



Pharma & Food Solutions

Baking Science into Success

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Dow Food Solutions offers a broad range of ingredients for the bakery industry. For us, providing food manufacturers with highly functional ingredients that help improve the quality of their products is only part of the story. It's much more about a drive to find novel solutions that help consumers live healthier, more convenient and enjoyable lives.

Dow's cellulose based ingredients address the textural and dietary considerations desired by many people including:

- Bake stable fillings that exhibit boil out control, shape retention, and water binding
- Gluten-free breads and baked goods with the shape and texture of traditional gluten containing products
- Bakery products with softer crumb structure, increased volume, freeze thaw stability, and longer shelf life

Enhancing Quality Through Heat Stability

METHOCEL™ food gums have the unique physical property of reversible thermal gelation.

Once hydrated, a METHOCEL™ solution will gel when heated. This gel is reversible, meaning that when cooled below its gelation temperature, the heated gel will return to its original solution state (Figure 1).

Thanks to this unique property, our METHOCEL™ portfolio of food ingredients prevent boil out and offer bake stability to fillings (Figure 2).

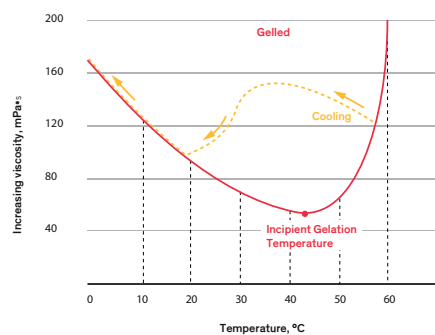


Figure 1: Thermal-Gelation of METHOCEL™

METHOCEL™ A4M Food Grade Viscous Solution after Cooling Down



Thermal-Gelation of METHOCEL™



METHOCEL™ A4M Food Grade Thermagel



Results from internal studies conducted in our laboratories in January 2014; Gelation of a METHOCEL™ A4M food grade product at 2% in aqueous solution (4000 mPa·s, 20°C), heating rate 0.25°C/min. The properties shown are typical but not to be construed as specifications.

The different gel strengths available in our METHOCEL™ portfolio of food ingredients allow use with sweet (max 50% sugar) or savory fillings, low or high water content.

Figure 2: Study of Boil Out Control in Sweet Fillings

Boil out is a common problem for heated bakery fillings. Fillings that are not properly stabilized will move during the heating process causing the fillings to escape.

**Coextruded Cream Cheese & Fruit Filling**

Ingredients (%)	Control	Sample with METHOCEL™ A40M Food Grade
Cream Cheese	45.13	44.73
Water (<50°F)	35.00	35.00
Granulated Sugar	17.00	17.00
Instant Modified Starch	2.25	2.25
Vanilla Flavor (liquid)	0.62	0.62
METHOCEL™ A40M Food Grade	0.00	0.40
Total	100.00	100.00

Results from internal studies conducted in our laboratories in October 2014. The properties shown are typical but not to be construed as specifications.

Instant Strawberry Pastry Filling

Ingredients (%)	Control	Sample with METHOCEL™ K100M
Water	61.27	61.07
Granulated Sugar	35.20	35.20
Instant Modified Starch	2.20	2.20
Citric Acid	0.60	0.60
Sodium Alginate	0.50	0.30
METHOCEL™ K100M Food Grade	0.00	0.40
Strawberry Flavor	0.10	0.10
Potassium Sorbate	0.05	0.05
Sodium Benzoate	0.05	0.05
Color	0.03	0.03
Total	100.00	100.00

Results from internal studies conducted in our laboratories in October 2014. The properties shown are typical but not to be construed as specifications.

In addition to offering bake stability to fillings and preventing boil out, our METHOCEL™ Portfolio of ingredients also:

- Helps to bind water and avoid syneresis in fillings
- Facilitates shape retention of toppings
- Offers freeze/thaw stability imparting a uniform consistency in frozen foods

Gluten Replacement : Bring Back Shape, Structure and Moistness

For the increasing number of people worldwide who are diagnosed with intolerance to gluten, including those with Celiac disease, or for people who are just trying to eliminate gluten from their diet for personal reasons, there seems to be little choice in terms of high quality, shelf stable bakery products.

Dow Food Solutions helps food companies make gluten-free bread, cakes and other baked goods that look, feel and taste like the foods

they are replacing. We offer a broad range of plant-based food ingredients that mimic the water-absorbing and structural capacity of gluten providing food manufacturers with a cost efficient and high performance way to make gluten-free foods that people enjoy.

Our WELLENCE™ portfolio of food ingredients controls crumb structure and volume imparting an airy feeling as outlined (Figure 3). It also helps cakes and breads achieve desired shape and volume and retain height both in the oven and when cooled (Figure 4).

Figure 3: Gluten-Free Bread Baked with WELLENCE™ Gluten-Free 47129 Food Grade Exhibits Controlled Crumb Structure, Uniform Air Cell Structure and Improved Volume.



Ingredients (%)	Gluten-free white dough bread baked with WELLENCE™ Gluten-Free
Water	51.0
Rice Starch	9.1
Tapioca Starch	10.6
Bamboo Fiber	5.7
Egg White Powder	4.2
Canola Oil	3.8
Potato Starch	3.4
Psyllium Husk	3.0
Maize Flour	2.3
Sugar	2.3
Cake Yeast	1.9
WELLENCE™ Gluten-Free 47129	1.1
Salt	1.1
WALOCEL™ CRT 20000 PA	0.5

Results from internal studies conducted in our laboratories in March 2014. The properties shown are typical but not to be construed as specifications.

**Figure 4: Volume Comparisons
Gluten-Free Hamburger Buns
Baked With or Without
WELLENCE™ Gluten-Free 47129**



Ingredients (%)	Control	Sample with WELLENCE™ Gluten-Free
Water	48.7	48.7
Rice Flower	9.6	11.4
Tapioca Starch	10.8	10.8
Sunflower Oil	7.2	7.2
Bamboo Fiber	3.6	3.6
Potato Starch	3.3	3.3
Psyllium Husk	3.1	3.1
Corn Syrup	2.9	2.9
Yeast	2.5	2.5
Albumen Powder	2.0	2.0
Maize Starch	1.8	1.8
WELLENCE™ Gluten-Free 47129	0.0	1.8
Salt	0.9	0.9

Results from internal studies conducted in our laboratories in March 2014. The methodology used for volume measurement in GF burger buns consisted of **rape seed volume test** (which uses displacement of very small spherical seeds against weight of those seeds to calculate the volume). The properties shown are typical but not to be construed as specifications.

Xanthan gum is also widely used in gluten-free bakery applications to bring viscosity to dough and batter based systems, and to provide a soft crumb in the finished product. However, xanthan gum cannot provide the structure and strength necessary when replacing gluten in bread formulations.

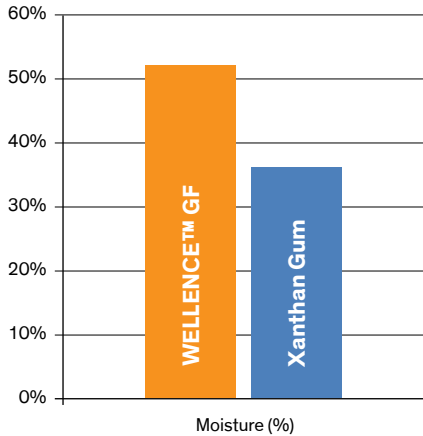
During baking, xanthan heat thins or loses viscosity and there is the risk the bread will collapse. WELLENCE™ gels softly at heated temperatures providing a controlled expansion/volume and also maintains homogeneity of the crumb (by limiting coalescence of air bubbles). Figure 4 illustrates the differences in height and volume between a xanthan containing gluten-free bread and a WELLENCE™ containing gluten-free bread.

In addition to stabilizing height and volume, WELLENCE™ also improves the textural characteristic of gluten-free bread when compared to xanthan gum. Figure 5 illustrates improvements in moisture retention and texture with WELLENCE™ Gluten-Free 47129.

Figure 5: Textural and Moisture Comparisons of Gluten-Free Bread Baked with Xanthan Gum vs. Bread Baked with WELLENCE™ Gluten-Free (GF) 47129

WELLENCE™ GF keeps your bread moist

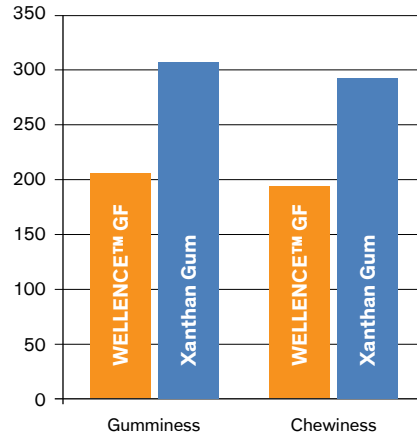
WELLENCE™ GF provides a less dry bread while maintaining the same water activity (shelf-life) of xanthan gum.



Results from internal studies conducted in our laboratories in september 2013. The properties shown are typical but not to be construed as specifications.

WELLENCE™ GF maintains traditional bread profile

WELLENCE™ GF provides a less chewy & gummy bread, closer in texture and mouthfeel to the traditional breads.



Results from internal studies conducted in our laboratories in september 2013. The properties shown are typical but not to be construed as specifications.

In addition to controlling crumb structure and volume in gluten-free baked goods, our WELLENCE™ Gluten-Free portfolio facilitates

- Consistent, improved dough handling
- Improved moistness by binding moisture in the food product

WALOCCEL™ Food Gums:

Controlling Moisture, Improving Processing, Enhancing Shelf Life

In addition to our thermally gelling food gums, Dow Food Solutions also offers WALOCCEL™ CRT and Clear & Stable™ food gums for bakery applications.

WALOCCEL™ food gums are very effective at binding water and managing moisture throughout the life cycle of a bakery product.

WALOCCEL™ provides the following benefits to bakery applications:

- Improves texture and extends shelf life of doughs and fillings
- Reduces syneresis through high water-binding properties
- Controls the rheology and viscosity of doughs and fillings
- Increases plasticity and elasticity of dough based products (improved machinability)
- Delays the retrogradation of amylose, extending shelf life
- Provides excellent freeze-thaw stability (ice crystal control)



Bakery Products with Improved Texture and Prolonged Shelf-Life

For dough or batter based products, WALOCEL™ has high water absorption and retention capacity. Moisture is retained in both the unbaked dough/batter and the baked final product. There is less drying out and less hardening or breakage of the baked crumb structure, and an extended shelf life can be achieved.

In bakery fillings, WALOCEL can be used to create fillings with a consistency ranging from flowing to thick. WALOCEL™ prevents phase separation and syneresis in fillings and also prevents fillings from absorbing into the dough or final baked product.

Dough With Increased Mechanical Stability

With the addition of WALOCEL™, doughs become more elastic and resistant to mechanical forces. The production volume (yield) can be increased because improved dough stability results in less

breakage during processing. Furthermore, the dough is less sticky so that cleaning times can be reduced.

Dough Applications with Less Tendency to Become Stale

Besides improved water retention WALOCEL™ has a second impact on the storage stability of flour-containing products. The cellulose derivative forms a film around starch granules and delays the retrogradation of the amylose by preventing crystallization.

Retrogradation of the linear amylose molecule is a natural process controlled by time and/or cold storage. The speed of staling can be reduced with CMC, and the shelf life of dough products can be extended.

Frozen Bakery Products With Less Ice Crystallization

WALOCEL™ controls the ice crystal formation in both frozen dough and finish baked goods. It slows down crystallization speed and reduces crystal growth. This protection lasts over several freeze/thaw cycles. The sandy mouth-feel in dough products,

and fillings is therefore also suppressed. Post frozen processing steps such as rolling out of unbaked thawed dough and folding of thawed baked flat bread products (wraps, tortillas, pancakes) without breakage are possible after thawing.

Additional Information about our Food Ingredients Including Regulatory Status

Our METHOCEL™ family of plant-based food ingredients consist of the cellulose derivatives hydroxypropyl methylcellulose, methylcellulose or blends thereof. METHOCEL Food Gums are commonly labeled as “Modified Cellulose.”

Our WELLENCE™ family of plant-based food ingredients consist of cellulose derivatives namely hydroxypropyl methylcellulose, methylcellulose, sodium carboxymethylcellulose (or blends thereof). Methylcellulose and hydroxypropyl methylcellulose are commonly labeled as “Modified Cellulose.” Carboxymethylcellulose is labeled as “Cellulose Gum.”

Our WALOCEL™ and Clear & Stable™ family of plant-based food ingredients consist of sodium carboxymethylcellulose (CMC). Carboxymethylcellulose is commonly labeled as “Cellulose Gum.”

The METHOCEL™, WELLENCE™, and WALOCEL™ cellulose product lines are gluten-free, Halal and Kosher Certified, GRAS, non-allergenic, and non GMO (with the exception of our highest viscosity grades).

Every day, we're helping bakery manufacturers meet their biggest challenge: how to make easy-to-prepare foods that will appeal to the discerning eyes of consumers.

Using the versatility of our plant-based portfolio, more of your consumers' demands can be met. Whether looking for baking stability, binding or foaming of your baked good, we have a solution to address your challenge.

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