

Fish Feed Technology

PhD. student

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- 1- Introduction: Chemical composition and ingredients.
- 2- Feed categories 1

Cereals and cereal by-products, despite their **high carbohydrate content**, form an important component in aquaculture diets. Their starch content helps to **increase the water stability** of the feed, particularly where heat is included in their method of processing. Cereals also contribute significantly to the protein and lipid content of the diet. Though **deficient in some amino acids (e.g., lysine)** they can be used to balance high-protein animal and vegetable ingredients. Cereals are often one of the cheapest raw materials that can be included in compound feeds for aquaculture. The **brans** are excellent sources of the **B group vitamins**.

Oil – Bearing Seeds and Oil Cakes :Many plants are grown specifically for the oil which their seeds or fruits produce, which is utilized for human food and other purposes. Vast quantities of by-products from the vegetable oil industry are produced and these are the staple ingredients of animal feedstuffs, being **high in protein and low in carbohydrate**. All are potential ingredients of aquaculture feeds. Examples of the plants from which products in this category come are the leguminous plants soybean and groundnut, together with mustard, rape, sunflower, safflower, coconut, kapok, cotton, oil palm, linseed, poppy, sesame .

In considering the use of ingredients from this group it is essential to understand the terminology used in describing oil-seed by-products because ingredients with apparently similar names have completely **different analytical characteristics**. The external coating of some seeds is sometimes but not always completely removed before oil extraction, e.g., in the case of sunflower seed, groundnut, and cotton seed. The material which remains after oil extraction is referred to in several ways

Decorticated (sometimes referred to as 'Dec')	Coating removed before oil extraction
De-hulled	Coating removed before oil extraction
Without hulls	Coating removed before oil extraction
(Undecorticated (shortened to 'Undec')	Coating not removed
With hulls	Coating not removed

Expeller: (shortened to 'Exp')

oil removed by mechanical process, either by hydraulic presses or by screw augers. The latter type can be distinguished by looking at the pieces of unground cake, which are not flat. The hydraulic process does not remove as much oil but damages the cake less than the screw process which generates a lot of heat.

Extracted: (shortened to 'Ext')

oil removed by a highly efficient chemical process using solvents. Sometimes the words 'solvent extracted' are applied to this residual product.

The characteristics of these products are that expeller residuals are much higher in oil content and lower in protein content than extracted products.

Two other terms are applied to oil-seed residues. These are 'cakes' and 'meal'. Normally, if a product is referred to as a 'cake' it means it is an expeller residue. Similarly a 'meal' normally refers to an extracted product. However there can be some confusion here because the word 'meal' can also be used to refer to a ground or milled product. So, the words 'groundnut meal' might refer either to groundnut cake which had been ground into a meal or it might refer to extracted groundnut. When in doubt, the chemical analysis is the only criterion to use in determining which product is being offered for sale if it is in ground (meal) form

Effect of Processing on Analytical Characteristics of Oil-Seed Proteins

Country and Material	H ₂ O	LIP	PROT	FIB	NFE	ASH
<u>Pakistan</u>						
Dec. Cottonseed	7.3	5.2	36.7	8.8	34.9	7.1
Undec. Cottonseed	6.5	8.9	21.5	24.5	32.5	6.1
<u>USA</u>						
Exp. Groundnut	10.8	7.3	45.1	6.8	24.7	5.3
Ext. Groundnut	8.5	1.2	47.4	13.1	25.3	4.5

Feeds of Animal Origin

These ingredients are either from terrestrial, avian or marine animals. They constitute the most important (and often the most expensive) ingredients of aquaculture feeds. Animal protein is necessary to balance the amino acid and vitamin deficiencies in cereals and other plant products. Animal proteins appear to contain unidentified growth factors for some animals. Marine proteins have always been important components of aquaculture diets although shortages of fish meal are stimulating research on methods of replacing them, either partially or completely, with other ingredients. Ingredients of marine origin are important sources of poly-unsaturated lipids (PUFA's), particularly of the important n-3 series. Some examples of ingredients in this category are blood, feather meal, poultry by-products meal, fish meal, meat meal, raw fish, fish oils, fish silage, shrimp meal and milk by-products.

Miscellaneous Feedstuffs

Many other ingredients have potential in aquaculture feeds; their value has not yet been fully evaluated, however. Some of these ingredients are sometimes referred to as 'unconventional' or 'non conventional' feedstuffs, though many, such as cane sugar molasses, are conventional ingredients in feedstuffs for other animals. This group of feedstuffs includes leaf protein concentrate, minerals, seaweed, by-products of sugar cane, by-products of fermentation processes, lipids, microbial proteins, algae, manures, and celluloses.

Soybean meal is produced in two major protein levels by different processes. Soybean meal must be heated (toasted) sufficiently to destroy, the trypsin inhibitor. Forty-four percent soybean meal is usually mechanically extracted to produce a meal of 44 percent crude protein; crude fat, 4.7 percent; and crude fiber, 6.0 percent. Forty-eight percent soybean meal is dehulled and solvent extracted to yield meal with a crude protein level of 48 percent; crude fat, 0.9 percent; and Soybean Meals .crude fiber, 2.8 percent

Cottonseed meal is produced in three protein levels. Cottonseed meals are classified as low gossypol if they contain less than 0.04 percent free gossypol. Forty-one percent cottonseed meal has a crude protein level of 41 percent; crude fat, 2 percent; and crude fiber, 12 percent. Forty-eight percent cottonseed meal has a crude protein level of 48 percent; crude fat, 1 percent; and crude fiber, 8 percent. Although all three cottonseed meals are solvent extracted, the lower protein meals may contain some .hulls

Blood meal is produced from clean fresh animal blood, exclusive of all extraneous material such as hair, stomach contents, etc. Blood meal may be dried by several processes, but most often by spray drying. Spray dried blood meal has approximately a crude protein level of 85 percent; crude fat, 0.5-3 percent; crude fibre, 2.5 percent; ash, 6 .percent; and lysine, 9-11 percent, with an availability of 80-90 percent

الإضافات ADDITIVES

المواد الاولية

"an ingredient or combination of ingredients added to the basic feed mix ...to fulfill a specific need." – " ...usually used in micro quantities and requires careful handling and mixing"

- Feed additives :
- Technological additives
e.g. preservatives, antioxidants, binders
- Sensory additives
e.g. Flavourings, colours
- Nutritional additives
e.g. Vitamins, trace elements, amino acids, urea
- Zootechnical additives
e.g. Digestibility enhancers, gut flora stabilisers,
favourably affect on the environment,
- others

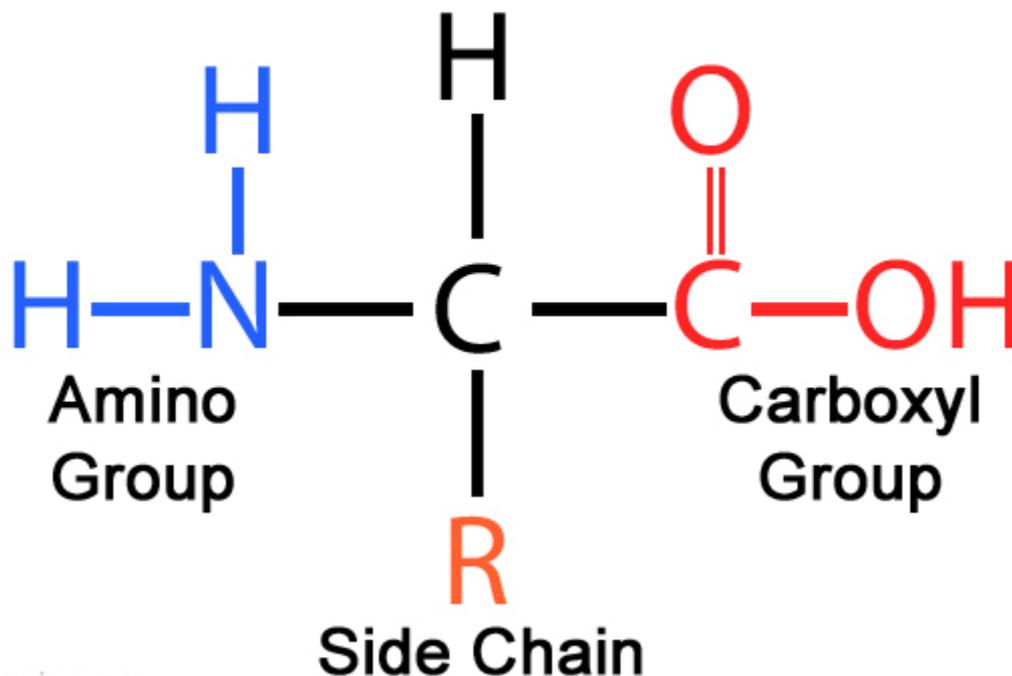
الإضافات الغذائية

FEED ADDITIVES

المواد الاولية

1. Amino acids
2. Fatty acids
3. Vitamins
4. Minerals

Amino Acid Structure



الإضافات غير الغذائية

Nonnutritive FEED ADDITIVES

المواد الاولية

1. Feed binders
2. Carotenoid supplements
3. Nonspecific Immune Stimulants
4. Probiotics & Prebiotics
5. Enzyme Supplements
6. Hormones
7. Antioxidants & Preservatives &
8. Fiber
9. Antibiotics
10. Flavorings and Palatability Enhancers

Nonnutritive Feed Additives

Nonnutritive feed ingredients are additives that are included in diets for reasons other than to provide nutrients. For the most part, these compounds have little or no nutritional value, yet they are important constituents of fish feeds, increasing pellet stability, diet safety, diet flavor, and animal and fish performance and health status and influencing the quality of the final product. Nonnutritive feed ingredients include

feed binders, carotenoid supplements, drugs and antibiotics, hormones, antifungals, antioxidants, fiber, flavorings, and water.

1- Pellet Binders

pellets strong enough to withstand normal handling and shipping without disintegrating. Moreover, fish feeds must be somewhat water-stable. There 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.