

THE FORTIFICATION OF STAPLE FOODS WITH VITAMIN A



Fortification of flour with vitamin A is a commonly used method to ensure a sufficient supply of this vitamin. It effectively helps to prevent vitamin A deficiencies. BASF is a leading vitamin A producer and offers special formulations for flour fortification.

Vitamin A for flour fortification is in powder form. It is very important to use a vitamin A powder formulation which has been specially developed for this purpose and possesses the following characteristics:

- High stability during storage and in the final flour product
- High purity and effectiveness
- Easy applicability during the fortification process (excellent flowability, low dusting)

Stability is strongly influenced by the particle size of the vitamin A powder. Larger particle size means greater stability, because the total particle surface area is lower in relation to total weight. Optimization of particle size distribution is thus an important quality parameter. Protection of vitamin A molecules by antioxidants like BHT is also an important determinant of stability.

Dry Vitamin A-Palmitate 250

BASF has developed a vitamin A product specially formulated for flour fortification – Dry Vitamin A-Palmitate 250.

It contains 250,000 IU vitamin A-palmitate per gram in a protective matrix of gum arabic and sucrose, coated with starch. It also contains BHT as an anti-oxidant, and tricalcium phosphate to improve powder flowability.

Dry Vitamin A-Palmitate 250 has been optimized for homogeneity and stability in corn flour and wheat flour.

The product fulfills the strict stability and particle size requirements published by the US Department of Agriculture (USDA) in Announcement CMSF4, Purchase of Cornmeal / Soy fortified Cornmeal for use in Export Programs, February 1, 1994. This requires at least 98% of particles to pass through a US Standard No. 50 sieve, at least 90% through a US Standard No. 60 sieve and at least 45% through a US Standard No. 100 sieve.

The stability of Dry Vitamin A-Palmitate 250 has been documented using the test specified in Announcement CMSF4.

Stability

Announcement CMSF4 specifies the following requirements for the flour tested:

- At least 99% must pass through a US Standard No. 20 sieve, at least 90% through a US Standard No. 25 sieve and a maximum of 10% through a US Standard No. 80 sieve
- The water content of the flour must be between 13.5 and 14.5%
- The level of vitamin A-palmitate in the tested flour must be 10,000-12,000 IU per pound (22,000-26,500 IU per kilogram)

The flour / vitamin A mixture must be stored in round glass bottles with screw tops, sealed with paraffin wax to avoid moisture loss. After storage at 45°C for 21 days, the contents of three bottles are assayed and compared with three bottles assayed before storage.

To pass the stability test, the vitamin A-palmitate must retain 80% of its original activity at the end of the storage period. The results of this test for the BASF vitamin A powder and another commercially available product are shown in Table 1. As can be seen, the BASF product easily passed the test.

Flour Fortification

BASF Nutrition – the healthy decision.

**BASF**
The Chemical Company

Table 1: Bulk stability of vitamin A-palmitate (45°C, sealed glass bottles)

	Retention	
	T = 0 days	T = 21 days
Dry Vitamin A-Palmitate 250 MS CWD (Fine Beadlet)	100%	90%
Spray-dried product	100%	81%

Table 2: Stability of vitamin A-palmitate in flour under tropical conditions (30°C, 75% relative humidity)

BASF batch		Competitive batch 1		Competitive batch 2	
4 weeks	10 weeks	4 weeks	10 weeks	4 weeks	10 weeks
86%*	88%*	73%	68%	64%*	64%

* Mean value of six batches (7/97)

Figure 1: Particle size analysis of vitamin A-palmitate and corn flour

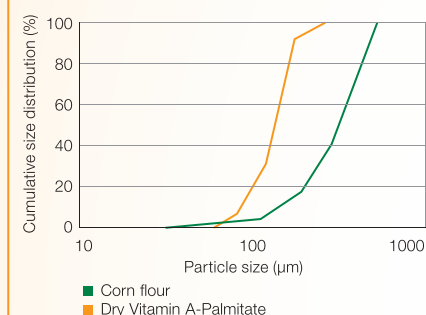
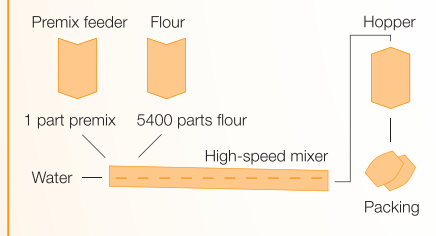


Figure 2: Flour fortification process



Tropical conditions

The stability of Dry Vitamin A-Palmitate 250 has also been documented under tropical conditions at the 22,000-26,500 IU / kg fortification level specified in the USDA Announcement. The test was carried out on commercially available flour without standardization of water content.

The flour was stored in cotton sacks at 30°C and 75% relative humidity. Activity was measured at the outset and after four and ten weeks. The results of this test are shown in Table 2.

The results show that the stability of BASF 's vitamin A was superior to that of the competitor products. The major drop in activity occurs in the first four weeks, leveling out thereafter. This test shows that use of BASF's vitamin A product makes it possible to achieve a shelf-life of two months with only 25% overage. To obtain the same result with the competitor products, an overage of 45-60% is required.

Technology

As can be seen from Figure 1, flour and vitamin A powder have a fairly similar particle size distribution, thus making segregation into different particle sizes unlikely.

Homogeneous distribution of vitamin A in the final product depends on steady flows of premix – a concentrated blend of microencapsulated vitamin A and flour – and the main volume of flour.

The vitamin A is usually added together with a vitamin / mineral premix. Depending on the components of this second mixture, a feeder should be selected that eliminates bridge formation and segregation of components in the feeder.

Figure 2 shows the mixing process in diagrammatic form. Typically, a continuous high-speed mixer is used to blend the flour and premix. Water is used in the production process to adjust the bulk density. With the right mixing tools, this will produce a homogeneous mixture. When a vitamin / mineral premix is used, there is a risk of segregation in the subsequent process stages, handling and distribution.

The exact measures that need to be taken to avoid segregation depend mainly on the particular features of the factory.

Other nutrients

Since flour is being consumed by the mass population it is prudent to consider iron, folic acid, thiamin (vitamin B1) and riboflavin (vitamin B2) in addition to adding vitamin A as part of the overall fortification program. It is a cost effective way to deliver nutrients to this population. The quality of these fortified ingredients must meet USP / FCC / BP / JP monograph requirements.

Internet: www.food-fortification.com
 E-mail: food-fortification@basf.com

Disclaimer

This document, or any answers or information provided herein by BASF, does not constitute a legally binding obligation of BASF. While the descriptions, designs, data and information contained herein are presented in good faith and believed to be accurate, it is provided for your guidance only. Because many factors may affect processing or application / use, we recommend that you make tests to determine the suitability of a product for your particular purpose prior to use. It does not relieve our customers from the obligation to perform a full inspection of the products upon delivery or any other obligation. The claims and supporting data provided in this publication have not been evaluated for compliance with any jurisdiction's regulatory requirements and the results reported may not be generally true under other conditions or in other matrices. Users must evaluate what claims and information are appropriate and comply with a jurisdiction's regulatory requirements. NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE.

