

Feed Manufacturing Process (Grinding and Mixing)

The major steps in dry feed manufacturing process are

- Procurement of quality ingredients and additives
- Storing in ware-house after proper labelling / marketing
- Preserving labile ingredients, e.g. oils, vitamins in preferably low-temperature (or cool place)
- Accurate weighing of the ingredients (ground and unground) and additives in proportions required for the select formula
- Preparing vitamin and mineral premixes

- Grinding of unground materials
- Microgrinding
- Screening
- Mixing
- Pelleting/ extrusion
- Cooling/ drying
- Crumbling
- Screening particle segregation
- Bagging
- Storage

Preparing vitamin and mineral premixes

- In order to facilitate uniform dispersion of vitamins, minerals and additives that are normally required in small quantities in formulated feeds, a premix is prepared
- Each of the ingredient that is to be used in premix preparation must be finely ground ($<200 \mu$).
- A carrier material also should be ground to uniform level and the two must be mixed thoroughly in a batch type mixer.

- The premix is then blended with the feed mix equal to 3-5% of the total mix (30-50 kg/ tonne of feed) and the mix is ready for use in the final feed mix.

Grinding

- Grinding of ingredients helps in size reduction and Some moisture is removed due to aeration.
- Drying of feed materials before grinding will improve the grinding efficiency of the mill.
- Grinding improves feed mixing properties, pelletability, acceptability and digestibility.
- Hammer mill and attrition or plate mill are the machinery used for grinding.
- Hammer mills are most efficient to grind, dry low-fat ingredients; but proper screen selection and feed intake permits grinding many other material.

- Grinding efficiency of the mill depends upon the number of hammers, their size, arrangement, sharpness, the speed of rotation, the horse power of the motor, the size of the screen mesh used and the type of the material being ground.
- By selecting the appropriate screen desired particles can be obtained.
- Grinding of dry fish and other animal by-products may be difficult, but by mixing with other dry ingredients improved grinding can be achieved.
- Microgrinding of ingredients is necessary for prawn starter feeds.

Mixing

- The objective of mixing is to obtain a homogeneous dispersion of nutrients and additives, so that every unit weight of the feed fed to the animal has the same nutritive profile.
- Feed mixing includes all possible combinations of solids and liquids.
- Dry powdered materials mix adequately more quickly than moist ingredients or mixtures of the two.
- Micro ingredients such as vitamin and mineral premix and additives should be premixed to an amount 3 to 5% of the total feed mix before incorporation in the mixer.

- Accurate mixing requires the addition of ingredients in a sequence from batch to batch.
- The usual practice is to add large volume ingredients first, then those of smaller amount.
- Lipids should be sprayed on to the dry feed mixture to ensure their homogeneous distribution.
- Liquids should be added after all the dry ingredients have been mixed.

- Mixing may be either a batch or continuous process.
- Mixing equipment include horizontal continuous ribbon mixers, non-continuous ribbon mixers, vertical mixers, liquid mixers or blenders.
- Horizontal types are preferred for aquaculture feeds as they enable to blend small quantities of liquids such as lipids mollasses and also in mixing ingredients with different particle sizes.
- Bowl shaped mixers with paddles are the most suitable for moist feeds.
- Ingredients such as condensed fish or fermentation solubles, molasses or fish oils are often premixed in a bowl type variable speed mixer, blending the liquid with the dry ingredients.

- When lipid levels used in feed are high as required for carnivorous fish such as trout, sea bass and groupers, oils could be sprayed on to the pellets after pelleting.
- Heat sensitive vitamins, enzymes and other additives can also be sprayed after cooling the pellets.
- Chemical binders, if used, should be dissolved in cold or hot water and the solution is added to the feed mix.