I add in gluten-free dry baking mixes for extending the shelf life?

Given their extremely low water activity and physical state, gluten-free dry mixes do not require traditional amounts of preservatives. A very small amount of sorbic acid (and its salts) is often more than enough to secure a long shelf life. If the mix has a high amount of fat, and your water activity is lower than 0.3 or higher than 0.5, then you would have to use a chelating agent to prevent rancidity. Most importantly, an air tight packaging is key to improving shelf life. Lastly, a packaging material that is air tight and light impermeable would also help extend the shelf life of the mix.

“ For gluten-free bread preservation, what acids and quantities would you recommend?

Bread made with wheat or without it, if intended to be packaged and last for about two weeks, definitely needs the addition of preservatives (traditional or clean label). Preservatives with antimicrobial activity, such as calcium propionate, sorbic acid, cultured whey, corn, raisin or prune juice, or organic acids are some of the choices that bakers have at hand to extend the mold-free shelf life of bread. Using 0.5% of calcium propionate and/or 700 ppm (based on flour weight) of sorbic acid, often do the job to reach at least 2 weeks of shelf life.

Organic acids and clean label mold inhibitors may be added at much higher doses (to obtain equivalent shelf-life) depending on the percentage of propionic/acetic/lactic acids present in the inhibitor composition. Remember to bring down the pH of the dough system to below pH 5.5, so that your mold inhibitors can work optimally. This can be done through longer fermentation times, and also through addition of acids like fumaric or malic acids. One last thing, don't forget to look into sanitation and antimicrobial packaging.



“ My gluten-free bread gets holes under the crust. How can I minimize them?”

Holes below the crust, large air pockets in the crumb, blisters near to the crust, and crust-crumbs separation are often signs of early coalescence during proofing or oven spring. Coalescence is a very common phenomenon in gluten-free baking and involves the merging of many gas cells into a single, large bubble due to an unstable network. Holes can also be caused by the following:

- A weak and unstable system that is experiencing tremendous surface tension. This can be remedied by using emulsifiers like mono- and diglycerides, or lecithin.
- Chemical reactions happening too quickly in the baking powders used in GF batters.
- Proofing at a high temperature loosens and weakens the network, encouraging coalescence.
- Try reducing the proofing temperature to below 95°F (35°C) and decrease proofing time.
- A system that is lacking in, or inadequate emulsifiers.



This BAKERpaper is brought to you by Nepra Foods, a market leader in delicious allergen-free and plant-based food ingredients and consumer products. They have developed and sourced specialty ingredients and blends that make it easier for commercial bakeries and leading food brands to offer world class gluten-free products to their customers. [Get started here.](#)

**Problems when baking
GLUTEN-FREE?** We have the answers.



 **nepra**
www.neprafoods.com

Learn More

References

1. Arendt, E.K., Zannini, E.
“Buckwheat.” *Cereal Grains for the Food and Beverage Industries*, Woodhead Publishing Limited, 2013, pp. 370–408.
2. Casper, J.L., and Atwell, W.A.
“Gluten-Free Ingredients.” *Gluten-Free Baked Products*, AACC International, Inc., 2014, pp. 23–47.
3. Rosell, C.M. “Enzymatic Manipulation of Gluten-Free Breads.” *Gluten-Free Food Science and Technology*, Blackwell Publishing Ltd, 2009, pp. 83–98.
4. Rachel Crockett, Pauline Ie, and Yael Vodovotz, How Do Xanthan and Hydroxypropyl Methylcellulose Individually Affect the Physicochemical Properties in a Model Gluten-Free Dough?. *Journal of Food Science* Vol. 76, Nr. 3, 2011.

