

# **ROLE OF MICROORGANISMS IN AQUACULTURE**

# INTRODUCTION

- ❑ Microorganisms have major roles in pond culture, particularly in the:
  - Productivity
  - Nutrient cycling
  - Water quality
  - Disease control
  - Environmental effluent management.
  
- ❑ It is the most important to differentiate ecology of microbes from microecology.
  
- ❑ Ecology of microbes means microbial population, communities, diversity biomass and their interrelationship with the impact of environment.
  
- ❑ It occupies an important place in ecology in water and sediments.
  
- ❑ whereas beneficial microorganisms degrade pollutants inhibit or kills harmful microbes by antagonism, purify water bodies and reach eco equilibrium in water.



# CLASSIFICATION OF MICROORGANISM

Reviving

Neutral

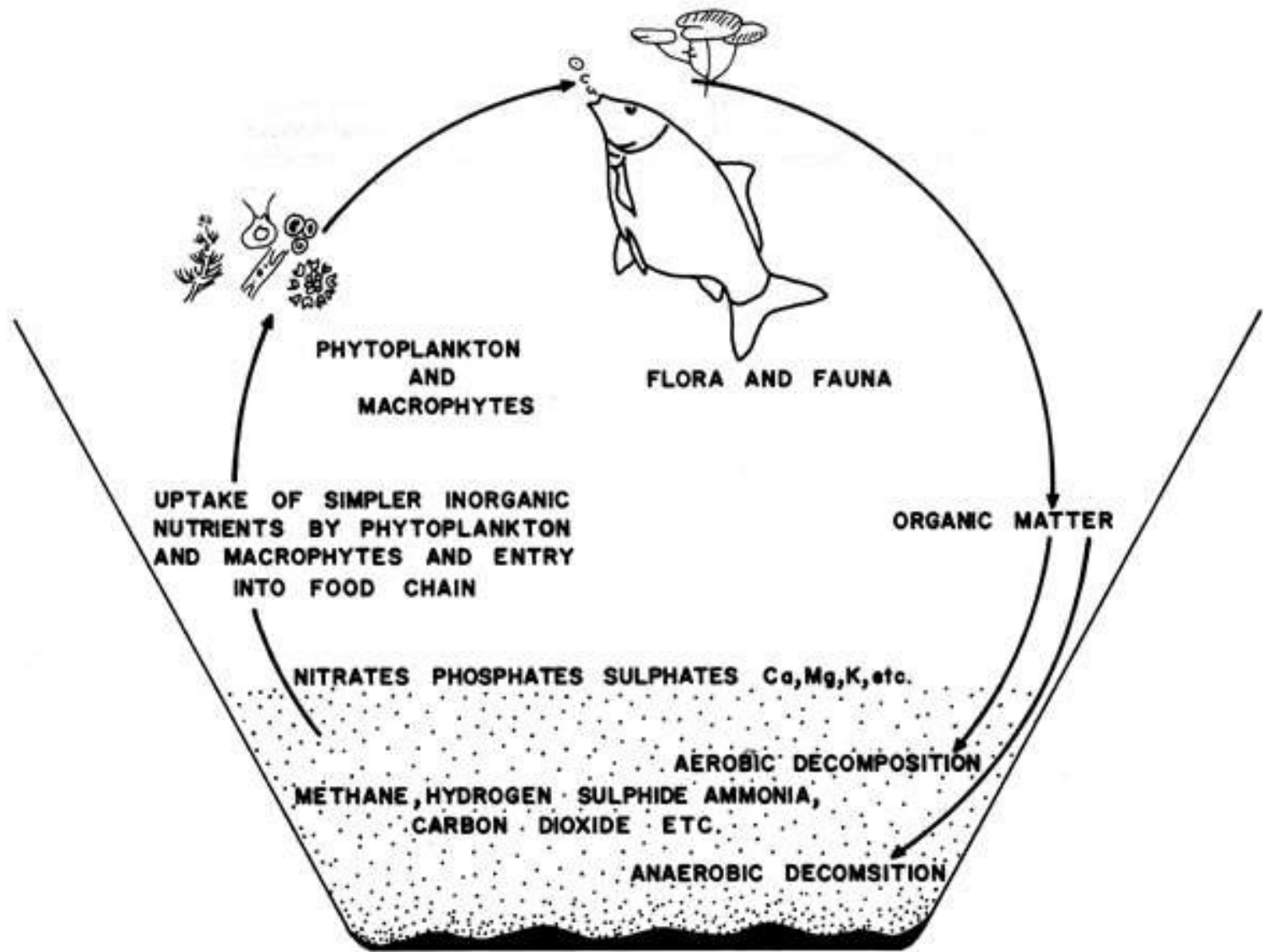
Disintegrating



# MICROBIAL PROCESSES

- ❑ The food webs in ponds is complex with feed pellet input and sediment water interaction affecting the algal bloom development, water quality and ultimately fish/prawn growth rate.
- ❑ Heterotrophic bacteria: Consume oxygen and release carbon dioxide while oxidizing organic matter.
- ❑ Autotrophic bacteria: Consume oxygen and carbon dioxide while oxidizing ammonia, nitrite or sulphide.





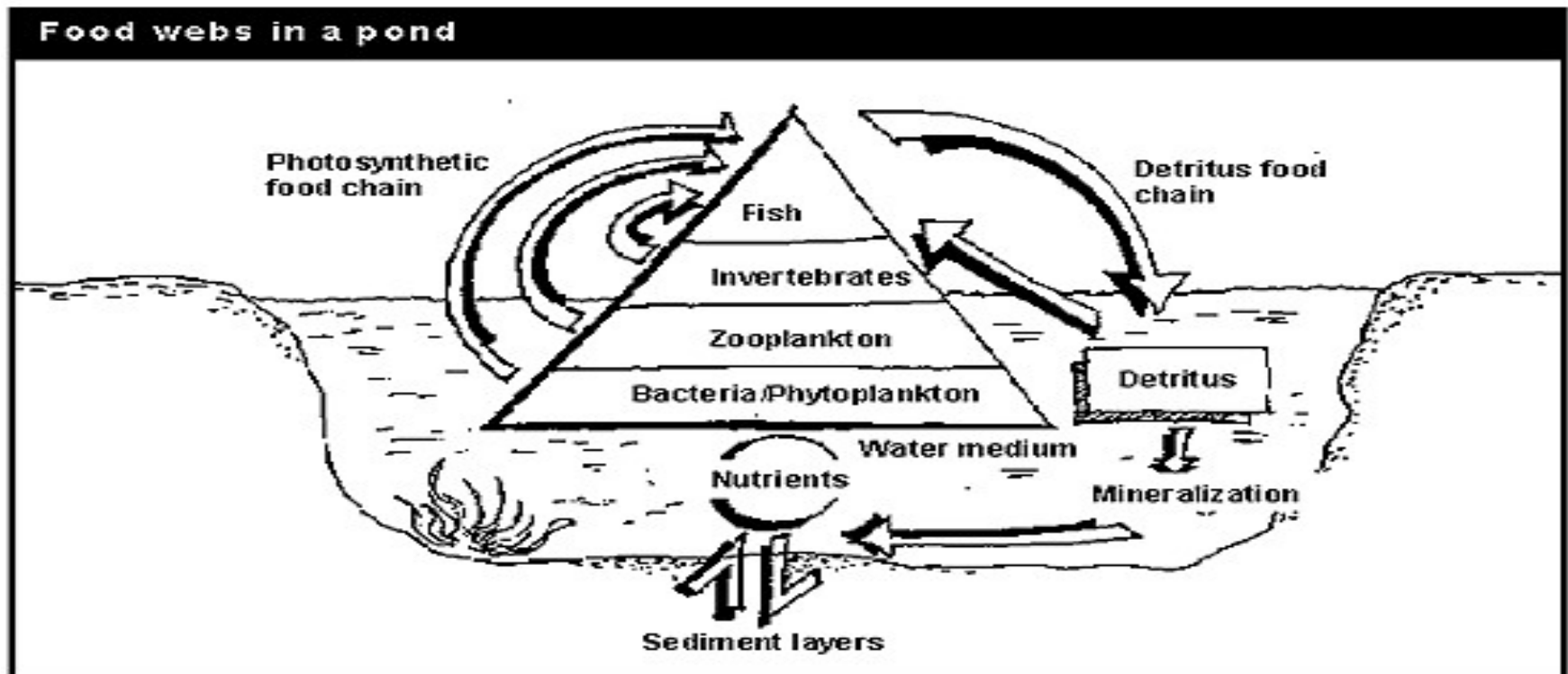
# ROLE OF BENEFICIAL MICROORGANISM IN AQUATIC ECOSYSTEM

- ❑ Microbes include microalgae, bacteria, fungi and virus.
  - Microalgae: Its mainly photosynthesize to absorb carbon dioxide and to supply oxygen in aquatic animal.
  - Bacteria and fungi: To decompose organic matter and keep the water clean.
  - Microbes are the predominant photosynthetic organism in most aquatic environment.
    - In aerobic condition algae, diatoms and cyanobacteria predominant.
    - In anaerobic conditions other photosynthetic bacteria are dominant.



# FUNCTIONS OF BENEFECIAL MICROORGANSMS

- ❑ Now a days, beneficial microorganisms are applied in aquaculture and mariculture mainly in the form of single strain, multiple strain with some synergists.
- ❑ The beneficial microorganism perform their function on two aspects:
  - To raise the health level of host
  - To promote the proliferation of beneficial microorganism and their metabolic product in microecology



# IN SOIL QUALITY MANAGEMENT

- ❑ During pond preparation nutrients added to pond in the form of fertilizer manures and feeds cause phytoplankton bloom that increase the concentration of suspended organic particles.
- ❑ Organic matter settles to the bottom and is decompose by microorganism.
- ❑ Metabolic products of aerobic decomposition are Carbon dioxide, water, ammonia and other nutrients.
- ❑ In anaerobic sediment some microorganism decompose organic matter by fermentation reactions that produce alcohols, ketons, aldehydes.





# CARBON CYCLE IN AQUACULTURE POND

□ Carbon is the basic building block of all organic matter and fixation of organic carbon in plant photosynthesis is the ultimate source of organic carbon for nearly all living organisms.

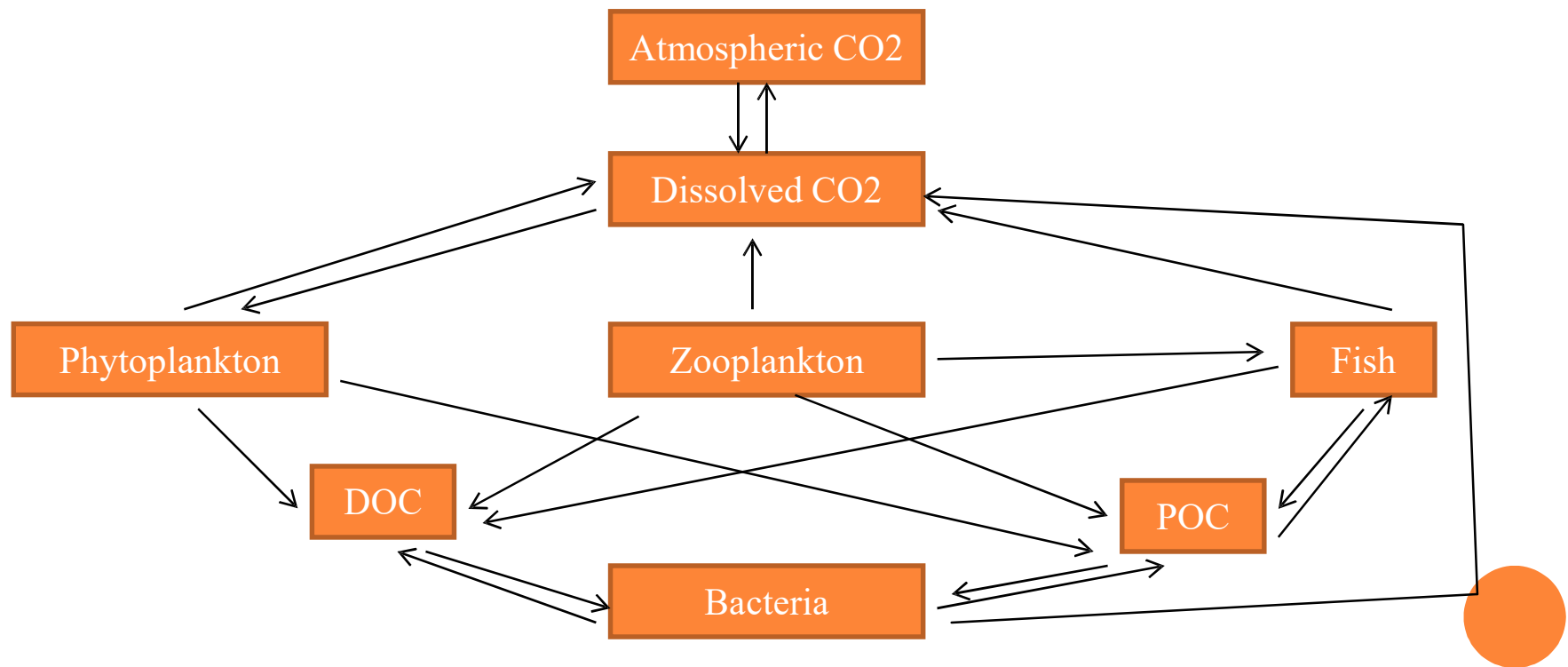
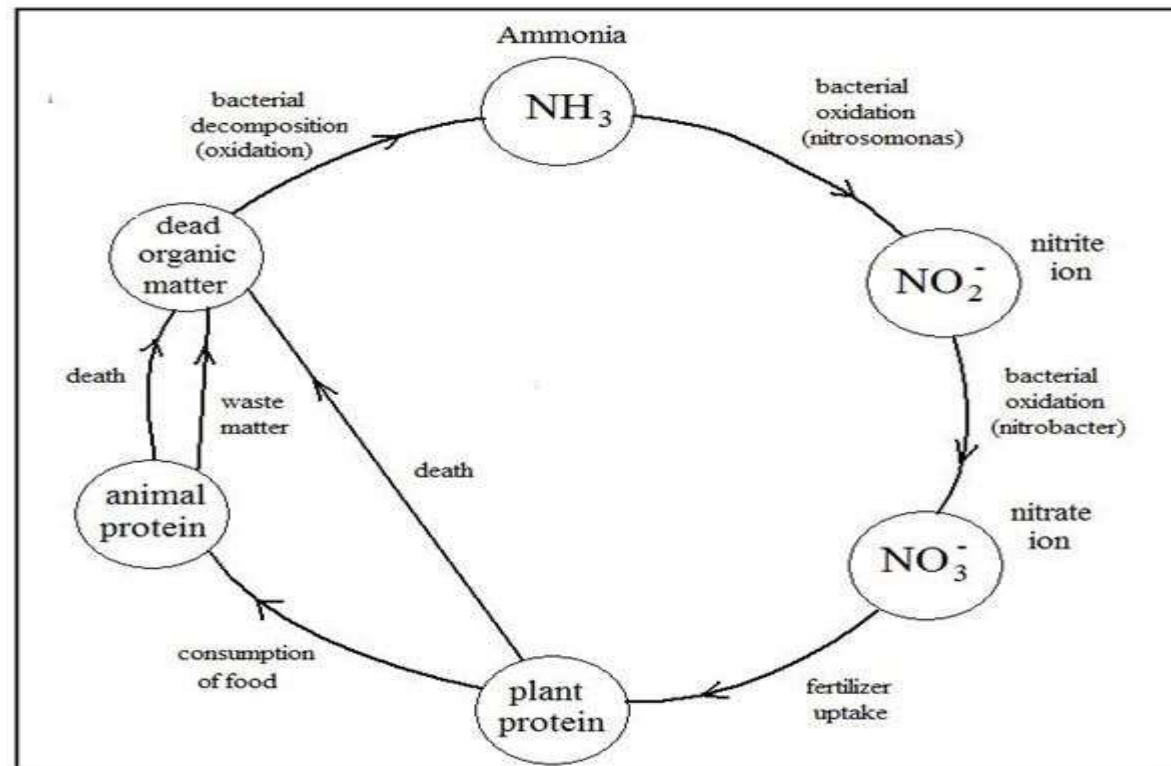


Fig: Carbon cycle in culture pond.

Where, DOC= Dissolve organic Carbon, POC= Particulate organic carbon

# NITROGEN CYCLE IN AQUACULTURE POND

- ❑ Nitrogen is a major nutrient affecting the productivity of aquatic ecosystem because it is an essential component of protein and other constitute of celluler protoplasm.
- ❑ The nitrogen in animal waste may contribute to the development of excessively high phytoplankton standing crops and may lead to the accumulation of nitrogen containing compounds.



# USE OF PROBIOTICS IN AQUACULTURE POND

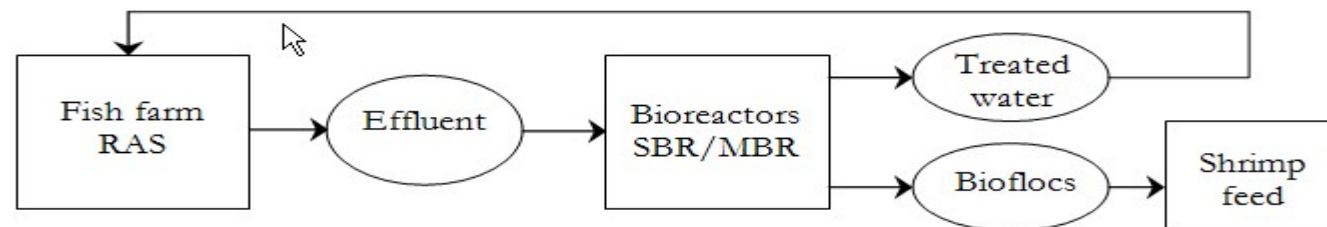
- ❑ Live microbial feed supplement which beneficially affects to the host animal by improving its intestinal microbial balance.
- ❑ Most probiotics used in aquaculture belong to the LCB of the genus *Bacillus*, to the photosynthetic bacteria or to the yeast.
- ❑ The benefits of the supplements include improve feed value, enzymatic contribution to digestion, inhibition of pathogenic microorganism, antimutagenic and anticarcinogenic activity, growth promoting factor and increase immune response.
- ❑ Use of bacillus species improved water quality, survival, growth rates and the health status of juvenile *Penaeus monodon* and reduce the pathogenic vibriosis.



# BIOFLOC TECHNOLOGY IN AQUACULTURE

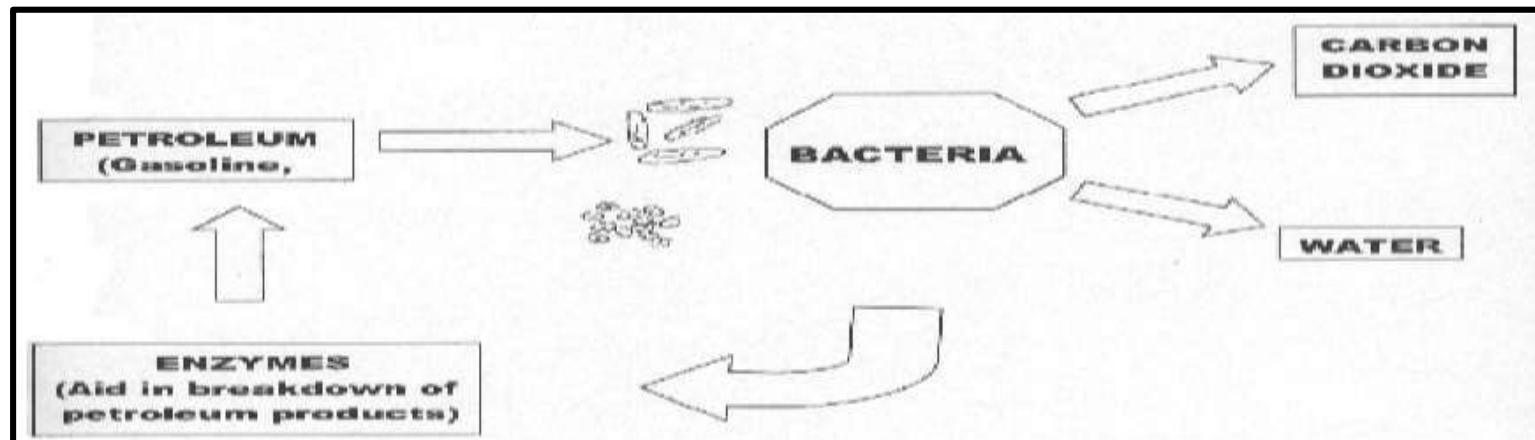
- ❑ The Biofloc is a protein rich macro aggregate of organic material and micro-organisms including diatoms, bacteria, protozoa, algae, fecal pellets, remains of dead organisms and other invertebrates.
- ❑ Biofloc technology is a technique of enhancing water quality in aquaculture through balancing carbon and nitrogen in the system.
  - The technology has recently gained attention as a sustainable method to control water quality, with the added value of producing protein rich feed in situ.
  - Biofloc technology has become a popular technology in the farming of Pacific white shrimp, *Litopenaeus vannamei*.
  - It is possible that this microbial protein has a higher availability than feed protein.

FIGURE 1. Biofloc technology process diagram.



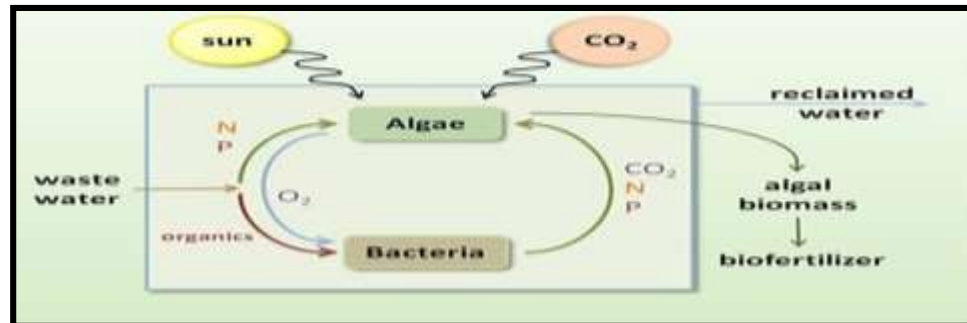
# BIOREMEDIATION

- ❑ Bioremediation has been recognised as an inexpensive, effective and eco-friendly, safe technology that offers new and innovative ways to clean up hazardous waste.
- ❑ This is a tool that can be used for the abatement of pollution resulting from a variety of compounds, biodegradable as well as recalcitrant.
- ❑ Though bacteria and other microbes are natural source of bioremediations tools.
- ❑ The most applicable one could be phytoremediations, especially with reference to aquatic pollution abatement.
- ❑ Phytoremediation work best at sites with low to medium amount of pollution and at sites contaminated with metals and nutrients.



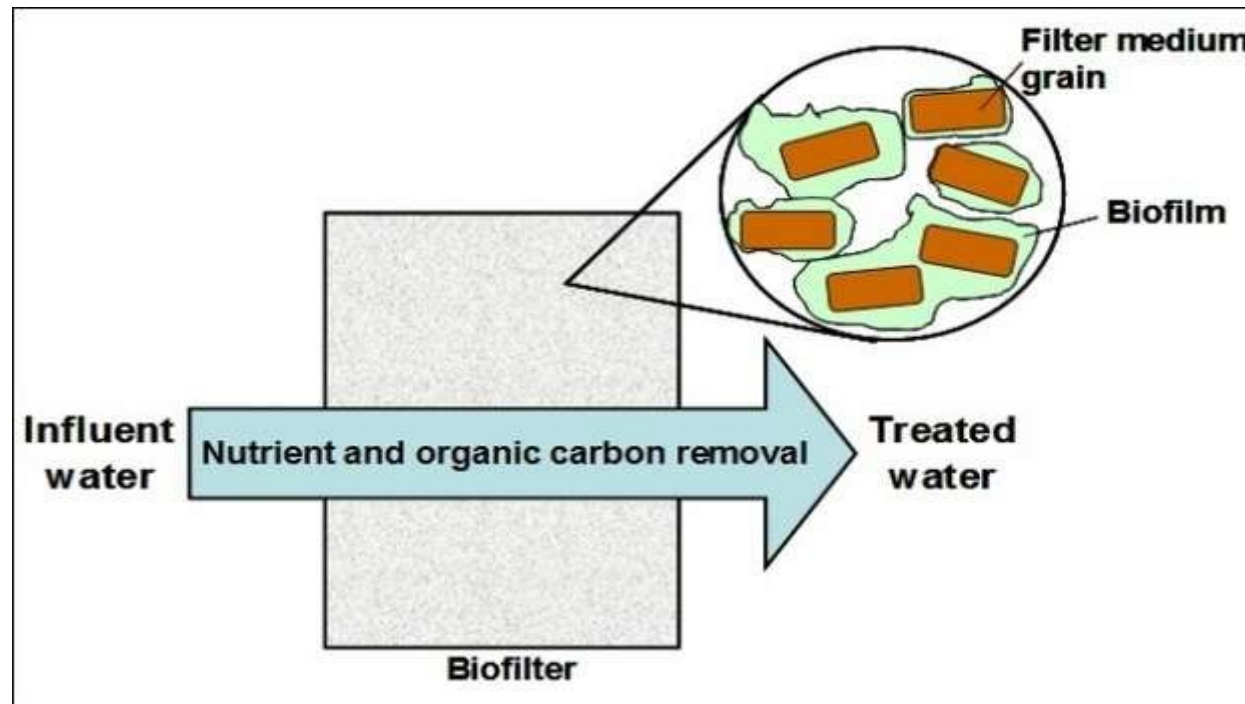
# MICROBIAL BIOFERTILIZER FOR AQUACULTURE

- ❑ Nitrogen makes one of the key nutrients for aquatic productivity so for as aquaculture is concerned.
- ❑ Certain bacteria and blue green algae can use atmospheric nitrogen and fix it to themselves.
- ❑ Phosphorus is next only to nitrogen in its overall importance as a nutrients in aquaculture.
- ❑ The irresponsible use of chemical fertilizers renders many aquaculture habitates.
- ❑ Phosphate producing bacteria and phosphate solubilizing bacteria can bring about the mineralization and solubilization of organic and inorganic phosphate compound in sediment and release orthophosphate from them.



# BIOFILTERS FOR AQUACULTURE

- ❑ Environmental stresses cause diseases, retard or check growth and affect feed intake or assimilation of aquatic animals in aquaculture system.
- ❑ In aquaculture oxygen deficiency, carbon dioxide and ammonia build ups are the main source of the environmental stress.
- ❑ Chemolitho-autotrophic ammonia oxidising bacteria are responsible for the rate limiting steps of nitrification in a wide variety of environments including aquaculture.



# PROBLEMS AND PROSPECTS

- ❑ There are several problems in the application of beneficial microorganism in aquaculture and mariculture:
  - Farmer do not distinguish microecology from the ecology of microbes.
  - How apply effective microorganisms.
  - The most important problem is that we know very less about the microbes so that research on microbes should be dependent worldwide.
- ❑ The present status of the utilization of beneficial microorganisms cannot meet the demand of cultured aquatic animals and water environment requirements.
- ❑ Harmful microorganism become dominant if condition develop that are favourable to their growth, activity and reproduction.







**THANK  
YOU !**