It is widely known that salt intake in many countries is still too high and is linked to hypertension, coronary heart disease, and strokes. Conclusive evidence on the effects of dietary sodium on blood pressure comes from a broad range of different studies performed on animals and humans. Therefore, in many countries, specific measures have been implemented to reduce salt intake. These measures are part of an established national nutritional policy and/or cardiovascular diseases prevention policies. The WHO (World Health Organisation) and FAO (Food and Agriculture Organization) are promoting the positive effects of sodium reduced diets on peoples’ lives and have published recommendations for salt intake postulating less than 6 g salt per day.

According to current data, salt consumption levels in most countries’ populations are significantly higher than these recommendations. The current average intake from adults is 12 g/day.

Processed foods account for 75% of the average salt intake; these are sources of salt hidden in food. In the UK – major sodium contributors are bread and baked goods which account for around 38%. (Source: SACN. Salt & Health, 2003)

Market trend: Sodium reduction in the baking industry

The market for sodium-reduced bakery products is on the rise. An analysis of end products in the baking industry has shown that the number of low/reduced sodium claims on packages has nearly doubled during the last four years (see figure 1). (Source: Mintel: Global New Product Database GNPD)

This means that we are seeing a trend whereby manufacturers are contributing in a meaningful way to the reduction of sodium content in their products and providing consumers with new product introductions as well as line extensions. Many of the new product launches – especially cakes, cookies and crackers – bear nutrition or health claims related to sodium.

Health claims used in the labelling, presentation and advertising of foods placed on the market, must be truthful for consumers. In Europe, claims on sodium reduction in food...
must stay in line with the EU-Regulation no. 1924/2006. Special leavening acids can help to reduce sodium in baked goods.

**Importance of proper leavening**
The leavening system is the most important part of a baking powder. It releases carbon dioxide during dough-making and baking.

**Baking powder consists of several components:**

A. **Carbon dioxide carrier**
The source of the carbon dioxide is sodium, potassium or ammonium hydrogen carbonate which develops CO$_2$ in the presence of moisture and/or heat. Sodium bicarbonate is the preferred carbon dioxide releasing substance for the chemical leavening process in baked goods.

B. **One or more leavening acids**
Leavening acids regulate the release of the carbon dioxide. These can be acids or acidic salts.

C. **Separating agents**
Separating agents prevent premature carbon dioxide development. These can be starch, flours, or calcium carbonate.

Two parameters are essential for the right selection, evaluation, and practical application of leavening agents in baked goods:

1. **Neutralizing Value (NV)**
The neutralizing value is the chemical reaction between a carbon dioxide carrier and an acid. The neutralizing value of a leavening acid is calculated by dividing the amount of the carbon dioxide carriers by the amount of the leavening acid needed for the neutralization. The resulting quotient is multiplied by 100. *(Source: Kichline and Conn, 1970; Parks, 1976; Brose, 1989)*

   \[
   NV = \frac{\text{Carbon dioxide carriers}}{\text{Leavening acids}} \times 100
   \]

2. **Rate of Reaction (ROR)**
The speed of reaction between the leavening acid and the carbon dioxide carrier provides the ROR. The rate of reaction is the amount of carbon dioxide (in percent) released from a defined amount of sodium hydrogen carbonate or potassium hydrogen carbonate under controlled conditions within 8 min through reaction with the relevant leavening acid. *(Source: Brose, 2001)*

**Baking powder: The main source of sodium**
Muffins, cakes and donuts typically have a sodium content of 350 mg/100 g, for cakes it rests with 300 mg/100 g.
Up to 66% of this sodium content is contributed by a typical baking powder using a sodium acid pyrophosphate (SAPP) as a leavening acid and sodium bicarbonate as a carbon dioxide carrier (see figure 2).

It is evident that sodium has to be reduced in the baking powder. A reduction of more than 35% in the baked good is possible by just replacing the leavening acid in the baking powder. Following the EU regulation, a “reduced sodium” consumer claim is then allowed for the end product. Other ingredients such as the carbon dioxide carrier and the added salts may remain unchanged.

The leavening acids widely used in the baking powder of muffins, cakes and donuts are sodium acid pyrophosphates that contain 20.4 g sodium per 100 g.

Budenheim has developed calcium phosphate specialties that help to reduce the sodium content in the leavening acid. This new product line – LEVALL® SR – is sodium-free. It does not contribute any sodium to the final product. Easy replacement of SAPP with LEVALL® SR is possible. The sodium content of the baking powder can be reduced by up to 50% compared to the existing products. Depending on the recipe this reduction might actually be higher (see figure 3). Thanks to the important calcium contribution the development of even healthier products is possible. The calcium phosphate based leavening acid can be combined with other leavening acids. Following bakers’ needs in terms of specific ROR (rate of reaction) and NV (neutralization values), different products are available.

The new product range – available with slow or fast acting products – can be used in various applications such as sponge cakes, cake batters, cake rolls, biscuits, layer cakes, muffins, waffle batters, cake doughnuts, tea biscuits, choux, and pancake batters.

Its calcium ions improve the stability of dough and batters. Sensory tests showed that baked goods with LEVALL® SR have similar baking results in regard to crumb and crust as well as colour and texture (tactile). The mouthfeel is the same and the final goods do not have any unpleasant after taste.

Currently, this new product line has started to be used successfully in practical industrial applications.