Premixes: overview

A *premix* or *master mix* is a blend of micronutrients used to fortify flours. Seldom is only one nutrient added. The normal practice is to fortify flour with multiple micronutrients. It is more convenient to add them all at once as a single premix, the one exception to this is calcium, which is normally added separately due to its large bulk requirement

Advantages of vitamin/mineral premixes

1. *Nutrient Ratio:* If the premix has been properly designed, manufactured and mixed, the ratio between the different nutrients is constant. Because of this constant ratio, testing of only one of the nutrients in flour can verify that the delivery dose was correct for all. This assumes no destruction of vitamin activity or separation of the micronutrients after the premix was added. This single nutrient then acts as an *indicator* for all the other nutrients. Iron is often used as an indicator nutrient.
2. *Standardized Addition Rates:* The dilution of the premix can be adjusted through the use of a *carrier* to give a standardized addition rate that meets the needs of the production facility to produce a uniform level of fortification. Some mills are large enough to allow use of concentrated premixes while others are small and require a more dilute premix when the feeder cannot accurately handle the necessary low feed rate. Also, there is better dosage accuracy and mixing homogeneity with dilute premixes than with straight nutrients if the feeder is able to operate in the middle of its delivery range rather than at the lower end.
3. *Excipients:* The premix can have *excipients* and *free-flow agents* added to improve its flow or adhesion properties. Continuous flow flour mills require a free-flowing premix that does not clump or bridge in the feeder.
4. *Single Weighing:* A single premix requires only one weighing for batch systems or feed rate adjustment in continuous systems. This reduces labor requirements and greatly lessens the chance for error.
5. *Technical Support:* Often, but not always, the premix supplier will supply and service the feeder for adding the premix.

Design and composition of premixes

There are a number of considerations that are made in the design or formulation of a fortification premix. See Guidelines on Premixes for a more detailed discussion of these.

1. *Fortification Standard:* A premix is designed to meet a **fortification standard** or add a set level of micronutrients. The former is the most common but adding set levels is becoming more commonplace.
2. *Natural Levels:* If designed to meet a fortification standard, the **natural levels** of the nutrients in the fortified product must be considered. The level added is to make up for the difference between the natural level and the standard.
3. *Overages:* An **overage** necessary to account for variation in that natural level, to make up for any processing or storage losses and to insure that the final level will be minimally achieved, must be included. An overage of 10% is often used when fortifying dry cereals. As an example, to fortify wheat flour, containing 12 ppm iron to the U.S. standard of 44 ppm, 35 ppm iron is typically added, which is the target less the natural level plus 10%.

4. *Nutrient Concentration:* The amount of each nutrient source must be adjusted on the basis of the **concentration** of the nutrient source used.
5. *Manufacturing Overage:* A small **manufacturing overage** (usually about 2%) is included to insure the premix meets label claims by assay.
6. *Addition Rate:* The desired **addition rate** of the premix then determines the final formulation. Ideally, the addition rate is set to be in whole units, such as 150 grams/ton.
7. *Free-flow Agents:* **Free-flow agents**, such as tricalcium phosphate or precipitated silica (silicon dioxide) may be added to keep the premix from clumping.
8. *Carrie/Excipient:* The **remainder** may be starch (wheat or corn), maltodextrin or an inexpensive mineral, such as calcium carbonate or calcium sulfate. Starch or maltodextrin is preferred as a carrier since it lowers the bulk density of the premix making it somewhat easier to handle and feed. Wheat or corn flour is not recommended for use as a carrier because of possible infestation and stability problems. Concentrated premixes with little or no carriers are desired when they are transported long distances or are subject to high shipping costs. However, small mills may have difficulty in accurately feeding these highly concentrated premixes.

Premix production and quality control

Micronutrient premixes are typically made by precision weighing of the ingredients and batch mixing in a ribbon or twin shell blender to produce a homogeneous mixture. Commercial premixes are customarily analyzed for all contained nutrients. This generates a certificate of analysis (COA) on each batch of product. This analysis, usually done by the premix supplier, is the most difficult and expensive aspect of commercial premix production. The COA is the guarantee from the manufacturer to the user that a particular batch of premix contains all of the desired nutrients in the correct amounts. In some countries (e.g. South Africa) premix suppliers must be certified by the government and required to submit product for periodic testing by a certified referee laboratory. Appendix E lists some of the larger, commercial premix suppliers.

Large mills or a group of mills in a particular area or country may choose to make the premix themselves rather than use a commercial product. This could be a cost-effective approach if only one or two micronutrients are involved. Since shipping distances would be reduced, it would allow production of a more dilute product better suited to small, local mills. For more complex premixes it may be preferable to rely on commercial producers because of their better access to raw material and analytical capabilities.

Packaging, storage and handling of premixes

Vitamin/mineral premixes should be packaged in air and watertight containers well protected from exposure to light. Typical packaging is a polyethylene bag inside a heavy, cardboard box. The package should be such that the bag can be easily resealed and the box closed after a portion of the product has been removed.

Premixes should be kept in their original containers in a cool dry place prior to use. Once opened exposure to the light and air should be minimized to prevent product degradation.

Handling of premixes at the mill

When handling the premixes the following precautions should be taken:

1. The operator should use a dust mask to prevent inadvertent inhalation of the active ingredients.
2. The operator should wash hands and skin areas exposed to the material during filling of the feeder hoppers.
3. The fortificant premix should be well identified to prevent accidental replacement with any other flour additive or premix (this can be achieved by using a color coded system which identifies the different additive feeders and additive boxes).
4. There may be some allergic skin reactions to flour fortificants such niacin. It is therefore recommended that the operator use gloves and long sleeve shirts when handling the product. A common occurrence is skin reddening caused by the vasodilatation effect of niacin. This effect is transitory and not dangerous but it can be annoying.

Upon receipt of the shipment, the production lot number(s) should be recorded and retained. It is recommended that a first-in, first-out (FIFO) system of stock rotation be employed since the vitamins in the fortificant premix have a limited shelf life in terms of their biological effectiveness and stability. This is particularly the case with vitamin A. Unopened packages of premixes containing vitamin A have an effective shelf life of six months in warm climates. The shelf life of premixes containing minerals and only B vitamin is up to three years if unopened. Once a premix box has been opened it should be used within a few weeks.

Mill preblends

Some mills may want to dilute concentrated premixes prior to use by mixing with flour and other flour improvers. This is usually done in a small mixer at the mill, making just enough preblend for a day's run. It is not advisable to make more than that since the flour-nutrient blend will not keep well. Flour improvers can be included in the blend, including enzymes, azodicarbonamide and ascorbic acid. Additives that should **never** be included in this blend for safety reasons are concentrated forms of potassium bromate and benzoyl peroxide (flour bleach).