

***FEED INGREDIENT
USE IN FISH FEED***

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Introduction

- Shift from low input-low output type of culture to semi-intensive type of culture.
- Role of fish feed becomes more important for semi-intensive and intensive type of culture system
- Knowledge of type of ingredients very important to keep the formation of low cost and quality of fish and crustacean feed
- The various raw material or ingredients used for the manufacture for fish feed and crustacean
- They can be classified in several ways depend upon the factor such as Origin, composition, nutritional and chemical properties or economic criteria.
- A raw material is usually a food in itself i.e. a source of nutrient.
- The main characteristics of raw material which are sources of nutrients attractants, carotenoids, fiber and antinutritional factors

Feed ingredient classification

Can be classified on the basis of composition, function and source

Classification on the basis of composition

- Protein constituents- source of protein e.g. Fish meal, soyabean meal
- Lipid constituents: source of lipid e.g. fish oil, coconut oil.
- Carbohydrate constituents: e.g. Alginic acid, tapioca flour.
- Vitamin constituents: e.g. vitamin mix.
- Mineral constituents: requirement above 100mg/day are macro minerals and those required in micrograms are trace minerals.
about 21 minerals have been recognised.

Classification on the basis of function:

can be classified as

- (i) Energy supplements and
- (ii) Non energy yielding supplements

- **Energy supplements:** contain less than 20% protein and 18% fibres. E.g. vitamins, minerals.

Have physiological and biochemical roles.

are important in deciding efficiency of the diet.

- **Non energy yielding supplements:** have more than 20% protein level. E.g. Carbohydrates, fats and protein

Classification on the basis of source

- **Ingredients of animal origin:**

- Are generally protein contributors.

- Fish meal, slaughter house waste widely used.

- Fish meal rich in lysine and methionine, plants deficient in these.

- Fishing by-catch and low market value fish also included.

- **Disadvantage:**

- High bacterial load.

- Low shelf life of raw material and of the product made from them.

- Hygiene requirements in handling and processing adds up the cost of feed production



FISH MEAL



Artemia flakes

Ingredients of plant origin:

- **A**griculture forms the primary economic sector of India.
- **W**ide variety of flora also available.
- **P**lant ingredients of one type or other are available in almost all the season throughout the country.
- **H**andling such raw materials is easier.
- **T**heir shelf life is more than animal derivatives.
- **H**ygiene problem in handling plant derivatives is less.
- **C**ost of feed production is lesser.

e.g. Rice Bran, wheat bran, oil cakes and soya bean meal have been widely used as traditional feed in Indian aquaculture

Disadvantages of plant derivatives:

Nutrient profile highly variable.

Plant proteins deficient in lysine and methionine.

Digestibility of plant proteins is also less than fish proteins.

General Classification of ingredients:

- **Dry forages and roughages:** This include hay, straw, hulls and other products with more than 18% crude fibre content. e.g. Rice Bran and seed coats
- **Pastures, range plants and forages fed green:** includes ingredients that may be slightly cured on the stem, cut and fed fresh. E.g. *Hydrilla*, dried *Azolla*, *Colocasia* leaves etc.
- **Silages:** reduction of pH to hydrolyze and liquefy ingredients.
- **Energy feed:** ingredients with protein content below 20% and fibre content less than 18% (on dry weight basis). E.g. Vitamins and minerals mix.

- **Protein supplements:** ingredients containing protein level above 20% (on dry weight basis). E.g. oil cakes, soya bean meal etc.
- **Mineral supplements-**
- **Vitamin supplements:**
- **Additives:** makes feed more efficient by enhancing its pelletability, palatability, attractiveness. e.g. antibiotics, colouring materials, flavours, hormones, medicines, binders etc.

Conventional Feed Ingredients

- **Rice bran** : most popular ingredient of the practical diets for fin fishes especially carps.

Crude protein value of 10-12%, crude fibre 12-18%, total lipid 7-12%, ash 8-12%.

Good source of energy and B group vitamins.

Deoiled rice bran is better in terms of nutritional profile and this also keeps away the problem of rancidity.

- **Wheat flour and wheat bran**: good source of energy having crude protein 10-14%, crude fibre 12-18%, ash 6-18%.

Good source of phosphorous, potassium, magnesium and zinc.

Amongst vitamins, niacin, pantothenic acid and biotin are in good amounts.

- **Corn gluten:** Crude protein 20-30%.

Arginine and lysine levels are low.

Good source of iron and zinc, niacin and vitamin E.

- **Sorghum and millet:** Crude protein 8-12%.

Poor profile of amino acids, minerals and vitamins

- **Oil cakes and meal:**

(a) **Soyabean oil cake:** amongst plant oil cake is considered as the best source of protein, in terms of its protein content and amino acid profile.

lack in methionine, lysine and threonine levels are less.

Phytate, lipoxidase, antivitamin A, antivitamin D are some of the antinutritional factors present.

choline is found in relatively high amounts.

Protein level is 46-48% in solvent extracted meals

b) Cotton seed oil cake: Protein content varies from 29-42% .

Content as well as availability of lysine, threonine, and methionine is lower than in soyabean oil meal.

Good source of thiamine and vitamin E.

Phenolic pigment gossypol and cyclopropenoic fatty acids are anti-nutritional factors.

(c) Groundnut oil cake: Crude protein ranges from 35-42%.

Lower in lysine, tryptophan, threonine and methionine.

Good source of magnesium, sulphur and potassium.

Good source of vitamins, niacin, pantothenic acid, thiamine.

Choline and vitamin E levels are low.

Highly prone to fungal growth and mycotoxin (aflatoxin) in humid conditions.

(d) Sunflower oil cake: Highly deficient in lysine.

Methionine and **cystine** higher than soyabean.

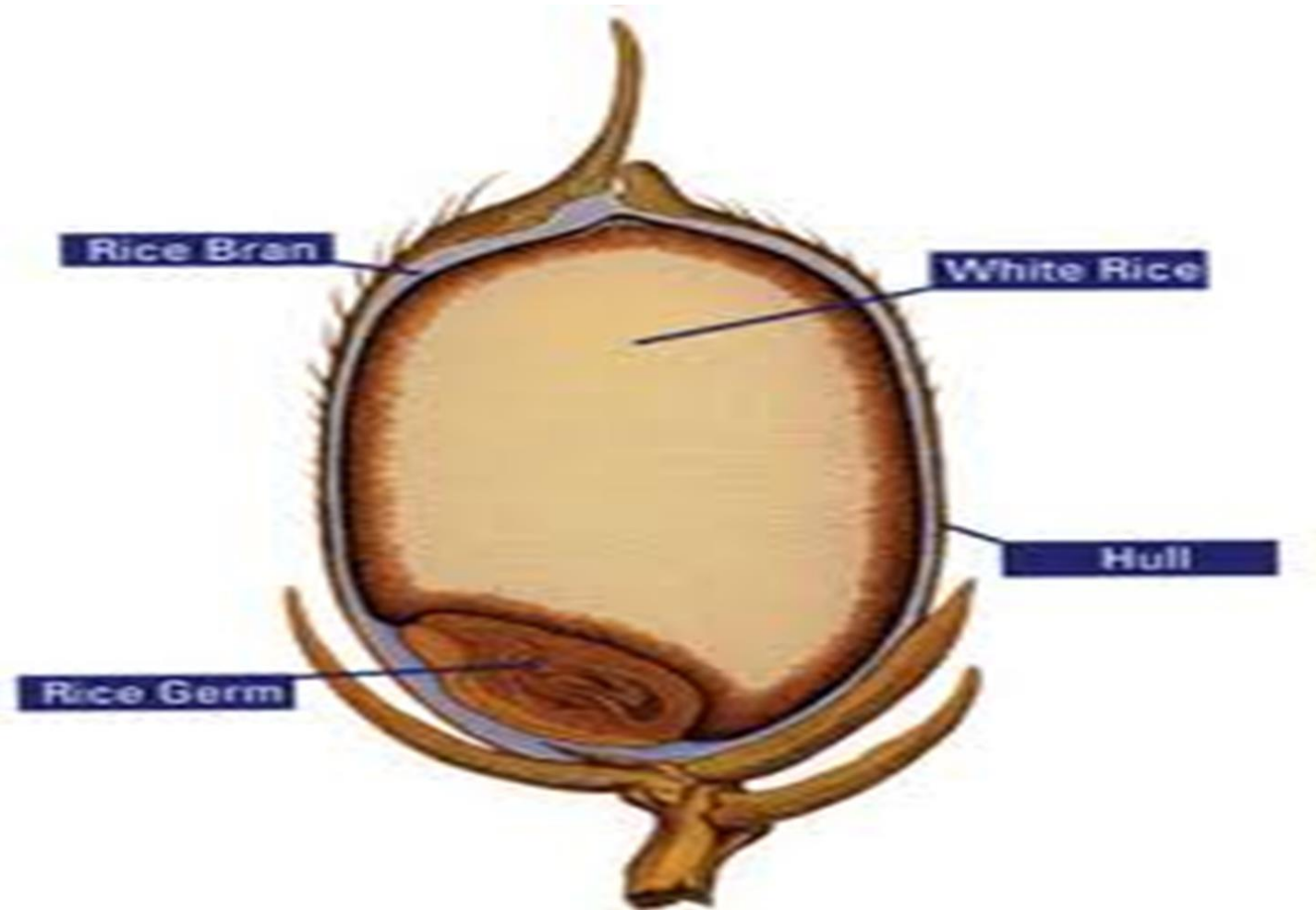
Vitamin B and **carotenoids** found in good quantities.

(e) Mustard oil cake: used in carp diets.

Non detoxified cakes contain **erucic acid**, **glucosinolates**.

Cereal products: Ground broken rice, wheat, sorghum, millets and maize can be used considering their cost, availability and carbohydrate content.

Root Crop: Tapioca, sugar beet molasses and meals from potatoes Have been used. Hydrocyanic acid content should be checked in the tapioca before use.





Rice bran



Wheat Bran



Cotton seed cake



sunflower oil cake

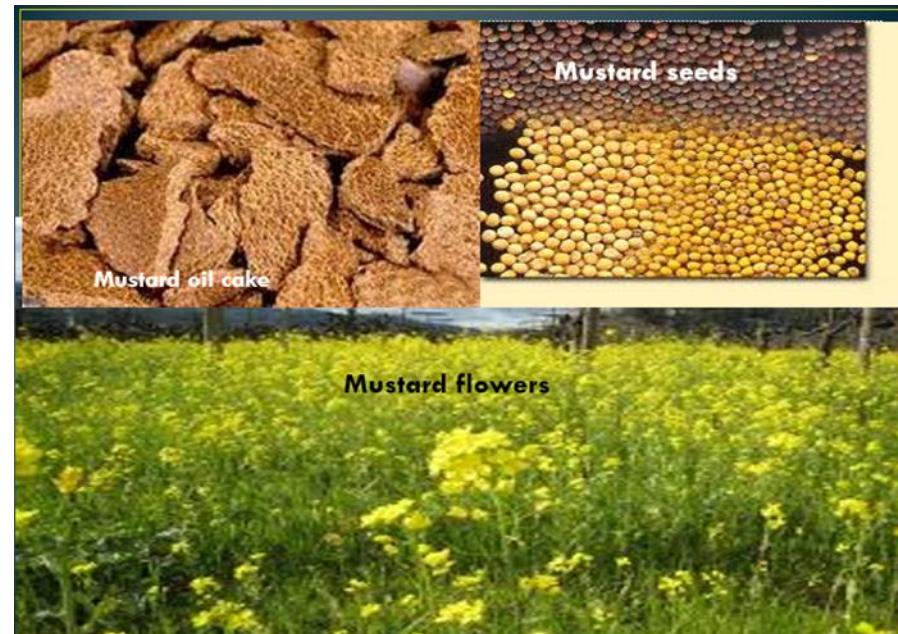
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Groundnut seeds

groundnut

Groundnut oil cake



Mustard oil cake

Mustard seeds

Mustard flowers



Soybean pellets

Soya

Colocasia plant

Colocasia tubers

NON CONVENTIONAL FISH FEED INGREDIENTS:

Refer to all those feed ingredients that are not traditionally used in animal feeding and are not normally used in commercially produced rations for livestock.

- **Characteristics of Non conventional feed resources:**

- They are end products of production and consumption that not have been used, recycled or salvaged.

- They are mainly organic and can be in solid, slurry or liquid form.

- Their economic value is often less than the cost of their collection and transformation for use and consequently they are discharged as wastes.

Fisheries by-products:

Fish meal: perhaps the most abundant animal protein source commercially produced and marketed in several countries.

Protein content is 60-75%, fat ranges from 4-20%, ash content depends on the processing level and varies highly ranging from 11-12% in anchovies to over 23% in white fish meal.

Fish soluble: This is the water remaining after the oil is removed from the liquid pressed out during the manufacture of fish meal.

It is high in B group vitamin and contains an unidentified growth factor.

Serve as an attractant

Fish silage: prepared from trash fish, waste fish head, viscera prawn waste small crabs and mixed with a mixture of acids to bring down the pH to 4.

This causes liquefaction and prevents bacterial decomposition.

Crustacean meals: Meals obtained from small prawns, prawn heads, mantis shrimp, crabs and krill.

Good for shrimps.

Crude protein level varies between 30-50% depending upon size and species.

Ash content ranges from 25- 40% and chitin is as high as 16%.

Good source of cholesterol, carotenoid pigments, chitin, calcium, iron, manganese, choline, niacin, pantothenic acid and cyanocobalamin.

Fresh material should be used always.

In prawn feeds inclusion rates range from 5- 15% and meals from small prawns up to 25%.

Meat meal and meat and bone meal: dried mammalian tissue exclusive of hair, hooves, horns, hide trimmings, manure and stomach content.

Protein content is about 51% for meat meal and 50% for meat and bone meal.

Fat is about 9.1-9.7% in both.

Both have ash content of 27-31%.

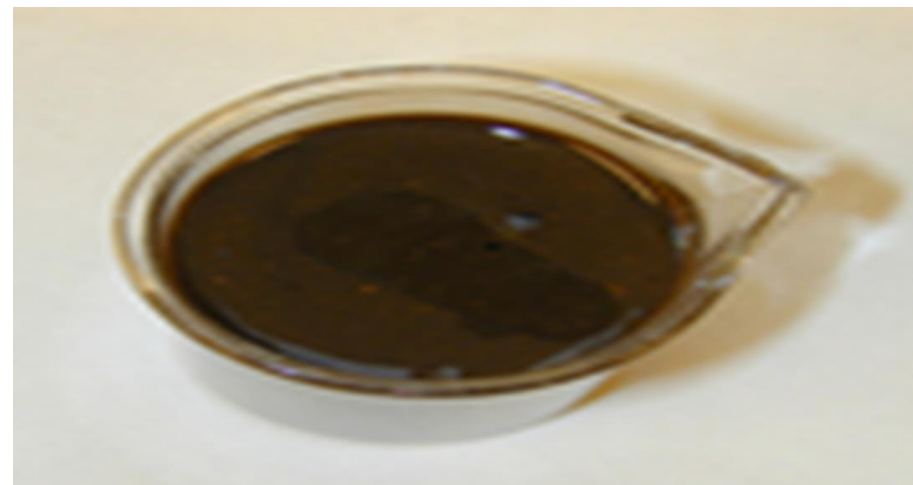
Blood meal: a dry product made from clean fresh animal blood, exclusive of all extraneous matter.

Can be prepared by spray drying, flash drying and conventional drying.

Protein content is 85%, lysine is 9-11%



Fish soluble



Fish Silage



Feather meal: made from poultry feathers, hydrolyzed under pressure in the presence of $\text{Ca}(\text{OH})_2$ and dried.

Protein content is 80-85% and not less than 75% of protein must be digestible by the pepsin digesting method.

Use in fish feed restricted due to poor digestibility by fish.

Milk by-products: Dried whey, dried whey products, casein and dried skim milk.

Dried whey is obtained when lactose has been removed. Protein content is relatively low (13-17%), yet are classified as protein supplements.

Dried skim milk forms a part of larval diet as its digestibility is high and has good amino acid profile.

It has about 34% protein.

Casein is the residue obtained by acid or rennet coagulation of defatted milk. It has 80% protein.

Concentrates: feed or feed mixture which supplies primary nutrients (protein, carbohydrate and fat) at higher level but contains less than 18% crude fibre with low moisture and total ammonia nitrogen over 60% on air dry basis.

Miscellaneous ingredients: Fruit processing waste as from citrus fruits can be incorporated in the diets which act as a source of carotenoids and vitamins.

Single cell protein: Term applies to a wide range of products of microbial origin (Tuse' 1884, Taco & Jacson 1985).

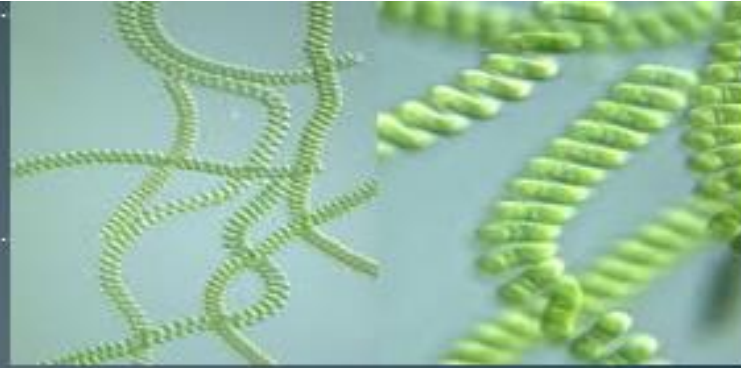
The microbes may be of algal (*Spirulina maxima*, *Scenedesmus obliquus*, *Chlorella vulgaris*), fungal or bacterial origin (*Methanomonas methanica*) resulting from fermentation process.

Yeast, *Spirulina* are some of the examples of SCP.

Yeast may not be used as such but is fed to *Artemia* in which lipid content is seen to rise. Feeding this *Artemia* provides fish fry with essential fatty acids in the diet.



Chlorella



Spirulina



Scenedesmus



SPIRULINA POWDER



SPIRULINA TABLET

Spirulina



maggots



water hyacinth

Spirulina has crude protein level of 55-65% with good levels of essential amino acids, calcium, and phosphorus.

Azolla as feed ingredient: *Azolla*, which grows in association with the blue green algae *Anabaena azollae*, is perhaps the most promising from the point of replacing animal protein ingredients and reduce cost of production.

Easy to cultivate, high productivity and good nutritive value.

Azolla contains 20-25.5% protein, 3.1%fat, 4.9%carbohydrate, 8.5-11.7% cellulose and essential amino acids.