Manufacturing of a Quality Premix

A premix is a mixture of vitamins, trace minerals, medicaments, feed supplements and diluents. It is a value added solution for feeds with sustainable safety and quality. The premix industry is charged with the responsibility of manufacturing a high quality premix consistently, efficiently and economically.

Its main objective is to deliver the micro ingredients in a manner desired by the consumer. Premixing has progressed from the simple hand mixing of several ingredients to mechanical mixing, to continuous mixing, and now to computer controlled mixing. However, the basic concept of mixing ingredients together to result in a homogeneous blend has remained unchanged.

Quality assurance is a proactive, continuous system for monitoring reproducibility and reliability of a product. It encompasses all the activities undertaken to ensure predetermined standards of a quality premix. Good manufacturing practices covers all the areas of the production process like personnel, facilities, raw materials, quality assurance checks, inventory control, processing, mixing, packaging and delivery.

Premix manufacturing process comprises:

A. Raw Materials
   1. Selection & Specifications
   2. Purchase
   3. Receipt & Storage
   4. Sampling & Analysis
   5. Processing

B. Formulation

C. Weighing

D. Mixing

E. Packaging

F. Labeling

G. Storage of Finished Premix

A: RAW MATERIALS
1: Selection & Specifications
Vitamins and trace minerals are available in different forms and their bioavailability varies between sources. Amongst vitamins the stability forms an important criterion whilst bioavailability, potency and reactivity with trace minerals aid in their selection process. The form of ingredient selected must also be easily available, of economic interest and also impart acceptable physical attributes to the premix. The specifications for all raw materials should be based on recommendations applicable for particular animal's feed as mentioned by AAFCO, AOAC, AFMA, I.P, U.S.P., etc.

2. Purchase of Raw Materials

Raw materials must be procured from approved vendors and should conform to the specifications laid down by the nutritionist. No material should be received without a certificate of analysis. Purchases should be done periodically taking care that sufficient inventory is maintained at all times.

3. Receipt & Storage of Raw Materials

The receiver should have enough information from the quality assurance program to be able to recognize the quality of product. The complete details of the raw material along with its reference number must be entered into the stock records.

4. Sampling & Analysis

Sampling of raw materials is performed following a quality assurance programme. To obtain a representative sample, sampling should be done from bottom, center and top layer of the bag using a sample probe. When large consignments of raw materials are received, it is advisable to mix the raw material in mixer and then analyze each mixed batch to make an accurate assessment. Instruments like H.P.L.C, flame photometer and spectrophotometer are used for analysis of raw materials to obtain accurate results. Raw materials should be analyzed by trained personnel using recognized and approved methods.

5. Processing

Processing seeks to modify the physical properties of raw materials to meet the specifications of premix. Processing basically includes:

A. Sieving

B. Milling

Sieving is a primary process of removing foreign materials from raw materials as well as separating coarse ingredients. The operation can be carried out in equipments like vibratory or mechanical sifters. Care must be taken that the sifter is cleaned well before and after use to prevent any sort of contamination. The ‘overs’ obtained in the sieving process may then be ground.

A multimill can be used to reduce particle size to the desired screen analysis. Regular checks should be
performed to detect wear of mill screen and blades. The sieved and milled material is then bagged, weighed, labeled and transferred to the warehouse area for storage.

B. FORMULATION

This is an important and critical step in manufacturing a premix. Qualified personnel possessing knowledge and expertise regarding micro ingredients and powder technology should formulate a premix.

The formulator has to consider the source of ingredients based on their physical, chemical characteristics, bioavailability, their interactions when mixed, handling characteristics, and economic implications on the final product before any final conclusion is arrived at.

### Physical Characteristics

Particles of uniform size, density and that of spherical shape blend well to form a homogenous mixture. The chance of segregation is thereby minimized. For example trace minerals available in the market are invariably found to be coarse in nature whereas the vitamins are normally fine powders.

### Chemical Characteristics

Potency of vitamins, trace minerals and medicaments need to be considered whilst formulating high quality premixes. Based on the customer’s requirement the formulator has to include the micronutrients considering their analytical value so that desired amount can be delivered when mixed in the feed. Selection of carrier and its percentage is important for formulating a quality premix.

The batch manufacturing record serves as a link between the formulator and actual production. While preparing the batch sheet the formulator has to give importance for the following details:

- Nutrient requirements
- Potency of ingredient
- Level of free flowing agents
- Percentage of carrier
- Inventory of materials
- Selection of ingredients
- Process loss
- Level of antioxidant
- Packing & packaging material

The manufacturing of a premix should follow the batch control sheet under the supervision of trained personnel.

C. WEIGHING
Weighing is an important point in manufacturing of a premix. No matter how good the formula is, it is difficult to achieve the desired nutrient levels in the premix without precise weighing. Any extra addition of vitamins may not improve performance but costs extra money, whereas lower levels could depress performance.

D. MIXING

The mixing process is the heart of any premix-manufacturing unit. In a premix the proportion of ingredients vary considerably; hence in order to obtain a homogenous blend the mixing operation should be divided into two steps, A) Micro mixing and B) Macro mixing

A. Micro mixing, as the name suggests, is for mixing micro ingredients which weigh less than one percent of mixer capacity. The micro mix so obtained should be then mixed in the large mixer with all other ingredients.

B. Macro mixing is the actual blending of all components of the premix along with carriers in a batch mixer. The content uniformity of the premix is based on following parameters:

   i. Type of Mixer
   ii. Mixing Time
   iii. Mixing order

(i) Type of mixer
A mixer selected must be able to provide homogenous mixtures of physically adverse particles incorporated at various levels in the mix. Horizontal or vertical mixers can be used. It must meet safety standards and must be properly installed.

A normal feed mixer is not recommended for premixes. A specialized mixer capable of mixing to a low CV (Coefficient of variation) is the most desired. Specialized Nauta mixers are normally capable of ensuring homogenous mixing. Examples of mixers: ribbon mixer, conical screw mixer, mass mixer, and cylindrical plough mixer etc.

Regular mixer evaluation should be accomplished by conducting coefficient of variation studies. C.V value of less than 5% is indicative of acceptable mixing. The mean assay value for the tracer should also be within the permissible limits of analytical variation.

(ii) Mixing time
The mixing time is also crucial for obtaining a homogenous premix. It is evident that a shorter mixing time leads to under mixing while prolonged mixing time results in demixing. By trial and error and also by conducting coefficient of variation studies, optimum-mixing time can be arrived for a particular mixer.

(iii) Mixing order
The sequence of addition of various ingredients while loading the mixer can affect the quality of premix. If proper mixer loading sequence is not followed, oil balls, chemical interactions and particle segregation can result in a premix.

E. PACKAGING

The primary purpose of packaging for a premix is to maintain the stability of micronutrients and to protect the integrity of the premix. Improperly packaged vitamin premixes experience considerable loss in the potency of various sensitive ingredients.

F. LABELING

Labeling of premix serves two purposes:

- Provides complete information about the premix
- Gives an identity to the premix and helps in differentiating from other premixes. The premixes of different types like vitamin, trace mineral and composite should bear labels of different colour. This prevents any confusion and mix-ups between premixes.

G. STORAGE

The retention of the quality of a premix depends on storage conditions. Premixes should generally be stored in a cool and dry place and utilized as soon as possible. Open bags should be properly closed to prevent exposure to air and moisture which may lead to caking.

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References available on request

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