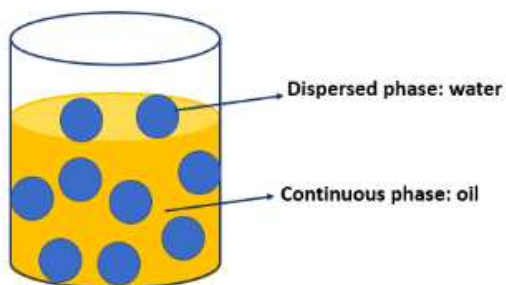


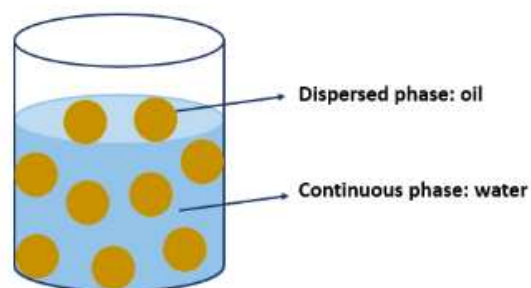
# How to Replace Emulsifiers

## What is an emulsifier?

An emulsifier is a substance that acts as a stabilizer. In systems like oil and water, emulsifiers stabilize two or more immiscible compounds. Commonly added to bakery goods, including bread, cake and cookies, emulsifiers can be plant or animal based or commercially produced. There are two types of emulsions:



Water-in-oil emulsion (W/O), eg., butter



Oil-in-water emulsion (O/W), eg., milk



# What is the function of emulsifiers in baked goods?

The presence of emulsifiers in high volume baking is essential to keeping the quality of baked goods consistent throughout the entire process.



Here's how they impact different products

## Bread and Ferment Products:<sup>2</sup>

- Higher hydration
- Dough strengthening
- Improved flexibility for machinability
- Finer and softer crumb
- Improved crumb uniformity
- Better resilience at the slicer
- Extends softness over shelf life

## Icing & Frosting:<sup>3</sup>

- Improves stability to temperature fluctuations
- Prevents oils from seeping out over the product's shelf life
- Prevents crystal formations
- Provides sharper designs with better edges
- A better mouthfeel and texture

## Cookies:<sup>3</sup>

- Better machinability
- Controls cookie spread
- Less crumbly
- Less friable
- Maintains texture over shelf life

## Cakes:<sup>2</sup>

- Keeping a consistent specific gravity
- Tolerance to processing
- Prevent coalescence of cells and structural collapse
- Uniform cell structure
- Higher volume

## Pastries:<sup>3</sup>

- Emulsifiers in the pastry shortening gives better flexibility and machinability to the shortening, resulting in better volume for an improved flakiness
- Prevents water migration and provides a better crisp



# Emulsifiers Commonly Used in Baking

Product	Emulsifier
 Bread/buns/rolls/pizza/flatbread/bagel	Egg, soy lecithin, sodium or calcium stearoyl-2-lactylate (SSL or CSL), mono- and di-glycerides, diacetyl tartaric acid ester of mono- and diglycerides (DATEM), guar gum, gum arabic, carboxymethylcellulose (CMC), xanthan gum, cornstarch
 Cake/cupcakes/muffins	Egg, SSL, CSL, propylene glycol monoesters (PGME), soy lecithin, mono- and di-glycerides, Polysorbate 60, polyglycerol esters (PGE), sorbitans, polysorbate 60, modified corn starch, gum arabic
 Cookies	Egg, soy or sunflower lecithin, mono- and di-glycerides, polysorbate 60, modified corn starch, propylene glycol mono- and diesters of fats and fatty acids, xanthan gum
 Shelf stable filled pastries/snacks	Modified wheat starch, soy lecithin, xanthan gum, egg
 Frosting/icing	Polysorbate 60, SSL, modified corn starch, guar gum, agar, carrageenan, soy lecithin, CMC
 English muffins	Soy lecithin, SSL, mono- and diglycerides, guar gum, cellulose gum, xanthan gum, CMC, methylcellulose
 Pies	Polysorbate 60, modified corn starch, carrageenan, cellulose gum, mono- and diglycerides, soy lecithin
 Pastries	DATEM, canola lecithin, guar gum, carrageenan, agar, modified corn starch, soy lecithin
 Pancakes/waffles	Soy lecithin, gum arabic, CMC, Polysorbate 60, xanthan gum
 Snack bars	DATEM, soy lecithin, gum arabic
 Biscuits/crackers	Soy lecithin, modified corn starch, mono- and diglycerides, xanthan gum, carob bean gum



# What's the best way to replace an emulsifier?

Since the emulsifier's main function is to stabilize the food system, any ingredient that can accomplish this function has the potential to replace a specific emulsifier. Enzymes, hydrocolloids, proteins and modified starches are common are common emulsifier alternatives because they are more label friendly. Plant proteins which can provide emulsifying properties are also used to substitute emulsifiers.

---

## **Enzymes:**

Enzymes such as phospholipase or transglutaminases work on fats and protein molecules to improve dough texture, volume and gas retention. They do this by catalyzing protein or peptide bonds for polymerization.

## **Modified Starches:**

Modified or pre-gelatinized starch granules can absorb water at a lower temperature and swell to increase the viscosity of dough or batter. An increased viscosity stabilizes the food system.

## **Proteins:**

Protein is mainly responsible for strength, water-holding, foaming, flavor and color of bakery goods. It is the building blocks of any food system. Some examples are wheat gluten, whey protein, egg whites, or soy isolates.

## **Hydrocolloids:**

Hydrocolloids are not really emulsifiers due to lacking of lipophilic and hydrophilic linkage in the structure. Hydrocolloids molecules cannot flexibly cover the interfaces on oil-water mixtures quickly to create a stable emulsion because of large molecules and complex size. Hydrocolloids can still functionalize as emulsifiers by increasing the viscosity of water surface or by interaction with surface- active substances. Some well-known hydrocolloids include gum arabic, methylcellulose (MC), hydroxypropylmethylcellulose (HPMC) and propylene glycol alginate (PGA). Others are carboxymethyl cellulose, carrageenan and xanthan gum



## “ Instead of DATEM, what can be used in my refrigerated dough used by pizza chains?

Fermentation up to 4 hours enhances dough strength and machinability. However, longer fermentation time, makes it more acidic and creates a more unstable dough. Therefore, suitable emulsifiers like DATEM are usually used to stabilize the system. The best way to replace DATEM in this situation would be to try a sunflower or soy lecithin, with enzymes, depending on the formula. If cutting the fermentation time is an option, please do so. Clean label systems are not tolerant to extremely long fermentation times.

Enzymes such as phospholipase and transglutaminase can be used to modify the dough behavior and improve the volume, texture and structure of baked goods. These enzymes catalyzes cross-linking between proteins and starch chains, releasing the sugars. This will also help improve yeast fermentation.

Glucose oxidase is an enzyme which catalyses the oxidation of glucose to hydrogen peroxide and D-glucono- $\delta$ -lactone. The removal of glucose through the catalyzation allows free glucose for better fermentation. Lastly, ascorbic acid can also be used similarly.

## “ How can I improve the flexibility of my flat bread without DATEM or SSL?

Cracking is caused by loss of freshness and moisture migration which is a result of staling. Firstly, thermal profile your flat bread product and make sure that you are not overbaking it. Emulsifiers can act as anti-staling agents through increased dough stability and crumb softening. DATEM and SSL are typically used for this function in bread.

Modified wheat proteins that have a flexible nature can be used together with 1-2% increase in vegetable fat. Enzyme blends from ingredient suppliers can do the same. Gums (gum arabic, carboxymethyl cellulose, xanthan gum) are also helpful since gums can retain moisture which keeps the bread flexible.<sup>4,5</sup>



## ““ What emulsifiers can I use in eggless cake to make it soft, light and fluffy?

Eggs play an important role in cake batter, in creating structure and stability, coagulation, emulsification, foaming, texturizing, softness, and color.<sup>6</sup>

In order to replace this function, a combination of alpha dextrins, lecithins, hydrocolloids, gluten, and/or modified starches can be used.

## ““ What emulsifiers can I use to make sliced bread remain fresh?

Freshness of bread is prolonged by the high moisture content. However, the higher the moisture content of fresh baked breads, the greater the effects of staling. Thus, emulsifiers functionalized as anti-staling agents can be added in the dough for softening and moistening the bread. Common emulsifiers used in sliced bread to remain fresh include hydrocolloids such as carboxymethyl cellulose, guar gum and xanthan gum.

## ““ What common bread emulsifiers are used in high volume bakeries?

Sodium stearoyl lactylate (SSL), Diacetyl tartaric acid ester of mono- and diglycerides (DATEM) and Mono & Diglycerides. The above emulsifiers improve structure, helps with machinability and thereby produces a higher volume. A higher volume would increase the softness of the product. Many consumers perceive a softer product as a fresher product. Some common enzymes used in bakeries are transglutaminase and phospholipase.



## References

1. Nair, M. S., Nair, D. V. T., Johny, A. K., et al. Use of food preservatives and additives in meat and their detection techniques[M]//Meat Quality Analysis. Academic Press, 2020: 187-213.
2. Kohajdová, Z., Karovičová, J., and Schmidt, Š. Significance of emulsifiers and hydrocolloids in bakery industry. Acta Chimica Slovaca, 2009(2), 46-61.2
3. Gums. <https://bakerpedia.com/ingredients/gums/>. Accessed by Dec 04. 2019.
4. Orthoefer, F. Applications of Emulsifiers in Baked Foods. Food Emulsifiers and Their Applications. 2008, 263–284. TIC GUMS. [https://www.ticgums.com/products?gclid=Cj0KCQiAz53vBRCpARIsAPPsz8WfBfYsggEHyjOroel4Me\\_bos0b9czEHD2fC6MaUYQYTljuaacEmeIAaAiRAEALw\\_wcB](https://www.ticgums.com/products?gclid=Cj0KCQiAz53vBRCpARIsAPPsz8WfBfYsggEHyjOroel4Me_bos0b9czEHD2fC6MaUYQYTljuaacEmeIAaAiRAEALw_wcB). Accessed by Dec 04. 2019.
5. Egg. <https://bakerpedia.com/ingredients/egg/>. Accessed by Dec 02. 2019.
6. CAVAMAX® W6- EGG- FREE BAKERY SOLUTIONS. [https://bakerpedia.com/wp-content/uploads/2018/08/Egg-free-Bakery-Solutions\\_WACKER.pdf](https://bakerpedia.com/wp-content/uploads/2018/08/Egg-free-Bakery-Solutions_WACKER.pdf). Accessed by Nov 22.2019.

