Preparation and composition of formulated fish feeds

Formulation and preparation of artificial feed

Nutritional requirements

Ornamental fishes require protein, fat, carbohydrate, vitamin and minerals as like other vertebrates. Protein helps to build up muscle and tissue. Fat and carbohydrate provide energy. Vitamin and mineral mixtures are necessary to make the fishes constant to disease and strengthen their bones. Pigments like carotenoids are added to improve the colour of the fish.

Table 1 Nutritional requirement of small and adult fishes (percentage)

Sizes	Protein	Fat	Carbohydrate
Small fishes	40-45	4-6	40
Adult fishes	30-35	6-8	50

Artificial feed is classified into three major categories according to the preparatory methods.

1) Dry feed

The feed is in dried form with 8-1-% moisture. It is further classified into 5 sub-groups.

  i.   Pellets
  ii.   Flakes-are flat in structure
  iii.   Freeze dried feed-they are in frozen form
  iv.   Tablet form
  v.   Granular form- they are very small and round shape. They are similar to grains.

2) Moist feed

It is prepared daily and fed to fishes- the moisture content is about 35%.

3) Paste feed

This is mainly prepared for young ones of all type of ornamental fishes. The feed ingredients are made into paste and fed to fishes squeezing through mesh.

Feed formulation

Since protein plays a significant role on the growth and survival of ornamental fishes. The protein level is given importance while formulating the feed. To balance and formulate the required protein diet, Pearson square method is followed.

Using two ingredients

Using rice bran (protein 9%) and groundnut oil cake (protein 45%), a fish diet 27% protein can be prepared follows.

A square is constructed and the two ingredients are put on the two left corners along with the protein content of each. The desired protein level of the feed is placed in the middle of the square. Next, the protein level of the feed is subtracted from that of the ingredients and the answer is placed in the opposite corner.

Rice Bran   9   18

27

Groundnut   45   18
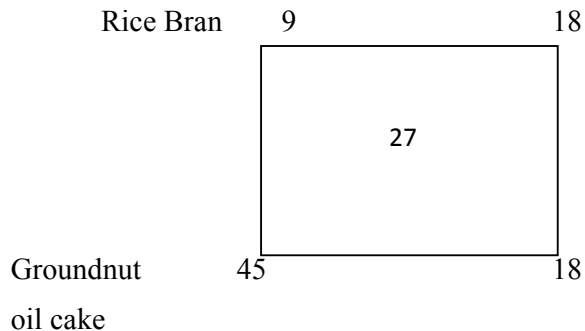
oil cake

Now the figures on the right side corner of the square are added i.e. 18+18= 36

Then the percent of rice bran to be added

$$In\ the\ feed = \frac{18}{36}\ x\ 100 = 50\%$$

$$\%\ of\ Groundnut\ oil\ cake = \frac{18}{36}\ x\ 100 = 50\%$$

To make 1 kg feed 500 g rice bran and 500 g groundnut oil cake should be added.

Using more two ingredients

Using prawn waste (protein 35%), fish meal (protein 60%), wheat bran (protein 15%) and tapioca (protein 2%), a fish diet with 32% protein can be prepared as follows.

The ingredients with less than 20% protein are grouped based on their protein content first.

Wheat bran   = 15%

Tapioca   = 2%

Total   = 17%

Average   = 17/2 = 8.5%

The ingredients with more than 20 % protein are based on their protein content are also grouped subsequently.

Fish meal   = 60%

Prawn waste   = 35%

Total   = 95%

Average   =95/2= 47.5%

Now the determined average protein contents are put on the two left corners of the square and rest is same as that of previous method.

Wheat bran +

Tapioca   =   8.5   15.5

$$\boxed{ 32 }$$

Prawn waste +

fish meal =   47.5   24.5
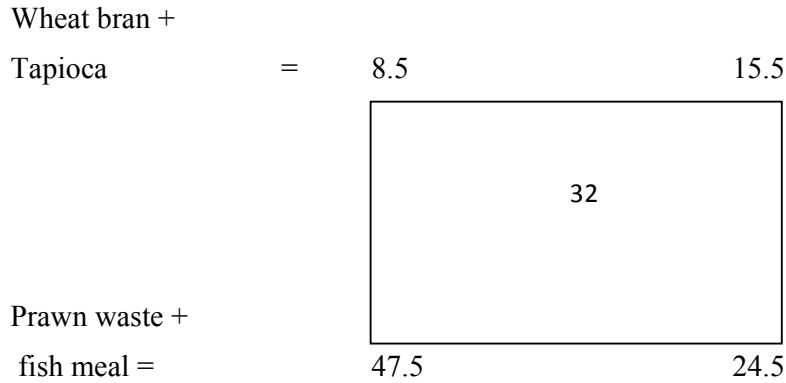
Now, the figures on the right hand side corners of the square are added as follows:

15.5 + 24.5 = 40.0

$$Wheat\ bran\ +\ tapioca = \frac{15.5}{40}\ x\ 100 = 37.5$$

$$Prawn\ waste + Fish\ meal = \frac{24.5}{40}\ x\ 100 = 61.25$$

$$Wheat\ bran = \frac{38.75}{2} = 19.373$$

$$Tapioca = \frac{38.75}{2} = 19.373$$

$$Prawn\ Waste = \frac{61.25}{2} = 30.625$$

$$Fish\ meal = \frac{61.25}{2} = 30.625$$

The composition of the feed is-

Prawn Waste = 30.625%

Fish meal   = 30.625 %

Wheat Bran   = 19.375%

Tapioca   = 19.375

Total   = 100%

After deciding the composition of feed mixture, ingredients are ground in a mixie individually and then they are mixed together. Cooking is done with a water addition at 30-35% level. The tough is thus prepared.

Feed preparation

There is no single way for the preparation of formulated fish feed, however, most methods begin with the formation of a dough-like mixture of ingredients. Ingredients can be obtained from feed stores, grocery stores, pharmacies and specially stores such as natural food stores as well as from various companies that may be found through the internet.

The dough is started with blends of dry ingredients, which are finely ground and mixed. The dough is then kneaded and water is added to produce the desired consistency for whatever fish is going to be fed. The same dough may be used to feed several types of fish such as eels and small aquarium fish.

Pelleting or rolling converts the dough into pellets or flakes, respectively. The amount of water, pressure, friction and heat greatly affects pellet and flake quality. For example excess water in the mixture results a soft pellet. Too little moisture and the pellet will crumble.

Proteins and especially vitamins are seriously affected by high temperature. Therefore, avoid storing diet ingredients at temperature at or above 70 ^{0}C and do not prepare dry feeds with water at temperature higher than 92 ^{0}C.

Tools required

Making your own fish feed requires few specialized tools. The tools are used primarily for chopping, weighing, measure ingredients and for blending, forming and drying the fed.
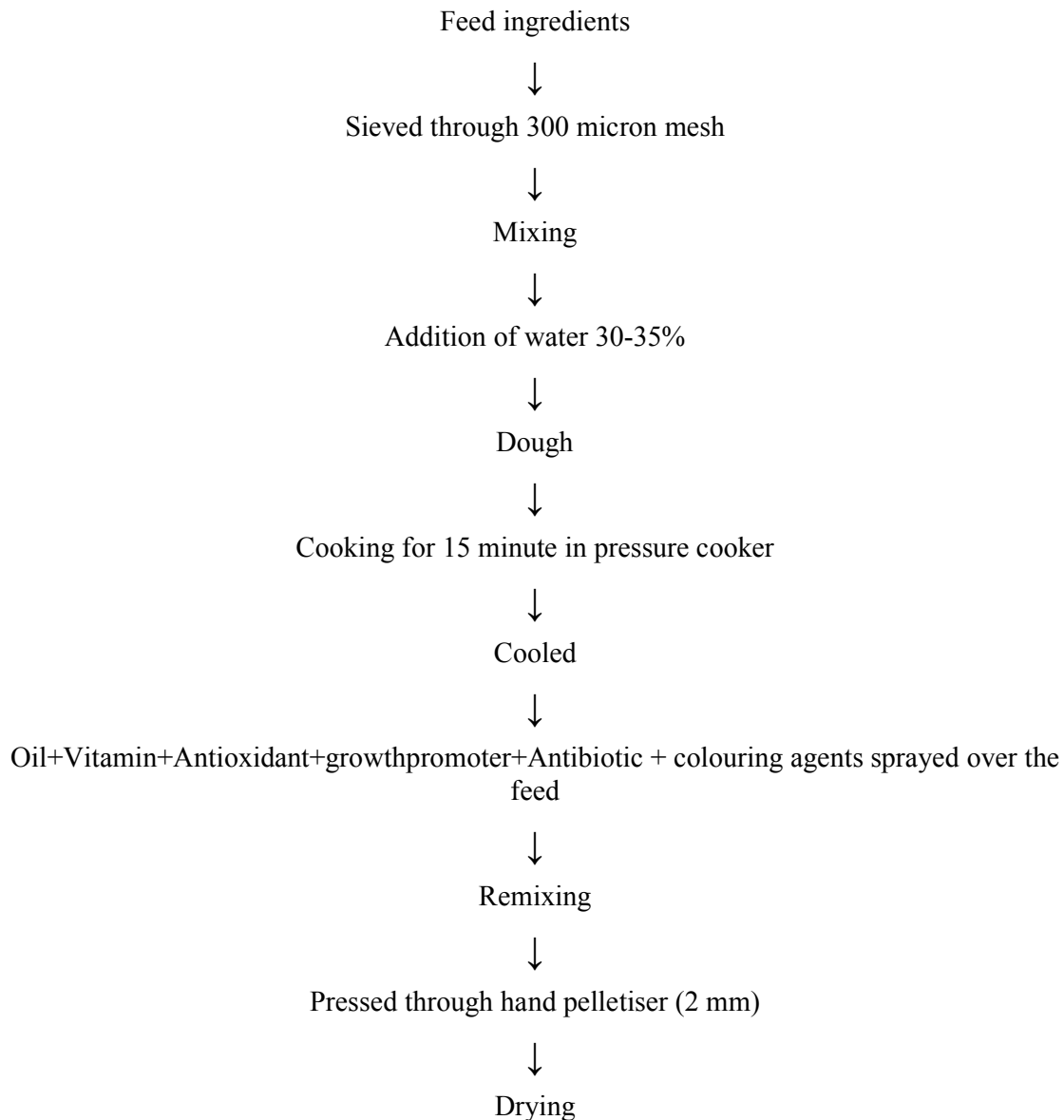
Multipurpose kitchen shears, hand graters, a pairing knife, a 5 inch serrated knife, a 6 to 8 inch narrow blade utility knife and a 10 inch chef knife for cutting, slicing and peeling can be used. A couple of plastic cutting boards protect the counter and facilitate handling the raw ingredients. Heat resistant rubber spatulas, wooden and slotted spoons, long handled forks and tongs are very good for handling and mixing ingredients. A basic mortar and pestle, electric blender, food processor or coffee grinder are very useful to chop ingredients, use grinder sieves and mince die plates to produce the smallest particle size possible. A food mill and strainer such as a colander or flour sifter help discard coarse material and obtain fine food particles. For weighing and measuring ingredients, dry and liquid measuring cups and spoons and a food or laboratory bench scale are required. Other utensils include plastic bowls for weighing and mixing ingredients, a thermometer and a timer. A saucepan and 10 inch stockpot are good for heating gelatins and cooking raw foods such as vegetables and starches. The ingredients and blends may be cooked in a small electric or gas burner. A few trivets to put under hot pans will protect counters and table tops.

Ingredients may be mixed by hand using a rotary beater or wire whisk. However, an electric mixer or food processor is more efficient. After mixing, a dough is formed which can be fashioned into different shapes.

A pasta maker, food or meat grinder will extrude the dough into noodles or spaghetti of different diameters. As the noodles emerge from the outside surface of the die, they can be cut off with a knife to the desired length or crumbled by hand, thus making pellets. A potato ricer also serves to extrude the dough into noodles of the same size. For making flakes, a traditional hand cranked or electric pasta maker will press out the dough into thin sheets.

The pellets or thin sheets can be placed on a cookie sheet and dried in a household oven on low heat or in a forced air oven. A small food dehydrator also performs the task quite well. To add extra oil and /or pigments to pellets, a hand held oil atomizer or sprayers can is useful. To separate pellets into different sizes, a set of sieves (example 0.5, 0.8, 1.0, 2.0 and 3.0 mm) is required.

Flow xhart for the preparation feed

Feed ingredients

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Sieved through 300 micron mesh

↓

Mixing

↓

Addition of water 30-35%

↓

Dough

↓

Cooking for 15 minute in pressure cooker

↓

Cooled

↓

Oil+Vitamin+Antioxidant+growthpromoter+Antibiotic + colouring agents sprayed over the feed

↓

Remixing

↓

Pressed through hand pelletiser (2 mm)

↓

Drying

Feeding rate

The amount of feed required by the fishes present in a system should be determined. Over feeding and under feeding should be avoided. Over feeding results in polluting water quality due to accumulation of uneaten feed and faecal matter. Under feeding results reduced growth rate of fishes due to insufficient feed.

The amount of feed given per day is calculated as follows.

Amount of Feed given per day = Biomass x Percentage of body weight of feed per day.

Biomass can be calculated using the following formula-

Biomass = Stocking density (in nos.) x Survival rate x Average body weight.

Feeding frequency

Frequent feeding results uniform growth and minimum wastage of feed.

Size of feed

        The feed size and frequency of feeding should be increased as the fish growth. The size of feed is also depends on the size of the mouth of the fish.

Feeding method

        Feeding can be done by broadcasting (throwing the feed in the pond) or keeping feed trays.

Feed formulations

        The feed formulations for live-bearers

Guppy (protein 15-34%)

Ingredients	Percentage
Wheat bran	70-80
Fish meal/shrimp meal	10-15
Soybean meal/skimmed milk/bitter milk powder	15-20

Note- Supplemented with tubifes for adult. Supplemented with Moina for fry.

Platy and Sword tail (18-21% protein)

Ingredients	Percentage
Wheat bran/flour	60-80
Fish meal	20-40

Molly (Protein 12%)

Bread crusts. Supplemented with phytoplankton + zooplankton + algae.

Feed formulation for Ornamental fishes (in general) or egg-layers

Ingredients	Percentage
Wheat bran	10.3
shrimp meal	15
Soybean meal	44.8
Fish meal	15.0
Rice polish	10.3
Fish oil	4.0
Vitamins and mineral mixture	0.5

Marigold petal meal	0.13
Ethoxquin	0.03

Or

Ingredients	Percentage
Wheat flour	14
shrimp meal	20
Fish oil	4
Ground nut oil cake	40
Beef liver	20
Vitamins and mineral mixture	2

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