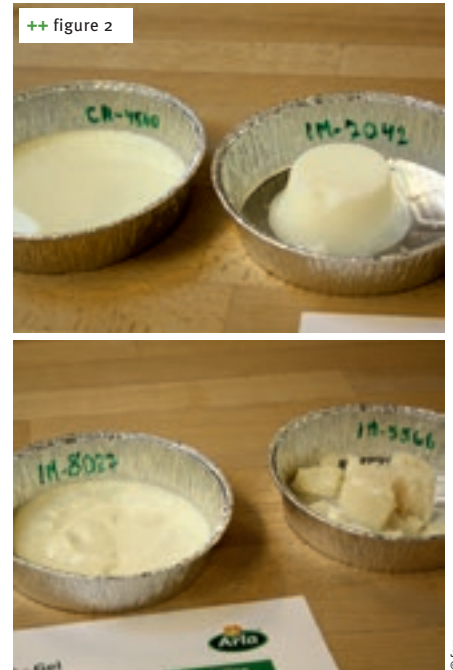


# Milk protein as a natural improver

ARLA FOOD INGREDIENTS NOW ALSO MANUFACTURES PROTEIN FRACTIONS, WHICH PROMISE BENEFITS FOR PRODUCERS OF BREAD, CAKES, COOKIES AND FILLINGS. THE PORTFOLIO IS MANUFACTURED PURELY FROM WHEY PROTEINS AND CAN BE LABELED AS MILK PROTEIN



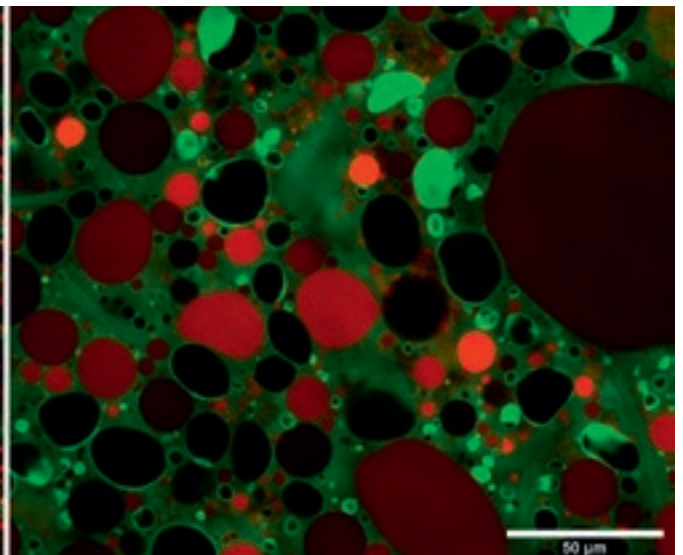
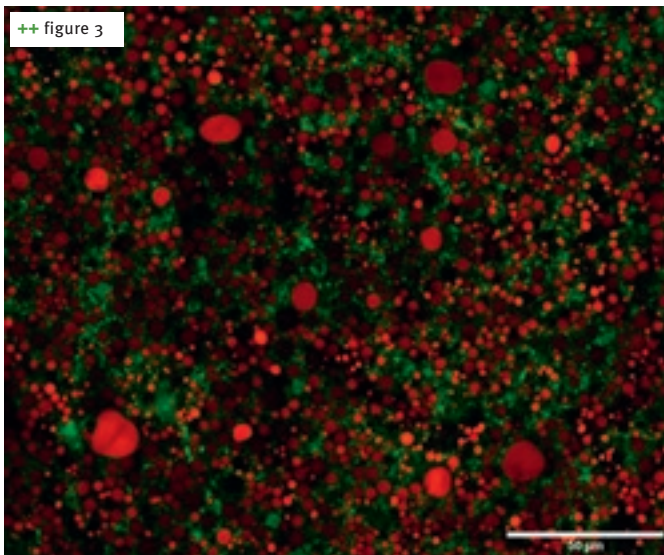
**++ figure 1**  
With an area of approx. 320 m<sup>2</sup>, the bakery business unit's Application Center has plenty of room for baking trials



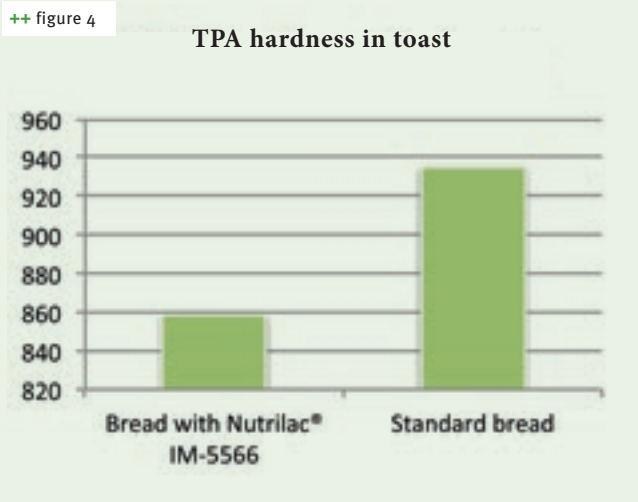
**++ figure 2**  
The four improvers in a gelling test

**+** Milk proteins are composed of about 80 % casein and 20 % whey proteins. The latter in turn consist of groups of various albumins and globulins. When broken down in more detail, whey proteins consist of different protein components, e.g.  $\alpha$ -lactalbumin or  $\beta$ -lactoglobulin, whose basic unit is composed of amino-acids. This results in countless alternative combinations to produce protein fractions. This is exactly the starting point of Arla Foods Ingredients Group P/S

in Viby, Denmark, a subsidiary of Arla Foods a.m.b.a. and thus a large supplier in the dairy market. The company has decades of experience with whey proteins. But while in the 1970s these milk constituents were still a byproduct that was used in animal feed, Arla Food Ingredients (AFI) recognized in 1988 that the protein fractions have various health and functional benefits, depending on their composition. The company built an Innovation Center solely for this purpose



**++ figure 3**  
Nutrilac® CH-4560 contributes a much more homogeneous batter (left picture) than the standard cake batter (right picture)

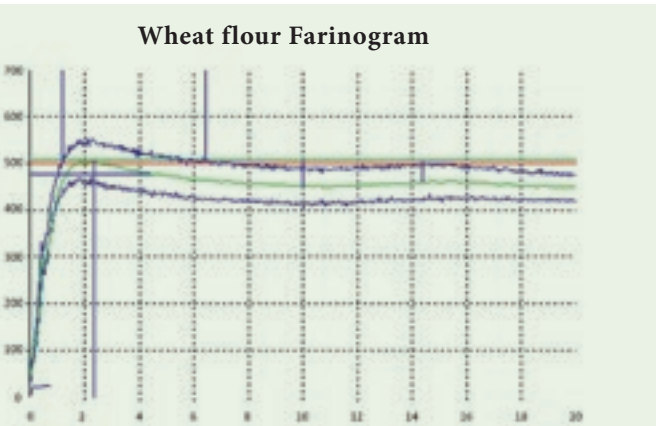
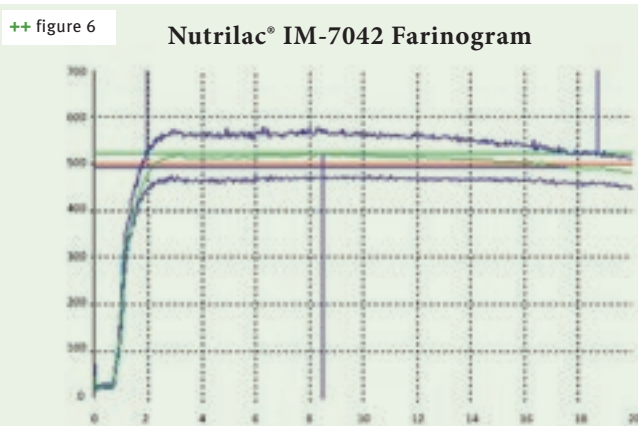


in which approx. 40 staff are now employed in sifting out these special properties by separating, modifying and drying the whey proteins. This is done by dissolving the proteins in water, then heating them; thus they remain a natural ingredient which consumers view positively – and which is regarded as one of Arla’s main strengths: naturalness. The Innovation Center has already discovered 80 different interesting types of milk protein fractions.

Not everyone knows that this major Danish business with its 593 employees has for ten years also had a Bakery business division that deals with the baked goods industry. In contrast to the rest of the company, it employs mainly people who come as bakers or bakery technicians from the baking industry, not from the whey business. Since 2009 it has been possible for all the protein fractions “developed” in AFI’s Innovation Center to be tested here in baking trials in the company’s own Application Center to discover their effect in products. Of the bakery department’s total of 16 staff, 4–5 are employed in this work every day. Milk proteins were used here in the past as an egg substitute, mainly in cake applications such as muffins or biscuits, and as a glaze. However, when baking through the bakery’s product range, the Application Center’s staff discovered that the various protein fractions have other meaningful properties extending beyond their function as an egg substitute.

The conceptual work for a new product range began in October 2012. More than 500 experiments have been carried out since then. These yielded the four natural improvers in the Nutrilac line, which have been on the market in the EU and in China since 6<sup>th</sup> May 2013. All four have multifunctional uses and thus have different benefits depending on the end product. Carsten Valentin, Senior Director Functional Milk Proteins at AFI, explains that for example baking tests with a protein fraction now marketed as Nutrilac CH-4560 showed that it produces a sand cake that has a firmer shape and is more stable than a cake manufactured without this ingredient. This is an advantage if a manufacturer has problems with sand cake breakages. Moreover, baked goods with CH-4560 often had a larger volume. According to Valentin, the effect of the higher volume in the case of biscuits also yields a more uniform pore structure. He says the ingredient also imitates a pleasant fat taste in the mouth. This is clear in figure 3 by the smaller particles formed during the 5-minute mixing. One of the examples of the application cited by the company is that “The higher level of emulsification is perceived by senses as a more creamy taste. This makes the improver useful in a vanilla-butter filling, for example.”

On the other hand AFI says that the predominant benefits with the ingredient Nutrilac IM-5566 are a fine crumb structure, high volume and a crisper texture compared to the respective standard product. The latter means for cookies ►



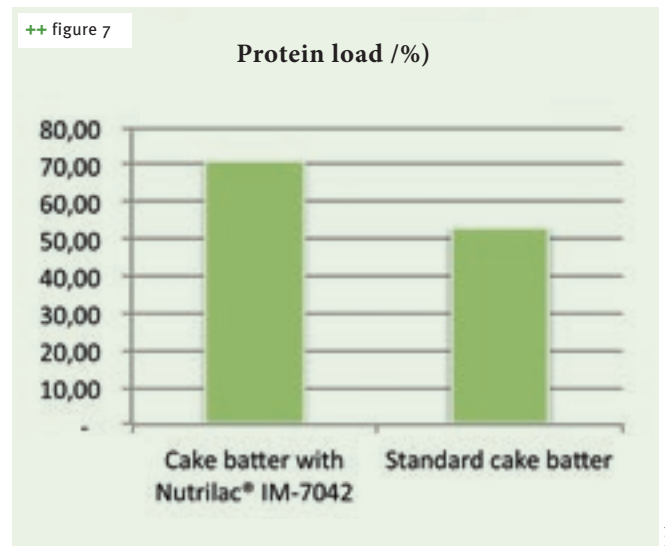
### Facts about Arla Food Ingredients

AFI based in Viby, Denmark, has 593 employees and made sales of EUR 450m in 2012. At the same time this subsidiary of the major company Arla Foods a.m.b.a. (18,112 employees; turnover in 2012: EUR 8.46bn) is satisfied with all the four business divisions “Functional Milk Protein”, “Nutrition”, “Permeate & Lactose” and “Bakery”, which altogether have had an annual growth of 17% since 2005. Of these Bakery is the youngest segment – it was established in 2003 with two employees. It has shown good continuous growth for the past couple of years, and now accounts for 10% of the volume, and an even bigger proportion of turnover. It now employs a staff of 16. +++

and biscuits improved crunchiness and snap, while breads gain a delicious crispy crust. As the ingredient provides higher crumb strength, it improves the slicing ability of breads and cakes and therefore reduces waste. The crumb strength goes along with soft and resilient crumb structure. In toast bread, for example, softness is increased at no expense to resilience (see figure 4). Furthermore, IM-5566 has a good whipping ability (see figure 5) that creates many more, smaller air bubbles in cake batter systems and contributes increased air retention. This gives a higher volume or improved foam stability, depending on the bakery application. The individual ingredient Nutrilac IM-7042 boasts an improved kneading tolerance. AFI confirms this based on a Farinogram (see figure 6) in a toast recipe. The result is higher volume with less baking loss. In Valentin's opinion, another highlight is the good emulsifying properties. Measurements of protein load reveal the percentage of protein that remains fixed in an emulsion after centrifugation. As the graph shows (see figure 7), addition of Nutrilac® IM-7042 results in a higher protein load – a clear indication of the stronger emulsion obtained. This is due to the milk protein's high water-binding capability.

Finally another fraction was discovered under the name IM-8027 which, according to AFI, achieves improved mix

++ figure 7



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viscosities, a firmer gel structure and better emulsifying properties (see figure 8). Increased batter viscosity locks in more of the air produced by the leavening agent and facilitates air bubble expansion during baking. In cookies and biscuits, the higher viscosity can also limit the extent to which batter spreads out during baking. In cakes, the ingredient contributes to well-formed cakes and even distribution of fruit and chocolate pieces throughout the crumb (figure 9). In regard to its emulsifying properties, tests have repeatedly shown that a small dose in dough systems for deep-frying gives the final product a longer-lasting crisp appearance. Examples are German Spritzkuchen and Chinese sachima.

AFI began marketing the new range for the Bakery area in May 2013. In a first step for this purpose, the company is making a stronger approach to countries such as Germany, Austria, Switzerland, Great Britain, Italy, Spain, the Netherlands and China. The plan is for sales to go directly to baking businesses at and above a certain size, as well as to baking improver manufacturers who can then use the individual ingredient for their baking mixes. The minimum purchase amount is a pallet with approx. 360 kg. The market launch in America as well as in the Middle East and Southeast Asia will then be pushed forward in October 2013. +++

++ figure 8

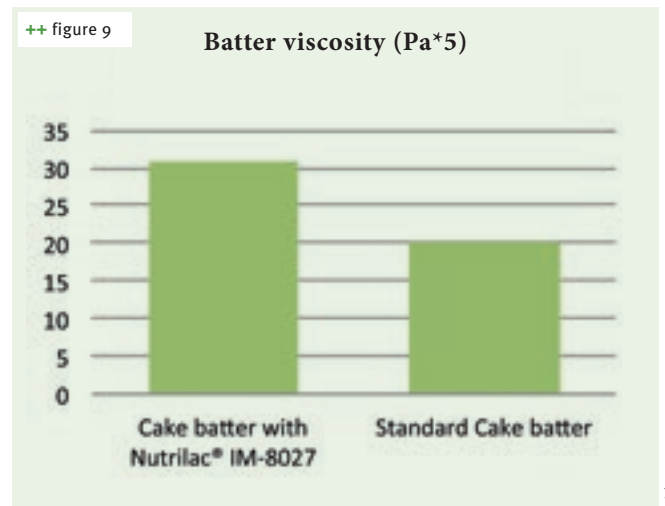
**Cake batter with Nutrilac® IM-8027**



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++ figure 9

**Batter viscosity (Pa\*5)**



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