

ROLE OF MINERALS IN AQUACULTURE

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Nutrition encloses the chemical and physiological process which provide nutrients for normal functioning of the body and maintaining homeostasis of the animal. Nutrition plays a major role in the increase in growth and survival, immunity, disease resistance, with the increased production in aquaculture stocking density also increasing parallelly to the production. Due to commercialisation in the aquaculture natural resources in the pond are not able to meet the nutritional requirements of culture organisms. In order to meet the nutritional demand of the organism, supplementary feeding is essential. In addition to the other nutrients, minerals play a major role in various functions of the aquatic organisms. Minerals play a pivotal role to establish minimum requirement and maximum tolerance for an element to secure optimal health and growth of living organisms.

Types of Minerals

Based on the requirement of the animal body minerals are classified into two categories namely

1. **Macrominerals:** These minerals are required in large quantities to the animal body.
2. **Trace minerals:** These minerals are required relatively in small quantities to the animal body

Macro Minerals	Trace Minerals	
Calcium	Zinc	Copper
Potassium	Iron	Selenium
Sodium	Arsenic	Chromium
Magnesium	Cobalt	Fluorine
Chlorine	Iodine	Manganese
Phosphorous	Molybdenum	Nickel
Sulphur	Silicon	Tin
	Vanadium	Aluminium

General functions of minerals

The general function of minerals and trace elements can be summarised as follows:

- Minerals act as cofactors in catalysts, enzyme activators and in metabolism.
- Minerals are important components of skeletal structures such as bones and teeth.
- soft tissues of the animal body consist of minerals
- Minerals play an important role in the transmission of nerve impulses and muscle contraction.
- Minerals play a vital role in the maintenance of pH of the blood and other body fluids
- Minerals play a key role in the homoeostasis and thus regulate the exchange of water and solutes within the animal body.

Biological role of minerals and their deficiency symptoms

Mineral	Biological function
Macrominerals	
Calcium	<ul style="list-style-type: none"> • Essential for of blood clotting, muscle functions formation of bone, cartilage and exoskeleton of crustacean • Essential for enzymes and plays an important role in enzyme activation • An important role in membrane permeability
Phosphorous	<ul style="list-style-type: none"> • Inorganic phosphate's play an important role in pH balance of animal fluids • An important component of Nucleic acids, Phospholipids and several enzymes • Essential for formation of bone, cartilage, and exoskeleton of crustacean • Key role in metabolism and cell energy
Magnesium	<ul style="list-style-type: none"> • Essential for formation of bone, cartilage, and exoskeleton of crustacean • Key role in enzyme activation, nerve irritability, muscle contraction • Intracellular pH balance
Sodium	<ul style="list-style-type: none"> • Main monovalent ion of intracellular fluids • Essential for osmotic balance and acid-base balance • Absorption of carbohydrate

- Potassium**
- Major intracellular cation
 - Essential for glycogen and protein synthesis
 - Essential for osmotic balance and acid-base balance
 - Essential for breakdown of glucose
- Chlorine**
- The major monovalent anion of extracellular fluids
 - Important role in the carrying of oxygen and carbon dioxide in the blood, and the maintenance of digestive juice pH.
 - Essential for osmotic balance and acid-base balance
- Sulphur**
- An important component of vitamins like cysteine and methionine
 - Component of vitamins
 - Detoxification of aromatic compounds

Trace minerals

- Iron**
- Oxygen and electron transport
 - Component of respiratory pigments and enzymes essential for tissue oxidation
- Zinc**
- Component of metalloenzymes
 - Key role in the production and metabolism of RNA
 - Cofactor of many enzymes
 - Wound healing
- Manganese**
- Acts as an enzyme activator for the enzymes that mediate phosphate group transfer
 - Essential for bone formation, regeneration of RBC and reproductive cycle
 - Component of the enzyme pyruvate carboxylase
- Copper**
- Component of a number of oxide reduction enzymes
 - Involved in iron metabolism
 - component of enzyme caeruloplasmin
 - Mandatory for melanin formation and purity of myelin sheath in nerve fibres
- Cobalt**
- Component of vitamin B12
 - Necessary for blood cell formation and conservation of nerve fibres
- Iodine**
- Necessary for balancing the metabolic rate of all body processes
 - Component of enzymes thyroid hormones (Thyroxine and Tri-iodothyronine)
- Selenium**
- An important role in the retention of Vit-E and component of the enzyme glutathione peroxidase
 - Biosynthesis of coenzyme Q involved in cellular electron transport

(ubiquinone)

- Protect cellular membranes and tissues against oxidative damage

Chromium

- Pivotal role in carbohydrate metabolism, cholesterol and amino acid metabolism.
- Cofactor for insulin
- Crucial role in nutritional and physiological responses on fish.

Fluorine

- Fluorine Intoxication
- Hardenong of exoskeleton.

Common symptoms of mineral deficiencies

- Hard tissue mineralization
- Reduced growth and feeding efficiency
- Softshell problems in crustaceans and skeletal problems in Fishes
- Anaemia, tetany and muscle dystrophy

Role of minerals in Aquaculture



Some of the Mineral mixtures commercially available in the market



Conclusion

In Aquaculture, minerals play a more role in the well-being of the cultured species. So, it is necessary to monitor the mineral supplements required for the culture species. The ratio and proportional of the minerals should be known properly. It is also important that the mineral supplements should be given in proper ratio. Failing to do so might affect production efficiency, species health, End production quality.

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