

Feed Additives

Chemo - attractants and feeding stimulants

- These are substances that, induce feeding behaviour in animals and help to improve feed intake.
- Free amino acids and nucleotides are the most important ones.
- In general, a mixture of L-amino acid, glycine - betaine, inosine or inosine - 5 phosphate are considered as 'Universal feeding stimulants' for fish.
- Inosine and inosine phosphate are found in relatively high levels in finfish and invertebrate tissues. During spoilage of fish, inosine will get decomposed to inactive hypoxanthine.

- Squid, shrimp, clam, mussel and polychaete extracts are known to be excellent natural attractants and feeding stimulants for prawns and carnivorous fin fish such as sea bass and red sea bream.
- Artemia powder is an attractant for European sea bass and mussel meat for *Lates calcarifer*.
- Among individual amino acids, glycine and taurine were found to be attractants for *Penaeus indicus*.
- A mixture of L - amino acids, containing alanine, glycine, proline, taurine and betaine were found to be feed attractants for *Penaeus japonicus*.
- Trimethyl ammonium hydrochloride (TMAH) a volatile substance is also considered to improve feed intake in prawn.

Feeding stimulants identified for fish and prawn species

Sl. No.	Feeding stimulant	Fish / Prawn
1	Free L-amino acids present in all animal tissue	Rainbow trout, sea bass, European eel, Japanese eel
2	D-amino acids	Not effective
3	Glycine, L-proline and L- alanine mixture	Most effective feeding stimulant for European eel, Japanese eel and sea bass
4	Inosine and inosine-5' monophosphate	Specific feeding stimulants for turbot and krill

Sl. No.	Feeding stimulant	Fish / Prawn
5	Inosine 5' - phosphate plus L-amino acids	Yellow tail
6	Glycine-betaine	Red sea bream, Puffer fish
7	L-alanine, glycine, L-histidine, L-proline plus uridine 5' monophosphate	Japanese eel
8	L-alanine glycine, proline and taurine; betaine, TMAH	Prawns

Pigments

- Colour of fish and prawn is a very important characteristic affecting market price.
- Cultured animals should have the natural colour and appearance, as that of the wild ones.
- Carotenoids are the most important among substances which render colour.
- Fish and crustaceans can not synthesize the pigments, but can alter the molecules by oxidation.

- In the case of crustaceans, carotenoids have an important function in reproduction.
- Addition of carotenoids to brood stock diets resulted in shortening of the maturation period, an increase in egg numbers, enhanced hatchability of the eggs, and survival of the larvae.
- The carotenoids may also have a role in the immune system in helping prevent disease problems.

- Addition of 30-35 ppm astaxanthin improved pigmentation in *Penaeus monodon* after eight weeks, with light-brown and greenish brown individuals.
- Crustaceans and polychaetes are very good source of carotenoids.
- β - carotene and its oxidative derivatives - cryptoxanthin, zeaxanthin, canthaxanthin and astaxanthin are the preferred carotenoids; but their efficacy in improving colour differs markedly.

Anabolic agents

- In order to improve growth, the species must be either genetically manipulated or given a substance which will act pharmacologically to improve the metabolic or digestive efficiency, and to promote protein deposition and hence growth
- The most successfully used hormone for growth promotion in fish culture is 17 α methyl testosterone, which is effective in doses as low as 2 mg/kg diet.
- The other potential growth promoting hormones are thyroxine, insulin, triiodothyronine, growth hormone and recombinant bovine somatotropin.

- Addition of synthetic enzyme preparation containing amylolytic and proteolytic activity at levels of 0.01, 0.02 and 0.1 % improved the growth of carp (*Cyprinus carpio*).
- The antibiotic terramycin act as a growth stimulant in carp. Addition of 6000 to 10,000 units per kg of dry diet ensured an additional production of 5-15 %.
- Another antibiotic drug called monesin (inosphores) has been shown to promote growth in shrimp.

- Glucosamine, the chitin precursor, has been found to promote growth in prawns.
- Substances like zeolite (1-2%), thyroproteins and phytosterols (0.1%) are also suspected to improve growth performance.
- Enzymes, like papain at a level of 0.1 to 0.2% and bile salts 20 g / tonne of feed have shown to promote growth in prawns.

Miscellaneous additives

- Aspirin is used in tilapia fry (100 mg size) diet at a concentration of 1 g / kg feed, as an anti-stress factor before transferring the fry to seawater race-ways (34-36 ppt salinity).
- Sorbital (liver-health), glycerololeate (water-oil emulsifier), fish autolysate (anti-stress), carnitine (for better utilization of lipid), sodium polyphosphate (antioxidant, anti-viral effect), are some of the additives used in fish feeds.