10. Fish meal as an ingredient in aqua feeds

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Fish meal is known as digestive feed ingredient of high quality in nutritional term. It is one of the favorable ingredients in feed manufacture for fish and shrimps. Fish meal contains ample amount of protein, lipid, mineral and vitamins. It is also applicable as high quality fertilizer of organic nature.

**Application of fish meal as an ingredient in diet of fish and shrimps**

- Fish meal is useful for conversion of small, bony and oily fish into byproduct which is not suitable for human consumption.
- Fish meal in aqua feed is helpful for enhancing the feed efficiency and growth as well.
- It enhances the uptake of nutrients.
- Balanced amino acid profile provides synergistic effects with other protein ingredients in the diet reducing the cost of feed manufacture.
- Balanced essential amino acid and fatty acid proportions in fish meal aid in growth, optimum development and reproduction in larvae and brood stock of fish and shrimps.
- Fish meal as one of the ingredients in aqua feed also helps in maintaining immune system functional.
- Fish meal in aqua feed is helpful in reducing the pollution from wastewater effluent by providing greater nutrient digestibility.
✓ Addition of fish meal in aqua feed imparts natural wholesomeness to the final product

**Quality of fish meal proteins**

High-quality fishmeal normally contains between 60% and 72% crude protein by weight. Typical diets for fish may contain from 32% to 45% total protein by weight, and diets for shrimp may contain 25% to 42% total protein. The percentages of inclusion rate of fishmeal in diets for carp and tilapia may be from 5-7%. Over-all protein digestibility values for fishmeal are consistently above 95%. Fishmeal contains certain compounds that make the feed more acceptable and agreeable to the taste (palatable). This property allows for the feed to be ingested rapidly, and will reduce nutrient leaching. It is thought the non-essential amino acid glutamic acid is one of the compounds that impart to fishmeal its palatability.

**Fish meal and lipid content**

The lipids in fishes can be separated into liquid fish oils and solid fats. Although most of the oil usually gets extracted during processing of the fishmeal, the remaining lipid typically represents between 6% and 10% by weight but can range from 4% to 20%. Fish lipids are highly digestible by all species of animals and are excellent sources of the essential polyunsaturated fatty acids (PUFA) in both the omega-3 and omega-6 families of fatty acids. The predominant omega-3 fatty acids in fishmeal and fish oil are linolenic acid, docosahexaenoic acid (DHA), and eicosapentaenoic acid (EPA).
**Energy in Fishmeal**

The lipids in fishmeal not only impart an excellent profile of essential fatty acids but also provide a high content of energy to the diet. Since there is very little carbohydrate in fishmeal, the energy content of fishmeal relates directly to the percentage of protein and oil it contains. The high digestibility of fish lipids means they can provide lots of usable energy.

**Fish meal minerals and vitamins**

Higher ash content of fish meal indicates a higher mineral content, especially calcium, phosphorus, and magnesium. Calcium and phosphorus constitute the majority of the ash found in fishmeal.

Nutrient content, high digestibility and palatability of fishmeal serves as the benchmark ingredient in aquaculture diets. In most recent years, aquaculture has used approximately 46% of the total annual fishmeal production. Optimal use of fishmeal in practical aquaculture diets is necessary to minimize feeding costs which can account for 40% or more of operating expenses.

New information on nutrient requirements of aquatic organisms coupled with advances in feed technology indicates that species-specific fish diets can be made by partial or total replacement of fishmeal with other plant and animal proteins. Plant based diets have been used successfully for juvenile fish growth but larvae and young ones still need fish meal for their growth.

Intensification in aquaculture resulted in increased demand for fish meal but fish meal market is volatile and prices often shoot up. The search for suitable and cost-effective alternative protein sources for use in industrial
aquafeeds will be the most critical factor in the development of intensive aquaculture in Asia.