

A pressing need for high purity sodium acid pyrophosphates

SODIUM ACID PYROPHOSPHATE (SAPP) IS ONE OF THE MOST COMMON LEAVENING ACIDS IN BAKING POWDER BECAUSE OF ITS PERFORMANCE PROFILES DUE TO VARIABLE RATE OF REACTIONS (ROR). A PURSUING RETARDATION OF THE ROR IN SLOW ACTING LEAVENING ACIDS HAS TRADITIONALLY BEEN ACHIEVED BY ADDING ALUMINIUM IONS. A NEW EU REGULATION SETS LIMITS ON THE ALUMINIUM CONTENT – AND THEREFORE WILL FORCE CHANGES IN SAPP



level in products. The volume, density and structural quality of baked goods are predominantly determined by the gas produced by the leavening acid and its reaction partner, the carbon dioxide carrier. During the production process of baked goods, chemical leavening agents are added to batters and dough; these release gas which, in general, is carbon dioxide. The carbon dioxide leavens the baked goods. Today, sodium hydrogen carbonate, also called sodium bicarbonate (NaHCO_3), is the most commonly used carbon dioxide carrier.

The rate of reaction (ROR) states how much carbon dioxide gas is released from the leavening acid into the batter thus causing initial leavening. The ROR value is determined following a standard test method that has been developed by Budenheim with standard dough. The ROR value of fast-acting organic acids such as citric acid, tartaric acid, and also cream of tartar ranges between 60 and 70. Alternatively, different types of SAPP produce ROR values ranging from 10 to 40. A SAPP with a lower ROR value (e.g. SAPP 10, SAPP 15, SAPP 20) is referred to as a slow-acting SAPP.

These substances are advantageous for the production of dough pieces that are stored for a longer period of time at cold or freezing temperatures prior to baking. In industrial processing, such properties are very important for a controlled production process.

The retardation of the ROR results in a reduction of the initial leavening process in favour of a post-leavening effect. This retardation in the ROR of SAPP has traditionally been achieved by adding metal ions, and in particular, aluminium ions. However, concerns regarding the possible aluminium impact on human health have now resulted in the legal

++ Author
Henrike Scheel
Marketing
Business Unit Food Ingredients
Chemische Fabrik Budenheim KG
Budenheim, Germany
baking@budenheim.com

+ There are a lot of reasons why the bakery industry successfully uses phosphates – especially sodium acid pyrophosphate (SAPP). SAPP based leavening acid is available in different variants and due to its excellent performance profiles and cost benefits, this group belongs to the preferred leavening acids used in Europe. Phosphates are utilized in many successful products. Available with varying rates of reactions (ROR) and different neutralisation values (NV) they contribute to optimize the production process to achieve a high quality



++ figure 1+2

Baking results SAPP 15 compared to LEVALL® AR 15

limitation of the amount of aluminium consumed. So, in general, efforts have been made to reduce the amount of aluminium in food.

Changing EU regulations for healthier baking

Focusing on consumer health and safety, international and national legislation has widened over the last few years to cover more contaminant classes and food categories. In 2006, the Provisional Tolerable Weekly Intake (PTWI) of aluminium was reduced from 7 mg/kg to 1 mg/kg bodyweight by the Joint Food and Agriculture Organization/WHO Expert Committee on Food Additives (JECFA). Two years later, the European Food Safety Authority (EFSA) followed this and also lowered the PTWI.

The new EU regulation 231/2012 has reviewed the purity specifications and has set certain limits for aluminium and other contaminants in specific phosphates. This regulation was officially published in March 2012 and will become effective December 2012. Following the new regulation, purity criteria for SAPP (E 450i) in food will change as follows:

- + Aluminium: max. 200 ppm
- + Arsenic: reduced from 3 ppm to 1 ppm
- + Lead: reduced from 4 ppm to 1 ppm

Transitional measures provide that “food-stuffs containing food additives that have been lawfully placed on the market before

1st December 2012, but do not comply with this regulation, may continue to be marketed until stocks are exhausted.”

For the baking industry, it is high time to look immediately after healthy SAPP alternatives. Solutions for easy 1:1 replacement of standard SAPP in existing, successful recipes are needed. Bakers need a new, pure SAPP generation to be in compliance with the new regulation.

As one of the biggest producers and suppliers of different specialty products for the baking industry, the target of the Chemische Fabrik Budenheim KG, Germany, is to provide the European baking industry with phosphate leavening acids – especially SAPP – with outstanding purity. By observing and following changing regional regulations, Budenheim worked on the stabilization of ROR while reducing contaminants with the target of developing a product range that can easily replace widely used retarded acting SAPP that have too high aluminium levels. The company developed a completely modified disodium dihydrogen diphosphate (SAPP) range that includes specified retarded rates of reaction (ROR 10 and ROR 15, ROR 20) and very low amounts of contaminants. These products comply with the latest EU legislation.

The new product line of modified SAPP displays dough reaction rates (ROR) of 13% CO₂, 14–17% CO₂ and 18–22% CO₂

after 8 minutes in the standard test – depending on the desired product type. One main advantage of the new LEVALL® AR (SAPP) is the significantly reduced level of aluminium compared to a state-of-the-art slow-acting SAPP. LEVALL® AR is a completely new product development with a stabilised and controlled low ROR value even undercutting the new EU purity criteria.

Results of successful application

During last year's trials, LEVALL® AR was successfully tested in different applications such as whipped batters, muffins and Madeira cakes. The production of a pound cake with LEVALL® AR 15 compared to SAPP 15 serves as an example. The dough was produced in the bakery lab using the all-in process (see table 1).

Different baking trials were performed to compare the standard SAPP 15 with the new product LEVALL® AR 15. The results show no differences in terms of volume, mass density, pH and baking loss compared to SAPP 15. The color and the structure of the crumb look the same. The crumb structure is coarse and the cells are distributed irregularly as is common in a pound cake and which is necessary for achieving good leavening of the baked good and good chewing properties. Furthermore the LEVALL® AR range has been successfully tested during the last few months at selected leading baking companies in the production of sponge cakes, muffins, whipped batters, scones and baking powders. Optimized baking results in production sites have been achieved in selecting

Benefits to manufacturers in the baking industry

- + Easy 1:1 replacement of existing SAPP types available on the market that are not in line with the new EU regulation
- + Development of healthy consumer products
- + Specified minimal levels of contaminants such as aluminium (€ 200 ppm), lead and arsenic (€ 1 ppm) and therefore in compliance with the new EU-regulation which will be valid from 1st December 2012
- + Complete product range from slow to fast acting leavening acids means controlled volume and pore structure (ROR 10 – ROR 40) which is essential in industrial bakery production
- + Consistent baking results can be achieved without principally changing production parameters
- + No reformulation costs
- + Batch per batch analysis of contaminants is cost saving as it means less analysis for manufacturers

Benefits to consumers

- + Lower intake of contaminants (aluminium, lead, arsenic) per day
- + Choice of healthier baked products
- + Tasty and attractive baked goods
- + Consistent shelf quality

the right LEVALL® AR product with optimized ROR value. Currently, the new product line is being tested by manufacturers in industrial tests. +++

Table 1 : Production of a pound cake

Ingredients	Formulation 1 (all-in)	
	[g]	parts
Sugar, fine	270	28
All purpose wheat flour (German Type 550)	200	21
Whole egg	150	16
Shortening	120	12
Wheat starch	100	10
Water	100	10
Whipping agent (Spongolit 283) ⁽¹⁾	15	2
Baking powder ⁽²⁾	10	1
NaCl	2	0.2

(1) Emulsifier supplied by Cognis, Illertissen

(2) Different baking powder mixes with the same CO₂ source

(Composition: leavening acid, NaHCO₃, starch)