

# MICRONUTRIENT PREMIXES

Extremely fine distribution as the highest quality criterion for micronutrient premixes with vitamins B1 and B2



**B**y enriching flour, mills in many countries make an important contribution to nutrition and public health. Flour is enriched with iron, folic acid, and especially with thiamine (vitamin B1) and riboflavin (vitamin B2). The homogeneous, very fine distribution of the individual components is important for the quality of mixtures with these vitamins. Otherwise, agglomerated riboflavin can cause yellow streaks or yellow-orange spots in the final product. (see photo 1)

The US, Great Britain and Canada led the way in enriching flour with B vitamins. In the war and the crises of the 40s, these countries recognised the importance of food supplements and passed laws requiring that flour be enriched with vitamins like thiamine and riboflavin. Today, in over 85 countries industrially made flour is fortified with vitamins B1 and B2 and micronutrients to protect consumers from nutritional deficiencies, voluntarily or by law.

**Vitamin B1 and B2: wide-ranging importance for health**

Thiamine is a water-soluble vitamin that occurs in many plants and animals, and performs important functions in the human metabolism and nervous system. Deficiency can present symptoms such as fatigue, memory loss, digestive and heart rhythm problems. A formerly widespread thiamine deficiency disease is beri-beri, which today is rare.

Riboflavin is a yellow vegetable colourant that plays an important role in the body in extracting energy from fats, carbohydrates and proteins, and in protecting cells against free radicals. Deficiency symptoms include skin problems, visual and growth impairment, fatigue and weakness.

### Compensation for nutrients lost in milling (see graphic)

Wheat has a naturally high content of B vitamins and would

therefore in principle be a good source of vitamins B1 and B2. But these micronutrients are contained mostly in the outer layers and the germ of the grain, so that they are lost to a great degree when grain is milled to get a lighter colour, since this removes the outer layers. Subsequent enrichment of the flour with the respective micronutrients can restore or even exceed their original content in the wheat.

As a rule, the amount of thiamine added is 5 – 7 ppm (mg/kg flour). Thiamine mononitrate is most commonly used. This is a white powder that has relatively high stability for a vitamin, and can be processed without problems.

Riboflavin, an intense yellow colourant, is a bit more difficult to work with. In order to be able to provide comprehensive advice on the use of vitamin B2, Mühlenchemie has done baking trials and colorimetric tests with riboflavin-enriched flour at its Technology Centre. The results show that the colouring effect only comes into play at relatively high concentrations. For example, at 6 ppm the crumb of sandwich buns showed quite visible yellow discolouration. However, at industry-standard concentrations of 2-4 ppm no significant discolouration was detected. (see photo 2)

### Yellow streaks and spots from clumped riboflavin (see photo 3)

So the problem for the mills is not so much the quantity as it is the quality of the riboflavin in the premix. The physical nature of the vitamin is what makes the difference. Riboflavin is an extremely fine powder that tends to agglomerate, so during compounding it needs to be distributed as thoroughly as possible. Coarse particles can have negative consequences in the final products.

For example, light colour is an important quality criterion for Asian noodles, which are made from bleached flour. If the premix contains insufficiently homogenised riboflavin there is a risk that the colour particles can break down under the high mechanical pressure that occurs during rolling and stretching of the dough,

leading to yellow-orange streaks.

Undesirable effects can also happen with buns. Individual yellow spots in the crumb are a sure sign of clumped or coarse riboflavin.

### Very fine distribution as a key quality factor

To prevent product defects of that nature, mills should use high-quality premixes and make sure the riboflavin is as finely distributed as possible. For the first quality check, there is a simple rule of thumb: well-mixed premixes look yellower than mixes with coarser particles, for the same riboflavin content.

There is also an easy test that gives a good initial idea of the homogeneity of the premix without expensive equipment. Simply sprinkle some powder on a light surface and spread it out with the back of a spoon. If yellow-orange streaks appear under pressure, it is a clear indication of agglomeration and insufficient mixing of the vitamin B2 particles.

### Potency reduction resulting from light and moisture

In addition to choosing a suitable premix, mills should pay attention to correct handling of sensitive vitamins. The stability of thiamine depends primarily on the moisture content during storage. Tests have shown that flour with 12 percent moisture content retains 88 percent of its thiamine after 5 months in storage. If the moisture content is just six percent, there is no loss of potency. Thus, in humid tropical regions it is important to create dry storage conditions to protect vitamin functionality. The packaging material should also reliably protect the micronutrients from moisture. Liquid- and vapour-proof aluminium composite

Vitamin B1

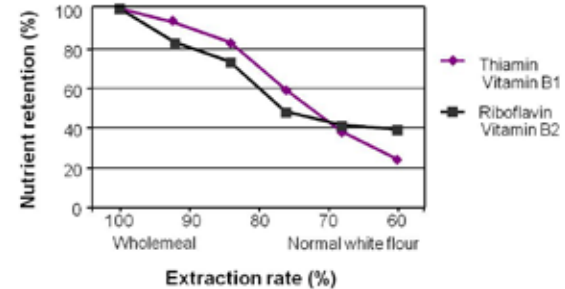


Vitamin B2

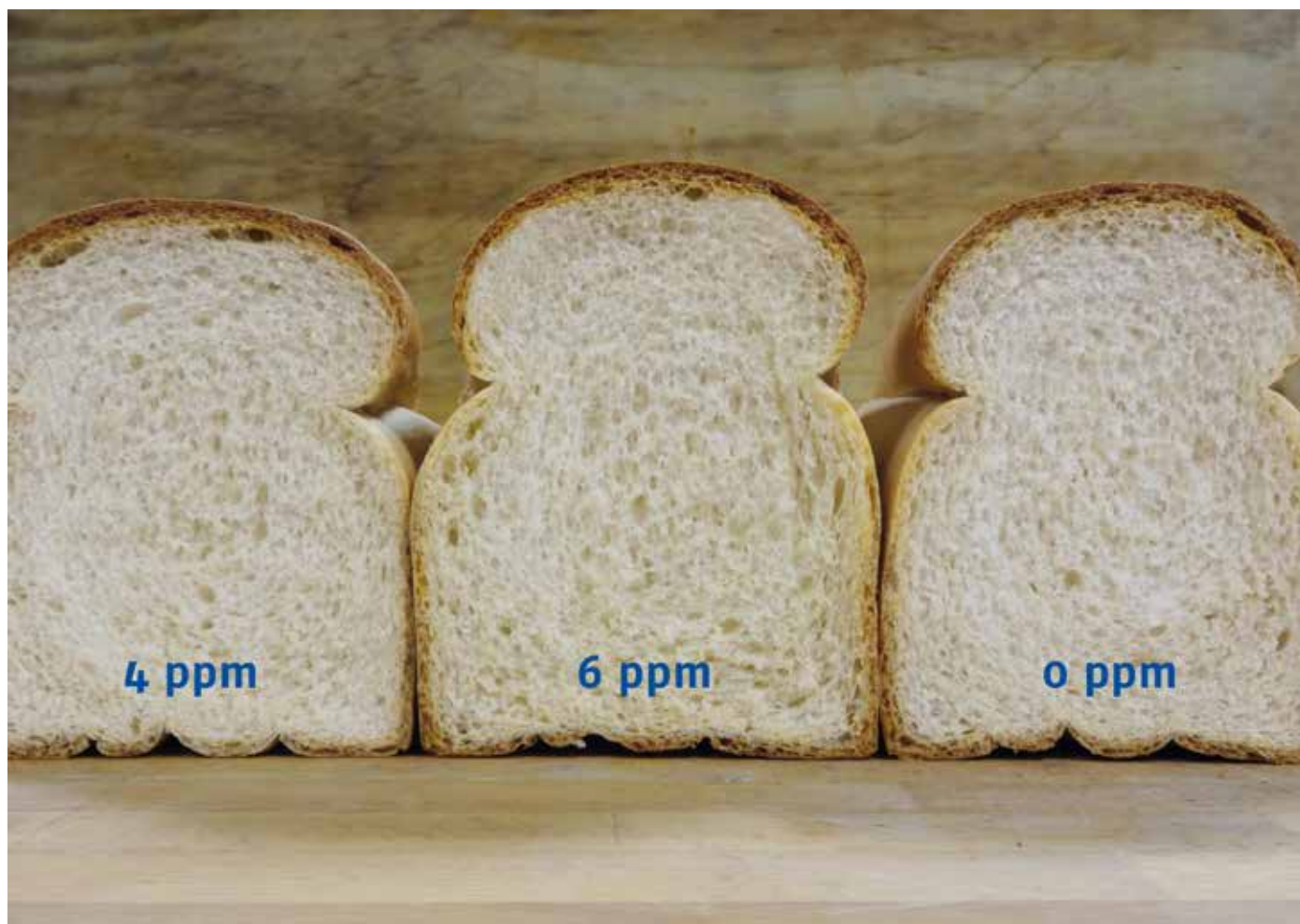


Raw Materials

### Micronutrient Losses During Wheat Milling



Micronutrient losses during wheat milling  
Wheat is a great source of vitamins B1 and B2. Losses during milling can be compensated through flour enrichment.



**Above - Photo 2: Impact of vitamin B2 on the colour of bread:** Adding 6 ppm riboflavin can cause yellowing of the crumb. But the standard in flour enrichment is 2 to 4 ppm, which does not cause discolouration.

foil is ideal for premixes that contain thiamine. This is also the packaging material of choice for vitamin B2, since riboflavin is extremely sensitive to light and aluminium inner liners offer full protection from it.

### Proper handling

It is also important to reseal premix sacks immediately after use and not leave them standing open next to the feeder, as can happen at small mills using only small amounts of micronutrients at a time. Light getting into the open box has a devastating effect on the stability of the vitamins and greatly reduces their nutritional value. It should be noted that this vitamin loss is not visible, since riboflavin retains its yellow colour even when chemical deterioration is well under way.

### Flour enrichment gaining ground worldwide

In the years ahead flour enrichment will become more widespread. To promote public health and improve economic performance, more and more governments are acting to ensure that the populace gets enough micronutrients. This makes flour mills very important in the health policies of these countries. Some mills may initially regard these regulations with scepticism, but as long as suitable premixes are sourced and are handled properly, vitamin and mineral enrichment can be integrated into routine operations without difficulty. ☺



**Photo 3: Prevention of yellow spots and streaks in dough**  
Simple quality check: Spreading out a premix containing riboflavin gives an indication of its homogeneity. If the agglomerates are too large, the particles come apart under pressure to form yellow-orange streaks. (left)