

Sewage Fed Fish Culture



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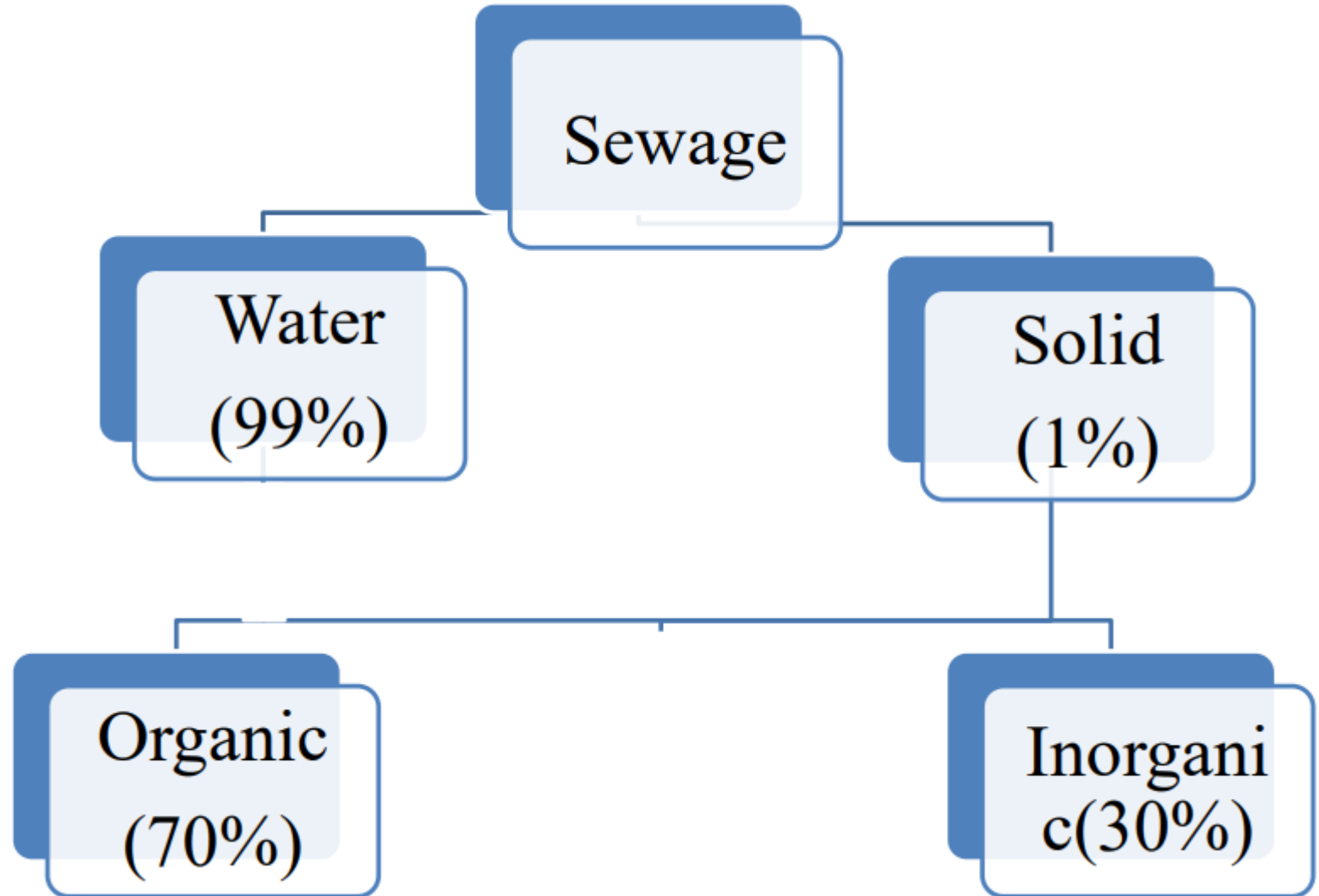
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SEWAGE?

- Sewage is defined as a cloudy fluid arising out of domestic, municipal and industrial waste, containing mineral and organic matter in solution or having particles of solid matter floating, in suspension, or in colloidal and pseudo-colloidal form in a dispersed state.
- Sludge differs from sewage in that it is the solid portion of waste and does not include fecal matter urine.

Composition of Sewage



PHYSICO-CHEMICAL CHARACTERISTICS OF SEWAGE

pH	6.8-7.8
CO ₂	10-140 ppm
Dissolve O ₂	almost nil to traces
Total alkalinity	170-490ppm
BOD	100-500ppm

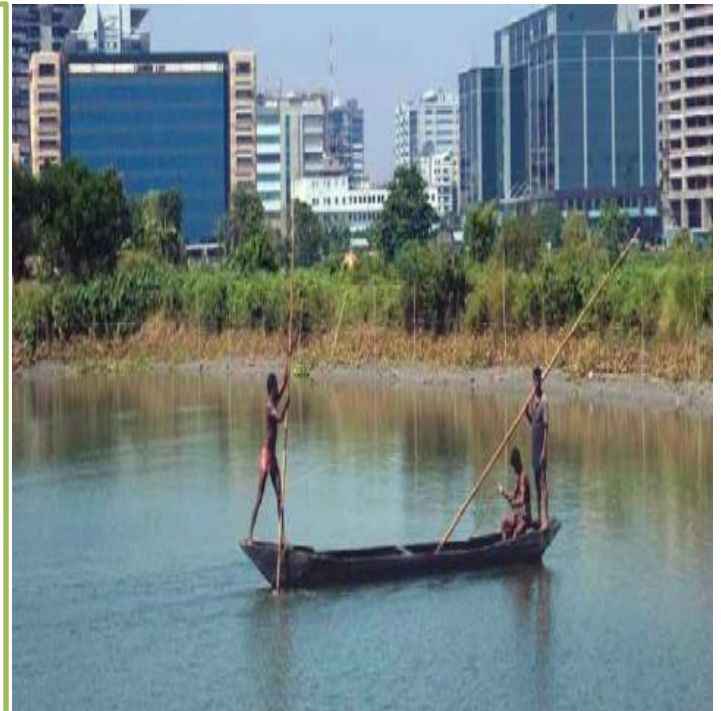
- Domestic sewage has been reported to contain about 250 – 400 ppm of organic carbon and 80 – 120 ppm of total nitrogen.
- Thus giving the C:N ratio of around 3:1.
- Industrial sewage may contain more organic carbon and hence may have a higher C: N ratio.
- Nitrogen in sewage is present partly as organically bound element and partly as ammonical nitrogen.

History of Sewage Fed Fish Culture

- The fish farmer of Kolkata developed a unique technique of utilization of domestic sewage for fish culture long back in 1930s.
- The early inspiration of utilizing the sewage for fish culture emerged from the waste.
- Stabilization pond used as water source of vegetable fields.
- This technique is considered to be the largest operational system in the world to convert the waste in consumable product.
- The growing fish demand of the metro city Kolkata is widely met by this technique.

Present Status of Sewage Fed Fish Culture

- In the course of time the area under sewage-fed fish culture reached up to 12,000 ha.
- But recently due to rapid and indiscriminate urbanization it has come down to 4,000 ha.
- Resulting in crisis of livelihood of rural people.
- There are appeals to Government to declare the existing sewage-fed aquaculture area as sanctuaries.



1. Primary treatment

- This is mostly the physical removal of solids by mechanical means.
- The solid material is removed by screening (for larger coarse particles), skimming (for floating solids) and sedimentation (for suspended particles whose density is greater than that of liquid) techniques.

2. Secondary treatment

- Soluble organic and inorganic matter, namely the carbohydrates, proteins, fats, hydrocarbons and other nitrogenous materials which are degraded mostly biologically, using microorganisms into the smaller constituents i.e. CO_2 , H_2O , NO_3 , NO_2 , SO_4 , PO_4 etc. which can be easily disposed.
- Some times chemical and physical removals of substances are combined with this to increase the effectiveness.
- There are three basic methods for secondary treatments:
 - *Activated sludge (flocculation)*
 - *Biological filtration*
 - *Waste stabilization*

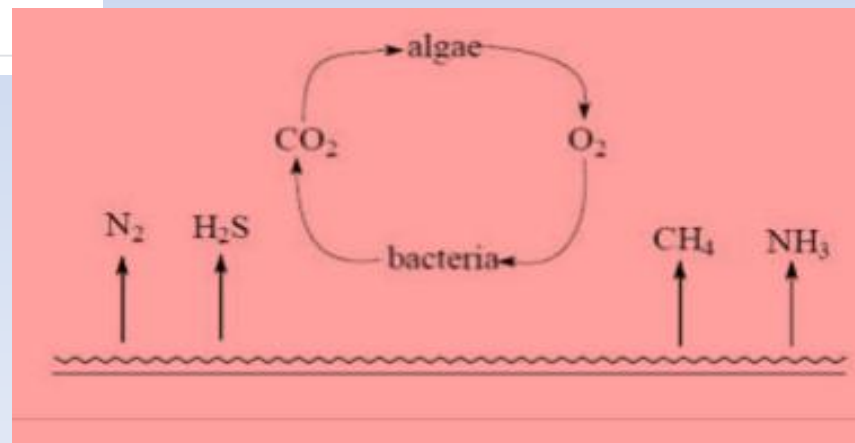
3. Tertiary treatment

- This is biological and chemical removal of soluble products of partial or complete oxidation.
- For example, removal of NO_3 , NO_2 , SO_4 , PO_4 etc.
- Physical or chemical removal of refractory organic or other substances which may be unpleasant and even toxic. Chemical treatment comprises of :
 - (a) Coagulation or chemical precipitation (e.g. by alum)
 - (b) Deodorization (by Cl_2 , FeCl_3)
 - (c) Disinfections or sterilization (by Cl_2 , CuSO_4 , liming etc.).

Oxidation Pond

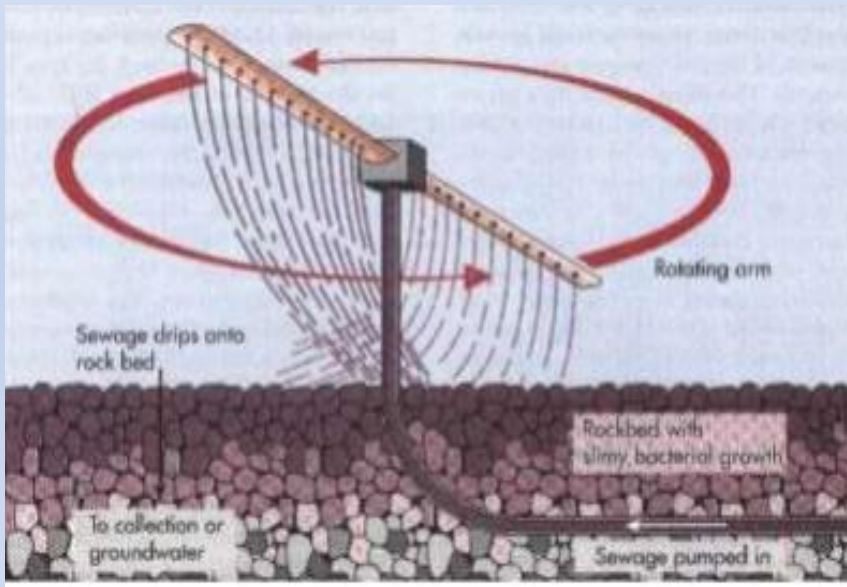
Importance: Organic matter contained in the waste is stabilized and converted in the pond into more stable matter which find their way into effluents.

Function: A conventional oxidation pond contain the algal bacterial culture, which oxidizes the organic matter into CO_2 , H_2O , H_2S , NH_3 and other decomposition products that are used as nutrients like nitrate, nitrite, phosphate

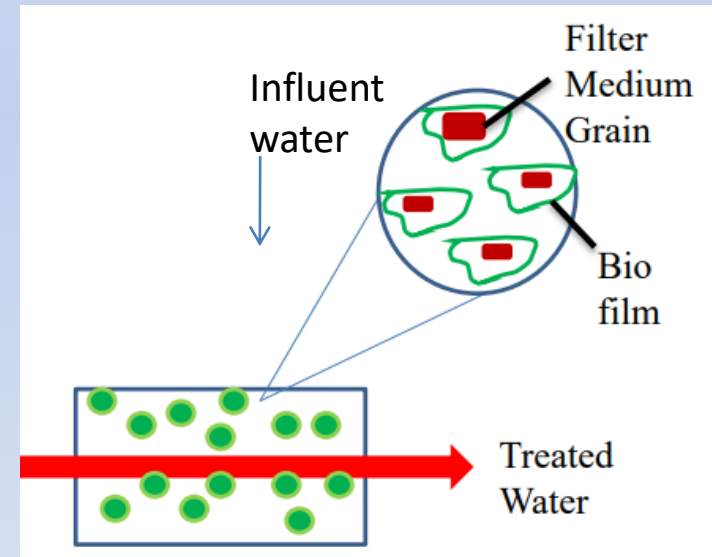


Filtration

There are two types of filtration process, viz., mechanical filtration and biological filtration such as trickling filter which uses filter medium grains covered with biofilm.



Trickling Filter



Nutrient and organic carbon removal through biological filter

The process generally adopted for the use of sewage treatment before release in fish ponds

Sedimentation

Dilution

Storage

Technologies adopted by farmers

- The sewage fed ponds are locally known as ***BHERIES***.
- These are the ponds of different sizes, which can be as big as 40 ha.
- The ponds are shallow with a depth ranging from 0.5 to 1.5 m.
- Generally the culture practice includes five phases:
 1. Pond preparation.
 2. Primary Fertilization.
 3. Fish stocking.
 4. Secondary fertilization (Periodic)
 5. Harvesting of fish.

Pond Preparation



1. Sewage fed ponds are pumped out to dry



2. Drying of pond during winter months



3. Bamboo sluice & dikes are repaired

Primary Fertilization

- After pond preparation, sewage is passed in to the pond from the feeder canal through bamboo sluice. It is left to stabilize for 15 – 20 days.
- The self-purification of sewage takes place in presence of atmospheric oxygen and sunlight.
- When the water turns green due to photosynthetic activity, the pond is considered ready for stocking.



Allow sewage flow in pond through open channel

Fish Stocking

- All the species of Indian major carps e.g. *Labeo rohita* (Rohu), *Catla catla*, *Cirrhinus mrigala* (Mrigal) and Exotic carps e.g. *Hypophthalmichthys molitrix* (Silver carp), *Ctenopharyngodon idella* (Grass carp), *Cyprinus carpio* (Common carps) are preferred to be stocked but the percentage of Mrigal is kept greater and that of exotic carps is lesser.
- The popularity of Talapia and fresh water prawn, *Macrobrachium rosenbergii* is increasing these days.
- *Pangasius hypophthalmus* is also stocked by some farmers to get rid of mollusks.
- As the sewage contains high content of nutrient, the farmers keep very high stocking density, i.e. 40,000 to 50,000 fingerlings/ha.



Seed Stocking

Secondary Fertilization

- After stocking, sewage is taken in ponds throughout the culture period at regular intervals @ 1– 10% of the total water volume of the pond.
- In bigger ponds, water level is maintained by continuous inflow and out flow.
- The requirement of sewage is determined by observing the water colour, transparency, temperature and depth.

Feeding of stocked fishes

- Due to high contents of nutrients in sewage, the cultured fishes don't require at all any supplementary feeding.
- However, occasionally, especially in rainy season when the potential sewage is lacking, they are fed with supplementary feed.

Health care of fishes

- The fishes are most vulnerable to bacterial diseases, but surprisingly the occurrence of bacterial or any other disease is not common in sewage-fed fish farms.
- Even when EUS was prevailing in past years in other areas, the sewage-fed ponds were uninfected.
- However, parasitic infections by *Lernea* (Anchor worm) and *Argulus* (Fish lice) are common but they are not given any proper treatment.
- There is a need to develop a technique to keep these problems aloof.

Harvesting

- The *BHERI* farmers have evolved rotational cropping system to maintain the supply to the market.
- Fishes are stocked and harvested throughout the culture period leading to periodical stocking and regular harvesting.
- After completion of one phase, fishes are restocked @ 1 Kg fingerlings per 5 kg harvested fish.
- Another harvest phase starts after 15days of restocking.
- Generally, drag nets are used for harvesting by encircling technique.
- Some fishes like Tilapia and Common carp require hand picking technique for their harvesting.
- Specialized fishermen are employed in fishing.