Role of Acidifiers in Gut health management of Aquatic species

In aquaculture feed, the dietary supplementation of organic acids and their salts as growth promoters has been established. The use of acidifiers in aqua feed requires a different approach due to diversified feeding habits and wide variation in the digestive system structure and physiological function. Dietary organic acids can increase pancreatic enzyme production, decrease stomach pH levels, inhibit pathogens, provide energy, improve mineral utilization, and improve nutrient digestibility, all of which improve animal development performance.

How does it work?

Feed Palatability: Acidifiers enhance feed palatability and intake.

Nutrient Digestibility: The effects of short-chain organic acids go beyond the modification of gut microflora and other benefits, such as improved digestive enzyme activity, increased pancreatic secretion, enhanced development of intestinal epithelium, intestinal barrier integrity and absorption of minerals including phosphorus, magnesium, sodium, and calcium.

Growth: Dietary supplementation of organic acids, their salts, or mixtures of those could improve growth, feed utilization, disease resistance, and survival.

Effect in Gut: The morphological feature of the gut is an important factor that determines the mode of action of the acidifier. Both gastric and monogastric aquatic animals benefit from organic acids. Therefore, the diversity in the aquatic animal gut morphology complicates generalizing the effective dietary acidifiers and their optimum doses for all cultivable fish species; it varies from species to species. Organic acids and their salts exert their growth-inhibiting effects on stomach and gut microbes through pH reduction and anion and proton effects in the microbial cell. Moreover, small acids are lipophilic and can diffuse across the cell membrane of gram-negative bacteria. In the more alkaline cytoplasm, they dissociate, and the released protons will subsequently lower the internal pH value. pH reduction alters cell metabolism and enzyme activity, thus inhibiting the growth of intraluminal microbes, especially pathogens.

Immunity: Acidifier can improve the general health status of cultured aquatic animal by its stronger antimicrobial effect towards acid-labile gram-negative bacteria, such as *E. coli* and *Salmonella sps*, *Vibrio sps.* than acid tolerant *Lactobacilli sps.* Anti-inflammatory properties have been described and attributed to likely causes of enhanced performance when supplementing some of these organic acids particularly sodium or potassium salt of organic acids, especially potassium format or diformate low pH, the un-dissociated form of an organic acid is lipophilic and can passively diffuse through the cell wall of pathogenic bacteria and

mould. In the alkaline cytoplasm of bacteria, organic acids dissociate and lower the internal pH. This inhibits bacterial nutrient transport, cell metabolism and enzyme activity. Thus, inhibiting the growth and propagation of pathogens especially gram-negative bacteria in the aquatic animal gut but acid-tolerant bacteria like Lactobacillus spp. etc. remain unchanged or may even be enhanced in numbers through propagation. The molecule of organic acid also attacks the DNA of gram-negative bacteria causing its death. Though medium chain fatty acids (MCFA) like capric, caprylic and lauric acid exhibit strong antimicrobial effect both on gram-negative and gram-positive pathogens.

Commonly used Acidifiers in Aquaculture

1. Formic acid or calcium formate and potassium formate as their most important salts.
2. Acetic acid or its sodium salt sodium acetate
3. Propionic acid or calcium propionate; butyric acid or sodium butyrate
4. Lactic acid and citric acid, Malic acid, fumaric acid

Effect of acidifiers in feed

- Higher growth rate
- Increases protein digestibility
- Improved feed conversion ratio
- Improved immune response
- Better feed conversion ratio

Effect of Acidifiers on the Gastrointestinal Tract

- Reduce the pH of the gut.
- Improve the action of digestive enzymes.
- Improve nutrient absorption.
- Support the growth of beneficial bacteria so it promotes higher production of metabolites.

Role in Metabolism

- It can directly be absorbed by gastrointestinal tract by passive diffusion.
- Directly enter the citric acid cycle for energy production.

Summary

The concept of using dietary acidifiers in aquaculture has been successfully established since a decade ago. Acidifiers can be supplemented in the feed either as free organic acids or as their salts singly or in a blend (mixtures) of two or more than two organic acid salts with the

combination of other functional additives. But dietary supplemented organic acids or their salts can hardly reach to the distal part of the gut to exhibit their mode of action. Though diversified aquaculture
species demands different type of acid combination due to their different feeding habit, structural differentiation of GIT, wide variation of their habitat along with variations in physiological functions, but 3rd generation acidifier may be helpful for aquaculture. Next generation aquaculture also demands a specific blend of organic acids and functional feed additives, which can broadly be used for all species. This will be a researchable issue for the future, which needs the attention of aqua nutritionists. Effective use of acidifiers raises the hope for production of antibiotic free fish and shrimp products for the consumers.

About Skretting

Skretting is a global leader in providing innovative and sustainable nutritional solutions and services for the aquaculture industry working closely with shrimp and fish farmers. Skretting has 30 production facilities in 18 countries on five continents and manufactures and delivers high-quality feeds from hatching to harvest for more than 60 species. The total annual production volume of feed is more than 3 million tonnes. It is headquartered in Stavanger, Norway and it employs 4,000 employees. Its team of more than 140 employees is dedicated to Innovation that works on the core competencies of nutrition, feed production and health for aquaculture. In India, we have head office in Hyderabad and our manufacturing footprint in Surat, Gujarat.

About Santron

Santron is an innovative product from Skretting. Santron contains organic acids, butyrates, medium-chain fatty acids (MCFA), buffers, fatty acids, and aromatic oils that ensure digestion, inhibit the growth of pathogenic bacteria in the gut, improve the microbial balance in the intestine, boost gut wall integrity, and have high solubility and a slow release of lauric acid butyrate’s for suitable absorption and gut retention time.

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