FUTURA
ingredients
designed by nature

EKÖMUL MG SERIES
DISTILLED MONOGLYCERIDES

EKÖLITE PE & PG SERIES
POLYGLYCEROL ESTERS & PROPYLENE GLYCOL ESTERS

EKÖLITE SE SERIES
SORBITON MONOESTERS

Bakery: Cake Emulsifiers in Gel Form

Winner of
Frost & Sullivan's
2016 Best Practices Award
Entrepreneurial Company
of the Year

Winner of
Frost & Sullivan's
2018 Best Practices Award
Food Ingredients
Company of the Year

PRODUCT NAME

- Ekömul MG Series
- Ekölite PE Series
- Ekölite PG Series
- Ekölite SE Series

Introduction

Cake gels are cake improvers comprised of water, emulsifiers and solvents which are used primarily in production of sponge cakes.

The key functionalities of cake gel are:

- To allow the use of a single step process or 'all-in-method' in industrial cake production.
- To improve emulsification of oil and water in cake batter.
- To provide quick whipping properties.
- To improve cake batter stability through increased viscosity to extend batter floor time.
- To boost cake volume through improved aeration of cake batter and coalescence of air bubbles during batter floor time and during baking.
- To impart a uniform and fine crumb structure.
- To improve softness of cake products and extend shelf life.

Typical Quality Concerns in Cake Gel

Cake gel manufacturers encounter a number of challenges during production as there are many processing variables involved that increase the complexity to produce stable and highly functional cake gels. To achieve cake gels with desired shelf life and functionality, some of the factors to be taken into consideration include:

- Raw material (e.g. quality of water and other ingredients)
- Cake gel formulation variations
- Processing facilities and operating conditions
- Type of emulsifiers used and dosages

Manufacturers who understand and are able to control these parameters will create cake gels with desired shelf life stability and obtain ideal functionality in the end product.

The typical quality concerns in cake gel production include:

a) Cake gel mixture formation
b) Cake gel setting temperature
c) Crystallisation of cake gel

a) Cake Gel Mixture Formation

Cake gel mixture formation is an important factor in cake gel processing. The successful formation of a cake gel mixture give a uniform and smooth solution without sign of phase separation. The mixture formation impacts the homogeneity during mixing stage and its viscosity affects the removal of air bubbles during filling stage. The mixture viscosity also has an indirect impact on the gel setting temperature, where a more viscous product tends to gel at a higher temperature which is not favourable.

Smooth and flowable mix

Thick, not flowy mix

Note: *Cake gel mixture during mixing stage.*

b) Cake Gel Setting Temperature

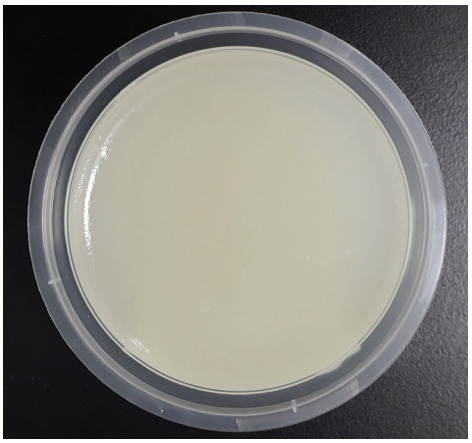
The setting temperature of cake gels is important as it determines the filling temperature of cake gel and condensation in packaging. Water hardness greatly influences cake gel setting temperatures, as hard water will reduce gel setting temperature. A lower setting temperature minimises condensation and ensure smoother cake gel setting, thus improving operational and supply chain considerations.

c) Crystallisation of cake gel

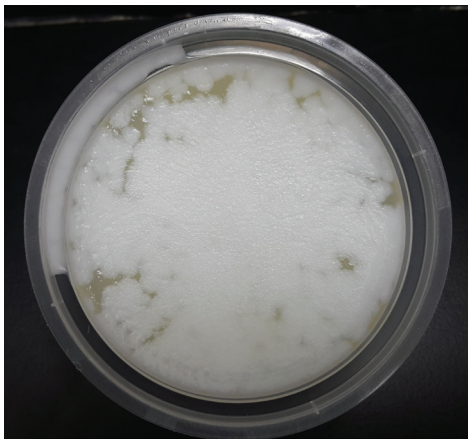
Crystallisation in cake gel refers to the appearance of white spots on the gel surface. This occurs due to the inherent instability of α-gels that transforms into a more stable state β-crystalline coagel. The active α-gel contributes to the functionality of aeration and whippability in cake gels. As a result when β-crystalline coagels are formed, the functionality of a cake gel is reduced. The rate of crystallisation in cake gel depends on the gel formulation and its processing conditions. Crystallisation may take place within days or up to several months.

The selection of emulsifiers and a balanced gel formulation is of critical importance:

1. To create a stable, active gel phase for longer shelf life of cake gels.
2. To provide the ideal aeration and whipping functionality during batter mixing.
3. To impart the ideal crumb structure, volume and softness to sponge cakes.



Cake Gel
(before crystallisation)



Cake Gel
(after crystallisation)

Note: *Cake gel before and after crystallisation after a period of storage.*

Emulsifiers for Cake Gel

a) Ekömul MG series Distilled Monoglycerides

Distilled Monoglycerides (DMG) forms the main composition of emulsifiers in a cake gel formulation and is the source of α-crystalline emulsifiers. DMG is hydrated into lamellar phases at elevated temperatures and forms the desired α-gel when cooled. Active α-gels are highly functional in promoting aeration, whippability and emulsification in cake batter. In cakes, DMG complexes with starches in cake batter during baking, to impart a fine, uniform crumb structure and aids in extending the shelf life of baked goods.

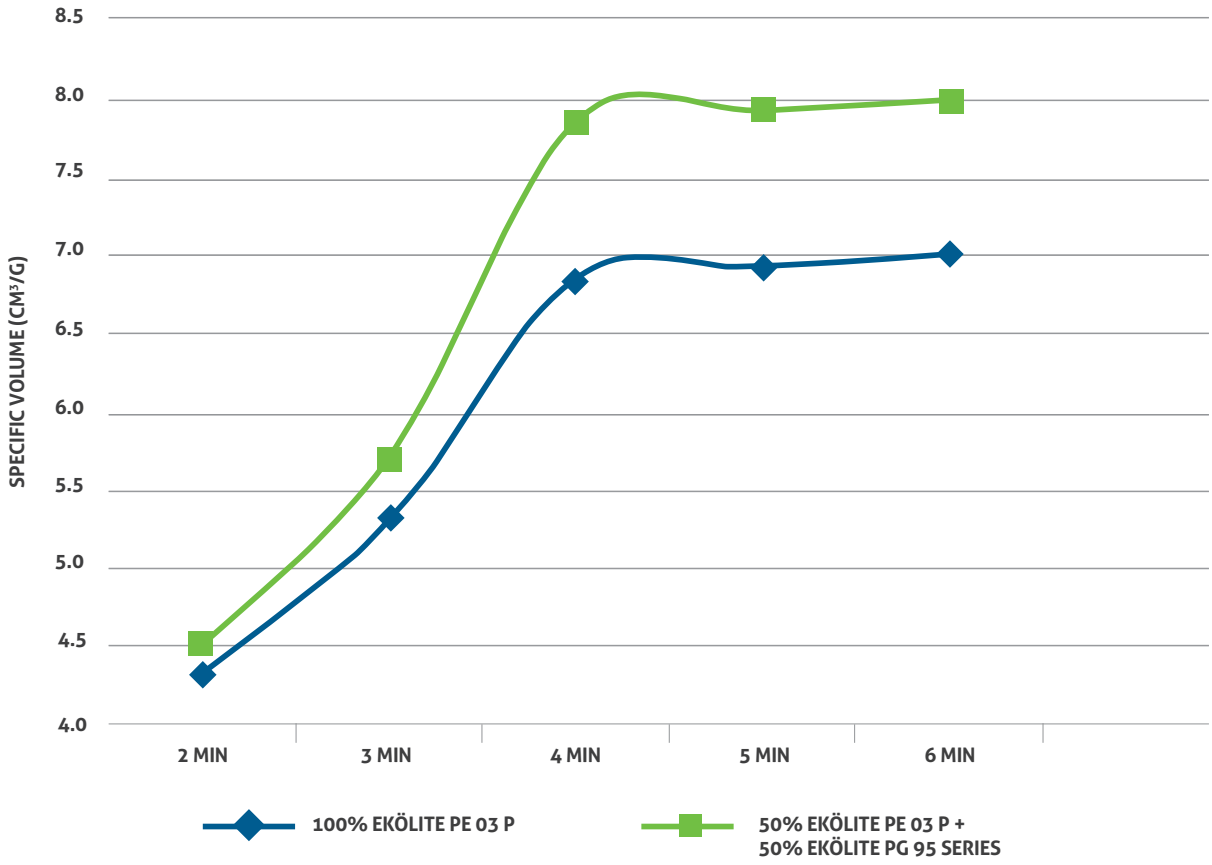
b) Ekölite PE series Polyglycerol Esters

Polyglycerol Esters function as α-tending emulsifiers to stabilise the α-crystalline structure of monoglycerides. The addition of **Ekölite PE series** into a cake gel formulation helps delay the transition of short-stability whipping-active α-gels to the non-whipping active β-coagel. By stabilising the active α-crystalline structure of monoglycerides, **Ekölite PE series** prolongs cake gel shelf life, which in turn influences the softness and crumb structure of the final product. **Ekölite PE series** is used to boost aeration and foam stabilisation of **Ekömul MG series** Distilled Monoglycerides.

c) Ekölite PG series Propylene Glycol Monoester

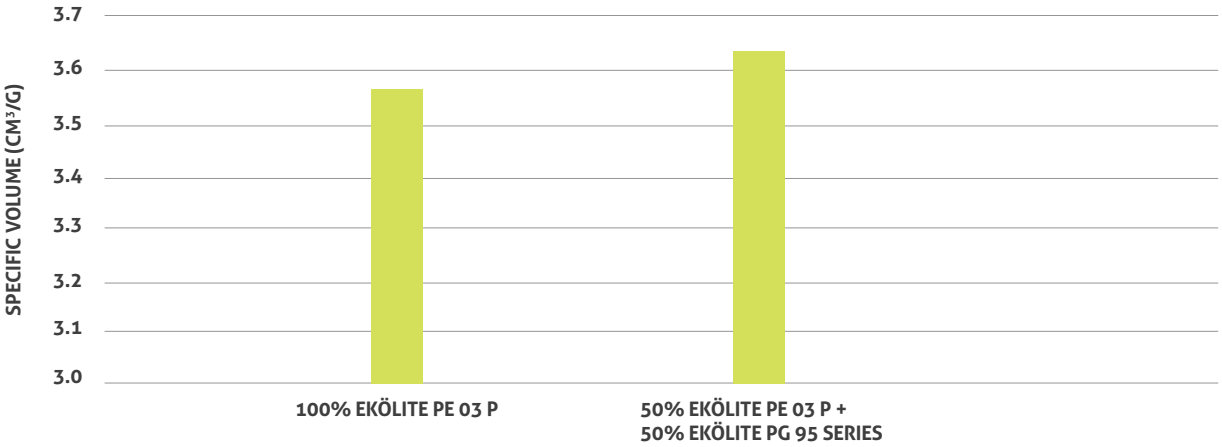
Propylene Glycol Monoesters function as an α-tending emulsifier to stabilise the α-crystalline structure of monoglycerides. **Ekölite PG series** performs a similar function to **Ekölite PE series** in terms of delaying the transition of short-stability whipping-active α-gels to the non-whipping active β-coagel. However, **Ekölite PG series** has superior aeration capabilities and foam stabilisation properties than **Ekölite PE series**. Thus, yielding cakes with a super fine crumb structure. Typically, **Ekölite PG series** is incorporated together with **Ekölite PE series** for ideal functionality in aeration, volume and crumb structure.

i) Comparative Cake Gel Aeration between Ekölite PE series and Ekölite PG series



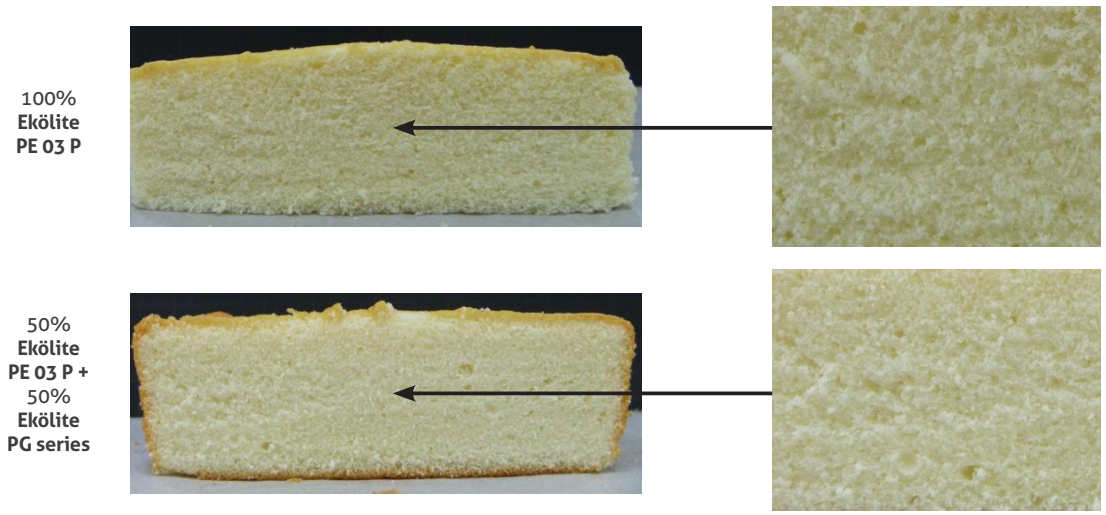
Note: *60⅔ water, 88% icing, sugar and 2% cake gel. Test conducted using cake gel aeration test. (Percentage of α-tending emulsifiers in the cake gel formulation totals 10%.)*

ii) Comparative Cake Specific Volume Between Ekölite PE series and Ekölite PG series



Note: *Test conducted with basic sponge cake recipe at 5% cake gel.*

iii) Comparative Crumb Structure Between Ekölite PE series and Ekölite PG series



Note: Test conducted with basic sponge cake recipe at 5% cake gel.

d) Ekölite SE series Sorbitan Monoesters

Sorbitan Monoesters is also an α-tending emulsifiers added to stabilise the α-crystalline structure of monoglyceride. **Ekölite SE 60 series** is often used in combination with **Ekölite PE & PG series** for synergistic effect but could also be added on its own to preserve the α-crystals of **Ekömul MG 95 series.**

General Compositions of Cake Gel

INGREDIENTS	DOSAGE	FUNCTIONS
Distilled Monoglycerides (DMG) **Ekömul MG series**	13-25%	- Source of α-crystalline emulsifiers (most active phase for aeration) - Aeration of batter - Emulsification of oil and water in batter - Retards staling - Provides improved crumb softness
α-tending Emulsifiers **Ekölite PE series** **Ekölite PG series** **Ekölite SE series**	5 – 15%	- α-tending emulsifier: stabilises DMG in its active α form - Form films with α-gel structures - Enhance aeration and foam stability
Humectant	25 – 40 %	- Retain moisture - Control microbial and chemical activities by reducing the system's water activity - Compositions depend on desired functionality, cost and legislation - Examples: Glycerol, Sorbitol, Propylene Glycol
Water	40 – 55 %	
Other additives	..	Additives such as potassium and sodium soap, and potassium hydroxide are used to regulate gel formation

Product Specifications

BRAND NAME	PRODUCT NAME	MONOESTER	IODINE VALUE	MELTING POINT, APPROX.	RSPO CERTIFIED		FEEDSTOCK
					MB	SG	
EKÖMUL	**Distilled Monoglycerides MG-Series**						
	MG 95 HP	Min. 95%	Max. 2	65°C	✔	✔	Palm
	MG 95 HO	Min. 95%	Max. 2	66°C	✔	✔	Palm
	MG 95 HV	Min. 95%	Max. 2	69°C	✔		Soya
	MG 95 HVX	Min. 95%	Max. 2	69°C	Non Palm		Soya
	MG 95 HR	Min. 95%	Max. 2	69°C	✔		Rapeseed
	MG 95 HRX	Min. 95%	Max. 2	69°C	Non Palm		Rapeseed
EKÖLITE	**Propylene Glycol Esters PG - Series**						
	PG 95 P	Min. 95%	Max. 3	44°C	✔		Palm
	PG 95 R	Min. 95%	Max. 3	44°C	Non Palm		Rapeseed
	PG 95 S	Min. 95%	Max. 3	44°C	✔		Palm
		Saponification Value	Iodine Value	Melting Point, approx.	RSPO Certified		Fat Source
					MB Palm	SG	
	Polyglycerol Esters PE - Series						
	PE 03 P	130-160	Max. 3	58°C	✔		Palm
	PE 02 P	125-145	Max. 3	58°C	✔		Palm
	PE 04 P	135-160	Max. 3	58°C	✔		
	PE 05 P	140-160	Max. 3	58°C	✔		
	Sorbitan Esters SE - Series						
	SE 60 S	147-157	Max. 3	58°C	✔		Palm

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