



# Enhancing Aquaculture Nutrition: An Exploration of Feed Additives

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## ABSTRACT

Feed additives are one of the most important components that indirectly improve fish production by enhancing the quality, health and growth of fish. Vitamins, minerals, probiotics, amino acids, exogenous enzymes, antioxidants, antibiotics, essential fatty acids and pellet binders are some of the feed additives commonly used in aquaculture. These feed additives are used for various purposes such as preservatives, binders, feeding stimulants, growth enhancement and food colorants. The dosage of feed additives used in aquaculture varies depending on the life stages of the fish, the types of additives used and the types of species cultured. Government agencies and organizations ensure safety, environmental sustainability, and product quality using feed additives in aquaculture.

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## KEYWORDS

Ingestion, metabolism, supplement, digestability

## Introduction

Feed additives are compounds or molecules added in a trace amount to a diet to supply essential nutrients, facilitate growth, improve ingestion of feed, enhance feed colorants and preserve the nutritional value of the feed. Feed additives play a crucial role in aquaculture as they not only influence fish production but also the fish farmer's investment. The cost of feed is a significant expense for fish farmers in aquaculture. Feed additives, depending on

their type and purpose, can increase the overall cost of feed. Feed additives, such as enzymes and probiotics, can improve feed conversion ratios, which means that fish or aquatic organisms can convert feed into body mass more efficiently. This can result in cost savings for fish farmers, as they require less feed to produce the same amount of biomass. Also, the use of certain feed additives in aquaculture results in better quality and enhance the natural color appearance of fish which attracts more customer and boost the market value.

**Table: Different types of feed additives commonly available in the market**

Vitamins	Vitamin C (Ascorbic Acid), Vitamin D3(Retinol), Vitamin E(Tocopherol), Vitamin K3(Menadione)
Minerals	Calcium (Limestone, Calcium carbonate), Trace Minerals (Zinc sulphate, ferrous sulphate, copper sulphate), Potassium (Potassium chloride), Phosphorous (Dicalcium phosphate, monocalcium phosphate)
Amino acids	Lysine (LysiPEARL), Methionine (MetAMINO), Threonine (ThreoPEARL, Thrive), Arginine (ArgiPEARL)
Fatty acids	Fish oil, algae oil and Vegetables oils such as soybean oil.
Probiotics	<i>Bacillus subtilis</i> , Lactic acid bacteria (LAB), <i>Bacillus licheniformis</i> .
Prebiotics	Mannan Oligosaccharides (MOS), fructooligosaccharides (FOS), Inulin, Galactooligosaccharides (GOS)
Enzymes	Protease (Lypazyme, Lysolipase), Lipase (Lysolipase,Lipazyme), Amylase (Amylozyme), Cellulase, Phytase (phytex,PhytasePlus)
Antibiotics & Antimicrobial	Oxytetracycline, florfenicol, tetracycline and sulfonamides
Binders	Tapioca, wheat flour, rice flour, agar, carragenin
Feed colorants	Carotenoid supplement; astaxanthin and canthaxanthin

## **Types of feed additives**

Fish feed additives can be categorized into two main groups

1. Nutritive feed additives
2. Non-nutritive feed additives

### **1. Nutritive feed additives**

Nutritious feed additives are administered to feed mainly in order to enhance the dietary value of the feed and their extended absence in feed may induce deficiency disease. Some of the examples of feed additives are-

#### **1.1 Vitamins**

Vitamins are added to fish feeds to ensure that fish receive all the essential vitamins they need for growth, metabolism, and overall health. These vitamins can include vitamin C, vitamin D, vitamin E, and various B vitamins.

#### **1.2 Minerals**

Minerals like calcium, phosphorus, iron, magnesium, sodium, potassium, copper, chloride and iodine are included in fish feeds to support bone development, metabolic processes, and various physiological functions.

#### **1.3 Amino Acids**

Amino acid supplements are used to provide essential building blocks for proteins. This helps improve the protein quality and balance in the feed, which is crucial for fish growth and muscle development.

#### **1.4 Fatty Acids**

Essential fatty acids, such as omega-3 fatty acids, are added to fish feeds to promote proper growth, reproduction, and immune function. These fatty acids are frequently found in fish oils that are produced from

materials such as fish meal. To enhance growth, feed may also contain 1% of highly unsaturated fatty acids (HUFA), such as docosahexaenoic acid and eicosatetraenoic acid.

### **2. Non-nutritive feed additives**

Non-nutritive feed additives in fish feed serve purposes other than directly providing essential nutrients. They may enhance the overall performance, health, or production efficiency of the fish. Common examples of non-nutritive feed additives in fish feed include:

#### **2.1 Probiotics and Prebiotics**

Prebiotics are indigestible substances that encourage the formation of good gut bacteria, whereas probiotic supplements contain beneficial microorganisms (such as bacteria and yeast). Both are used to improve digestion, nutrient absorption, and disease resistance.

#### **2.2 Enzymes**

Enzymes are used to enhance the digestibility of feed ingredients. They break down complex nutrients into simpler forms, making it easier for fish to absorb essential nutrients.

#### **2.3 Antibiotics and Antimicrobials**

While their use is becoming more regulated and restricted due to concerns about antibiotic resistance and environmental impact, antibiotics and antimicrobial agents are sometimes used in aquaculture to prevent or treat bacterial infections.

#### **2.4 Binders**

It is employed to increase feed manufacturing efficiency, decrease feed waste, and/or provide a diet that is water-stable, meaning the feed won't crumble in water.

#### **2.5 Feed colorants**

Food colorant added to fish feed stimulates feed ingestion by improving feed visibility for fish or imparting a desired coloration within the carcass of the cultured fish.

### Conclusion

Using feed additives in aquaculture play a pivotal role in enhances feed nutritional value, palatability, and feeding stimulants and promoting overall health of aquatic organism. Feed additives, such as enzymes and probiotics, can improve the feed conversion ratios leading to a higher production at minimum cost invest on the fish feed by the fish farmers. It also improves fish growth and immune systems that ultimately leads to sustainable aquaculture.

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