

DNR COLLEGE (A) BHIMAVARAM

2ND AQUA CULTURE TECHNOLOGY

PAPER -3 : FISH NUTRITION AND FEED TECHNOLOGY MANUAL



D.N.R. COLLEGE (AUTONOMOUS), BHIMAVARAM
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PAPER III-FISH NUTRITION AND FEED TECHNOLOGY

Total Hours-24

Hours per week-02

Total credits-01

1. Estimation of protein content in aquaculture feeds
2. Estimation of carbohydrate content in aquaculture feeds
3. Estimation of lipid content in aquaculture feeds
4. Estimation of ash in aquaculture feed
5. Study of water stability of pellet feeds
6. Feed formulation and preparation in the lab
7. Study of binders used in aquaculture feeds
8. Study of feed packing materials
9. Study of physical and chemical change during storage
10. Study on physical characteristics of floating and sinking feeds
11. Visit to aqua-feed production unit
12. Visit to a farm for studying feeding practices

1. Estimation of Proteins contents in Aquaculture feeds

Objective: To estimate the protein content in the fish food by kjeldhal method..

Principle: The nitrogen in the compound is converted into ammonium sulphate by digesting the compound with concentrated sulphuric acid. Ammonium sulphate thus obtained is decomposed by alkali and the liberated ammonium is absorbed in boric acid titrated against standard sulphuric acid / hydrochloric acid.

Requirements:- Boric acid 2% solution is prepared by dissolving 2g of boric acid in 100ml of water.

Sodium hydroxide 40% solution is prepared by dissolving 40gm sodium hydroxide in 100ml H₂O

Mixed indicators:- 0.2% solution is prepared by dissolving 150 gm methylene blue and 50mg methyl red in 100ml absolute alcohol.

Digestion mixtures: - Copper sulphate and potassium sulphate are mixed in the ratio of 1:5:

Standard 0.05 NH₂SO₄ :- 0.1 N solution of H₂SO₄ is prepared by diluting 2.8ml of concentrated sulphuric acid to 1lit. It is standardized against standard alkali and diluted to give 0.05N H₂ SO₄ .

Procedure:- 50 to 200 mg of dry sample or about 1 gm of wet sample is weighed into a Kjeldhal digestion flask.

- 10ml concentrated sulphuric acid and a pinch of digestion mixture (potassium sulphate) copper sulphate; selenium dioxide in the ratio 100:10:25 is added to the flask and the flask is heated on the Kjeldhal digestion track. A glass rod is added to reaction mixture to prevent bumping.
- The mixture is digested for 6-8 hours or until the digest becomes clear or colorless to ensure complete conversion. Of the nitrogen in the sample into ammonium sulphate. After cooling the volume is made up of to 100ml with distilled H₂O.
- From this solution 2 ml is taken for distillation along with 10ml of 40% solution of sodium hydroxide added to the inner chamber of kjeldhal distillation apparatus.
- Liberated Ammonia is steam distilled a receiver flask containing 100 ml of 2% boric acid solution to which 2-3 drops of mixed indicator is added.
- The indicator is red in boric acid turns green when ammonia is absorbed. The distillation is carried out for 5minutes.

- The content of the receiver flask is titrated standard 0.05 $\text{NH}_2 \text{SO}_4$ using a micro burette until the original red color is obtained as Compared with a blank.
- The nitrogen present in the sample is calculated using the nitrogen equivalence V_1 2.1 ml of 0.05 $\text{NH}_2 \text{SO}_4 = 0.007$ grams of nitrogen. The protein Value is obtained by multiplying the N_2 content by 6.025.

2. Estimation of Fat content in Aquaculture Feed

Objective: Estimation of fat in Fish Food.

Principle: The extraction of fat from substances is often tedious and requires thorough content and heating with solvent. This is done in a special apparatus known as Solvent extractor. In this procedure the apparatus is designed so that a fresh portion of solvent comes in contact with the materials to be extracted over a relatively long period of time.

Apparatus:- The apparatus consists of a flask; containing volatile solvent resting on a heating device. The flask is connected by means of interchangeable ground joints with a tube having a siphon arranged and a side arm again the extraction tube is connected by means of interchangeable ground joints with a water cooled Condenser

Procedure: Take 2.3g of sample in a thimble pack the mouth of the thimble by absorbent cotton so as to keep the sample in place. The thimble in the Soxhlet, extraction and connected. It with the pure weighed flask and also the condenser. The receiver contains suitable solvent via petroleum ether (B.P 60-80°C) as solvent.

The Extraction is carried out for 16 hours. Then remove the flask evaporate the volatile solvent at 60-80°C on a water bath. Dry the residue in an oven at 60°C, cool in a desiccator to a constant weight. The crude fat content can be calculated and expressed as percentage.

Calculation

Weight of the Sample = x gm

Weight of the Empty flask = w/g

Weight of the flask after evaporation = W₂g

Weight of fat calculated (w₂-w₁)g

X gm of the sample contain = (w₂-w₁)g of fat

Crude fat (%) = $\frac{W_2 - W_1}{x} \times 100$

α

Precautions: -

- Take the accurate weights after proper Calibration of balance
- Take care when handling with acids.
- The apparatus should be carefully handled during the performance of the experiment.

3. Estimation of Ash in Aquaculture Feed.

Objective: To Estimate the composition of Ash in Fish Food Sample.

Method: Animal feed, ADAC (American) official methods Analysis-1990

Procedure

Determination of Ash:- Ash in the products is really determined by incineration from either raw or divided

sample at about 600-700° weigh 2gms sample into pre-weighed crucible and place in temperature controlled furnace preheated to 600°C add at this temperature for 2hrs. Transfer crucible directly to desiccator, cool and weight immediately reporting % ash to first decimal place.

Calculation: % ash (weight of ash + weight of sample) x 100.

Estimation Moisture:-

Moisture of fish is commonly determined by sample at some elevated temperature and separating the loss in weight of terms moisture. The percentage of the moisture content. The percentage of the moisture content in the sample is calculated by the following formula

% of moisture: $\frac{(\text{weight of original sample} - \text{weight of dried})}{(\text{Weight of original sample})} \times 100.$

4 .Study of water stability of Pellet feed

- A Part from being able to withstand the rigors of handlings and transportation, Commercial feeds should also be relatively stable in water, minimizing disintegration and loss of nutrients due to leaching
- The degree of water stability required in a feed depends on the species cultured and it's feeding habits.
- Many fish species such as salmons, channa, cat fish, tilapia, sea bass and groups respond quickly to a diet that is of suitable pellets size and palatability.
- Such pellets need to retain their physical stability in water for only a few minutes
- In contrast shrimp feeds are felt uneaten for considerably long period of time therefore requiring greater integrity in the aquatic Environment.
- Water stability of pellets is influenced by a number of facts, foremost amongst which are diet composition, the manufacturing process and nature of the binders used.

Composition of diets:

- The proportion of ingredients which are difficult to grind or have binding properties should be kept to minimum.

Eg:- Rice, Bran, Bone meal.

- Hydrosopic ingredients such as salt, sugar and molasses absorb water, making the food moist and crumbly even before being dispersed.
- Generally, starching products have good properties, and gelatization process. Renders the final product.

Manufacturing process:

- Grinding is common to all manufacturing process.
- Grinding increase the surface area of ferol and there by permits more space for steam condensation during the conditioning process, resulting in harder and more desirable pellets.
- Hasting and Higgs (1980) studied the effecting of process cat fish food.

- Their work clearly demonstrated the certain processing parameters have a significant influence on water stability of pellets.

Binders :

According to stirrers (1970) there are at least three actions by which binders increases the hardness and water durability of pellets.

- Others are thought to undergo changes during the pelleting process and extract a chemical action with changes the nature of the feed mixture, hence increasing pellet durability.
- Several Studies have been carried out to evaluate different types of natural modified & synthetic substances used as binding agents for aqua feeds.
- Taking use of binders, such as starchy plant products that include plant starch, cassava starch, potato starch, bread or wheat flour, and others aquaculture binders.
- Include algenates, Canragecan plant gums, agar gelatin and chitoson.

5. Formation of Balanced Fish Feed

- The feed must be a balanced diet. It should produce optimum growth rate.
- The feed should contain all the essential amino acids and essential fatty acids.
- Ingredients of plant origin and animal origin should be included
- The feed must be acceptable by the fish.
- The typical adult feed should contain more proteins but less carbohydrate.
- It should contain all the nutrients essential for life activities..
- The following nutrients should be included in artificial feed.

Carbohydrates

Fats

Binders

Chemo attractants.

- The feed should contain Carbohydrates it is the energy Value of Carbohydrates is 1cal/gm.

The following are the fat source of fish feed.

Vegetable oil

Fish oil.

The feed must contain following minerals.

Phosphorous

Magnesium

Potassium

Cobalt

Sodium

Zink

The additives are added to make the feed more stable when additives are added to the feed will not dissolve and disappear in the water they bind the feed ingredients. So, they are also called binders

- Preservative are added to prevent the delay of the feed.
- Chemo attractants are added to add flavor and taste to the fish feed
- The following is a typical artificial feed formula

Tapioca flavour-9kg

Rice bran -27kg

Fish meal-23kg

Ground nut oil cake -14kg

Silk worm pupae.-26kg

Vitamins + minerals -0.1kg

Feed additives+

Preservatives+ - trace amount

Chemo attractant+

Total 100 kg



6. Study of binders used in Aquaculture feeds

- Fish feed must be formed into particles (or) pellets that are strong enough to withstand normal handlings and shipping without disintegrating.
- Moreover fish feeds must be water stable. These requirements make it necessary for feeds to contain binders.
- These are numerous materials that act as binders in fish feed including regular feed ingredients and ingredients added solely for their binding properties
- Some binders are by-products of cereal grains (or) plants and provide nutrients to the diet.
- Some commonly used binders include bentonite, lignin sulphate, and hemi-cellulose extract none of which provides nutrients to diet.
- Sodium bentonite and calcium bentonite may be added to dry, compressed fish feeds at no more than 2% act as a binding agent and also as a lubricant increasing pellet mill production rates and half life of pellet.
- Lignin sulphate is a product of pulping wood industry. It aids in pellet binding, reduces fines and permits addition of more steam. During the manufacture of compressed pellets.
- Hemi-Cellulose extract is a product made by spray-drying the concentrated soluble by-product of pressed wood manufacture.
- Nutritive binders include oat, grouts, vital wheat gluten, finely milled wheat bran, cotton seed meal, fish hydrolyzates, gelatinized starch.
- Non-nutritive binders include tapioca, alginates, agar and various gums.
- When feed ingredients do not possess suitable binding properties, it is necessary to add ingredients specifically to bind the diet.
- Moist feeds, having moisture content 35-70% always require addition of binders.
- Alginates are better binders than gum, Carrageenan, chitosan, collagen in 4% moisture diet.
- Agar is also an effective binder, but expensive.

7. Storage and handling of Feeds in culture Practices.

Introduction:

- Prepared feeds for fish and shrimp are perisistable products they care also more or less triangle depending on the types of feeds.
- Feed processors attempt to formulate of manufacture aquaculture feeds to extend their self life and improve durability.
- However, the degree to which aquaculture can reduce wasted food and realite its full purchase value is ultimately dependent on how well the base principles of feed storage handlings are understood and applied.

Moisture and heat:

These processes of deterioration are accelerated by a Variety of storage Conditions of these temperature and humidity can be singled out as the most important environmental features that grown storage on shelf life. These factors affects the moisture content of the diet, the role at which chemicals changes take place of the invasion and growth storage methods content will the atmospheric content depending on the relative humidity new (1987) Considered that a single safe moisture level is that which develops at a safe moisture level is that which develops at a relative humidity of about 78% however in most tropical areas the relative humidity is much high the resulting in feeds adding moisture. during stage consequently the feeds must stored for a shorter time high temperatures also effect feeds as temperature alone may oxidize vitamins and will accelerate oxidations process that have been initiated by activity.

Microbial damage:

Generally moulds becomes active at humidities above 70% fungal activity on other hand, generally occurs when the moisture content of feeds exceeds about 25%. This occurring at relative humilities of around 90%

Reduce nutritional value occurring to the dietary lipids, amino acid and vitamins by enzymative digestion fungi may also assist in the development of lipids ketonic ranching and non-enzymatic browning

Proper flavor and appearance, making feeds "lump" of less "palatable certain moulds in particular & pergillous flavors. Produce fake metabolite feed stuffs which one is particularly prone to infestation by a flavor or groundnuts, Cotton seeds and copra.

8. Study on Physical characteristics of Floating & Sinking Feeds.

Feed Plays a vital role in aquaculture growth and all activities of fish mainly depends on the food they consume. In nature, different feeding habits can be observed in fin fish and shell fish species they feed on zooplankton, Phytoplankton, filamentous algae, mesophytes, detritus matters, molluscans, small crustaceans and other small fish species many of them feed on more than one type of food

The prepared feed is called artificial feed or supplementary feed artificial feeds are also called Compound feed is called Supplementary feeding .Artificial feed is prepared by using feed ingredients of both plant and animal origin

Types of artificial feed based on the number of feed ingredients used for the formulation the feed are grouped into

Simple feed

Compound feed.

Simple feed

Simple feed is prepared by using a single feed ingredients this feed will not supply all the essential nutrients to fish hence, it is also called balanced feed.

Eg : Groundnut oil cake

Compound feed:

Compound Feed is prepared by using several feed ingredients this feed is a balance feed it will supply all the essential nutrients to the fish Pellets are artificial feed made into the shape of noodles they are hard floating and stable in water. pellets form a balanced fish feed they contain many feed ingredients such as fish meal, plant cakes, vitamins, minerals, feed additives etc.

Pelleting has enhanced by the addition of binders in the feed. Starch is a binding agent; gelatin, algin etc. are also used as binding agent. The feed is made into pellets in a machine called pelletizer. the making of pellets is called pelletizing.

The pellets feed are further grouped into

1. Floating

2. Non floating feed

Floating feed will float on the water surface. This feed is consumed by surface feeding fishes. Non-floating feed will sink to the bottom, and the bottom feeding fishes will eat them. If the non-floating pellet feeds are crumbled into uniform particles they are crumbles or grains.

Floating Pellets:

These are more expensive to buy and more expensive for mills to manufacture. Floating pellets require to go through an extrusion process, during this process section of a feed mill is most of the time costly to set up and run than a standard pelletizing section.

They are usually used in layer underlings food fish and brood fish must come up to the surface to eat this ensures you to observe your fish each day which can adjust the amount of feed per day and avoid wasted feed per day and avoid wasted feed and pond pollution problems

Sinking Pellets:

It is also known as a hard pellets. They are more economical sinking feed will have water stability of the bottom if uneaten. Since ingredient are passed through it makes it impossible for the fish to Selectively eat the ingredients they want sinking pellets are adopted to mechanical feeding and can be handled considerable without deterioration. Sinking pellets are sometimes used in winter when the fish do not regularly surface also by pelleting some feeds it can be avoided to harm some ingredients which do not like the extrusion process.