

SEWAGE FED FISHERIES



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INTRODUCTION

Sewage is a water-carried waste. This word is descended from old French word “assewer” derived from the Latin “to drain out”.

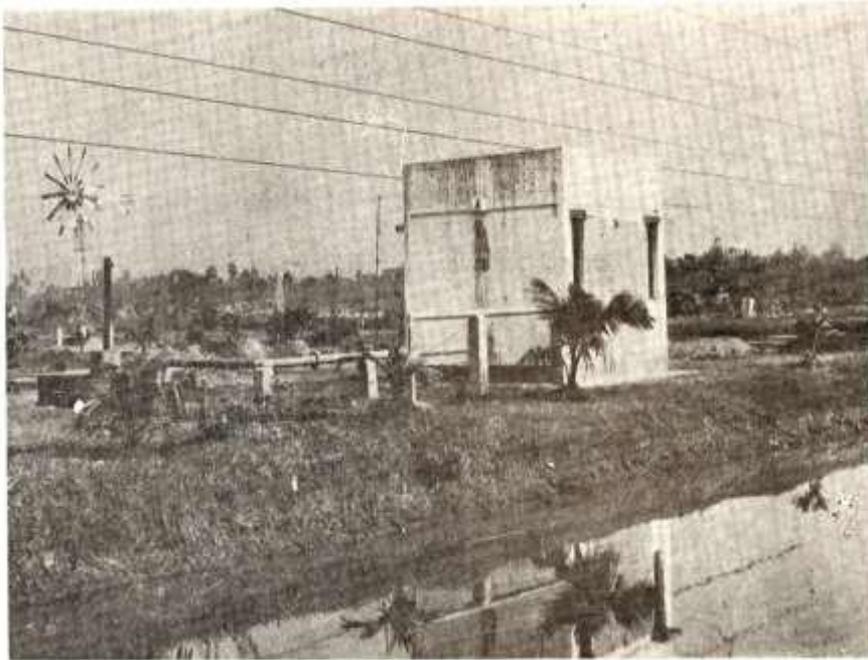


Fig.1 Pump house for supplying sewage to individual pond of the sewage – fed farm of CIFRI.



Fig. 2 Pumping stations transfer sewage from Kolkata City to East Kolkata Wetlands.

COMPOSITION OF SEWAGE

Sewage may vary considerably in composition and strength from place to place depending upon

1. different dietary habit of the people,
2. composition of trade waste and
3. water consumption Δ

There is also variation in composition between domestic and industrial sewage.

Domestic sewage contain about 250-400ppm of organic Carbon and 80-120ppm of total Nitrogen thus making C:N ratio of around 3:1.

Industrial sewage may contain more organic carbon and hence may have a higher C: N ratio.

(a)



(b)



Fig.3 (a and b) Industrial waste water polluting water bodies.

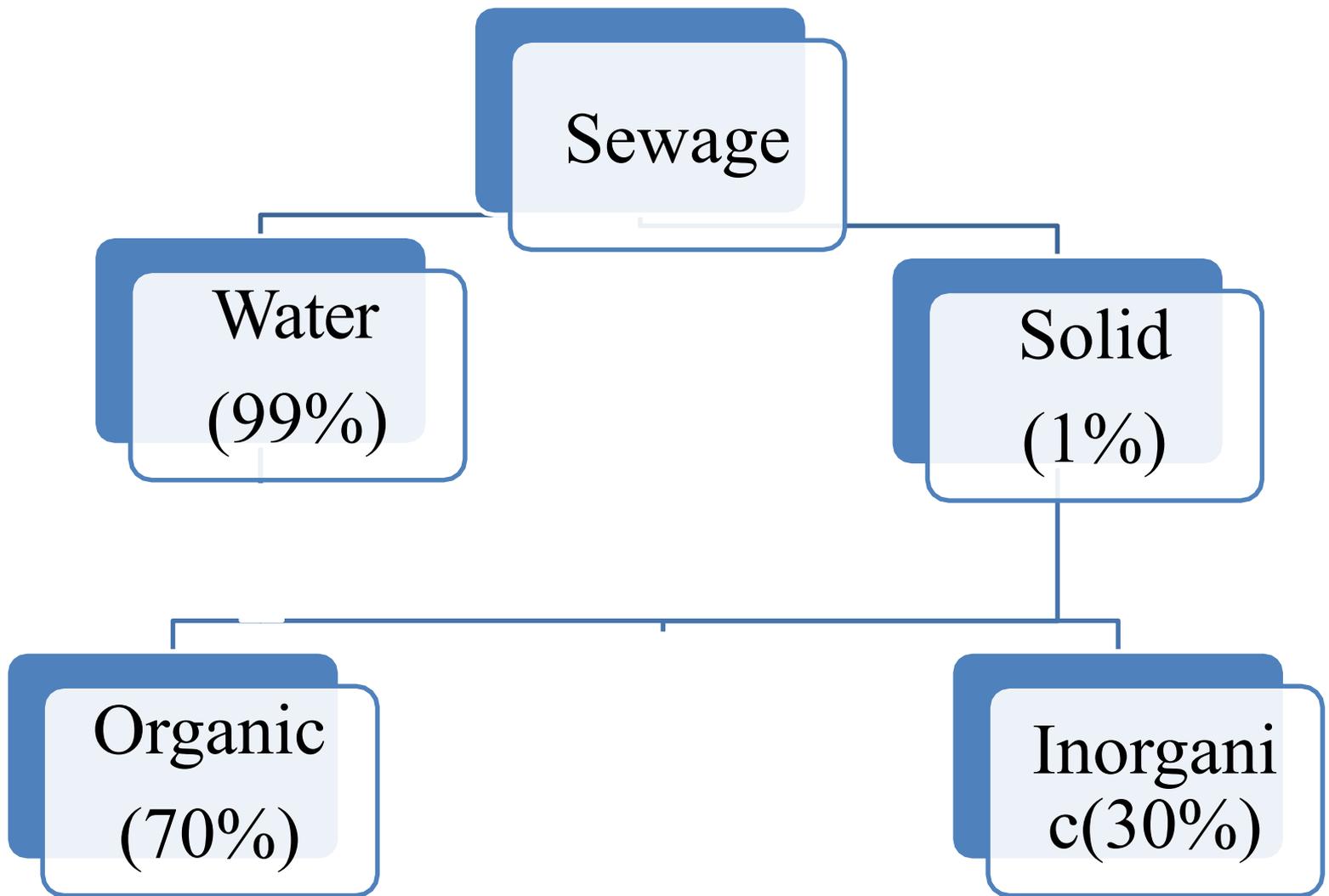


Fig. 4 Component of sewage

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

HISTORY OF SEWAGE FED FISH CULTURE

This technique was first developed in Germany and independently in Kolkata in 1930s.

The use of sewage for fish culture is now practiced in Indian states like Bihar, Madhyapradesh, Maharashtra and in countries like Poland, Hungary, Israel, Indonesia and Peru△

PRESENT STATUS OF SEWAGE FED FISH CULTURE

In the course of time the area under sewage fed reached up to 12,000ha. But recently due to rapid and indiscriminate urbanization it has come down to 4,000ha.



Fig. 5 Heavily urbanized wetland periphery is a major management challenge.

WASTE WATER TREATMENT

Primary treatment

Removal of solid particles by i) screening (for larger coarse particles)

ii) skimming (floating solids) iii) sedimentation (for suspended particles whose density is greater than that of liquid).

Secondary treatment-

Removal of organic and inorganic soluble matter namely carbohydrate, proteins,

fats, hydrocarbons and other material which are degraded into smaller forms like CO_2 , H_2O , NO_2 , NO_3 , SO_4 , PO_4 etc.



Fig.6 (a) Coarse screener for large floating garbage and twigs.

Fig. 6 (b) Fine screener for water plants, leaves etc.



Fig. 7 Mechanical Skimming device.

There are 3 basic methods for secondary treatment.

a) Activated sludge

In this process the sewage is aerated by air or by mechanical means.

The vigorous mixing and aeration are necessary to prevent the oxygen concentration in the water from dropping below 2-3mg/l otherwise the respiratory activity of the organisms in the tank is likely to be slowed.

The residence time of water in this system is 1 to 20 hours.

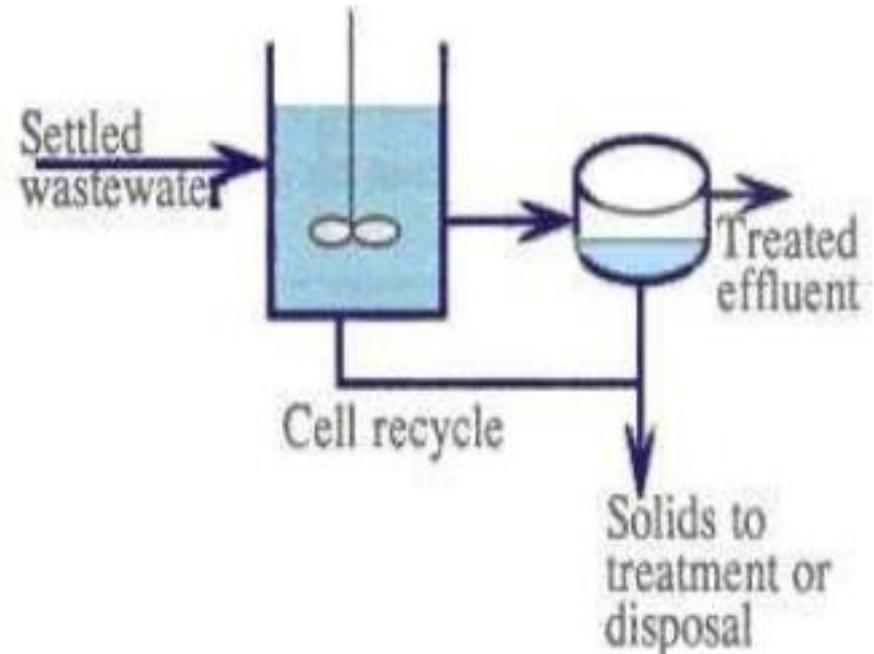


Fig. 8 Activated sludge system.

b) 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.

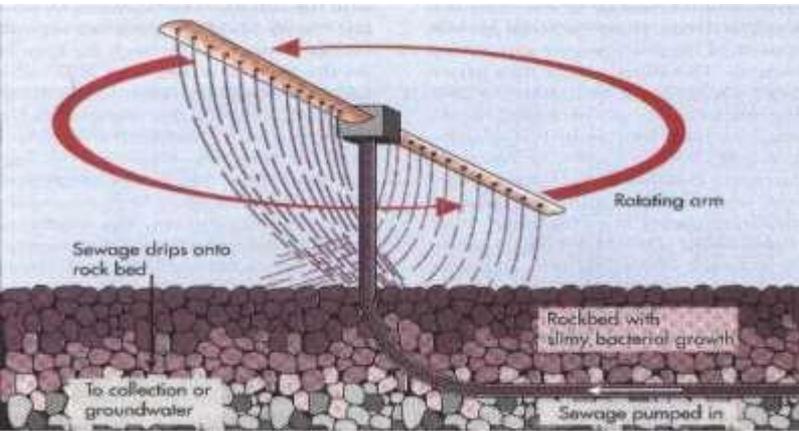


Fig. 9 Trickling Filter.

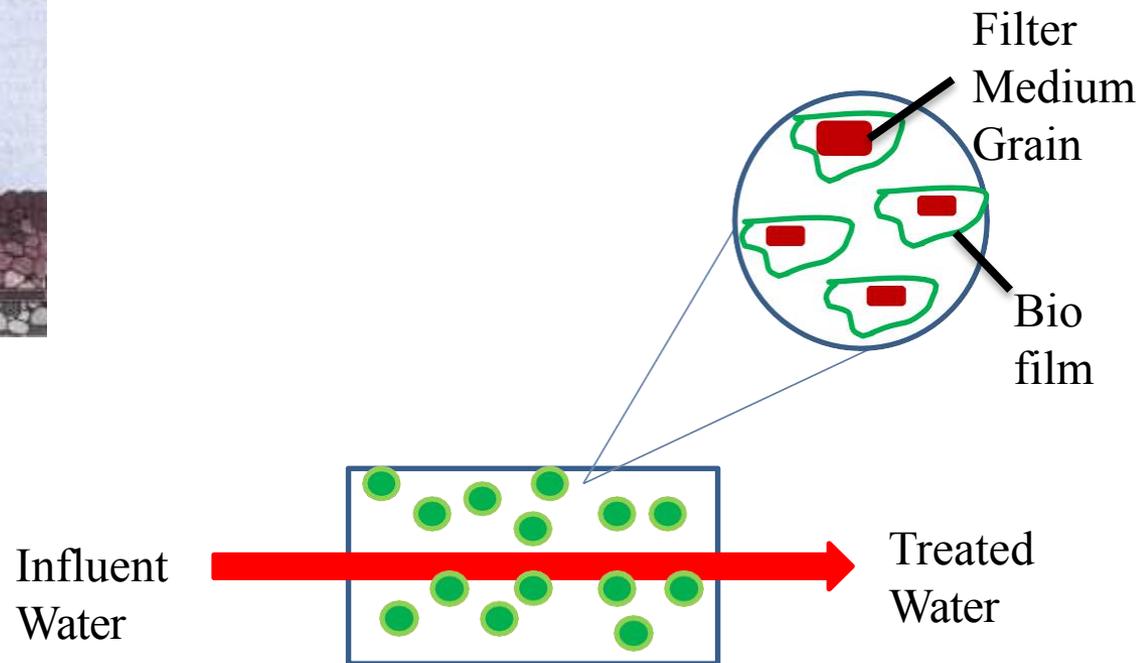


Fig. 10 Nutrient and organic carbon removal through biological filter.

c) 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 and sulphate



Fig. 11(a) Oxidation pond.

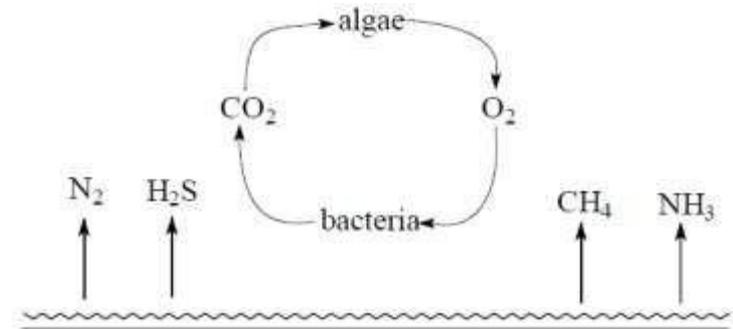


Fig. 11 (b) Reactions occurring in oxidation ponds.

PROCESSES ADOPTED FOR SEWAGE TREATMENT BEFORE RELEASING IN FISH POND

Sedimentation The function of sedimentation is to remove suspended solids from sewage to the maximum possible extent by two successive stages primary (to settle down most of the heavier solids) and secondary (to help in mixing and flowing).

Dilution A positive DO balance is maintained and the concentration of harmful ingredients such as CO_2 , H_2S , NH_3 etc can be kept below lethal limit by introduction of sewage in a freshwater body in various proportions like 1 parts of sewage to 5 parts of freshwater or 10 parts of freshwater with 4 parts of sewage are practiced.

Storage The oxygen required for biochemical reaction is obtained from freshwater so sewage is stored with freshwater for few days to oxidize the organic matter which make the fluid fit for pisciculture.

TECHNOLOGIES ADOPTED BY FARMERS FOR CULTURING OF FISH IN SEWAGE

1) Pond preparation

Fig. 12 (a) Sewage fed ponds are pumped out to dry.

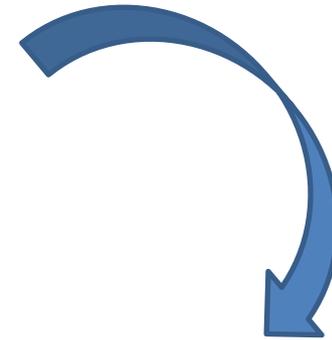


Fig. 12 (b) Drying of ponds is undertaken during winter.



Fig. 12 (c) Sewage fed fishponds; locally called “Bheries” have a bamboo sluice structure to prevent the entry of wild fishes and escape of the stocked fishes.



i. Pond preparation is undertaken generally in winter (November to February) when the fish growth is reported to be slowest.

ii. Ponds are drained and dried in Sun.

iii. Aquatic weeds like water hyacinth is grown along the pond dykes.

iv. The bamboo sluice gate is prepared which helps to prevent the entry of unwanted fishes and escape of cultured fishes.



2) Primary fertilization

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



Fig. 13 (b) Open channel through which sewage is flown to the pond.

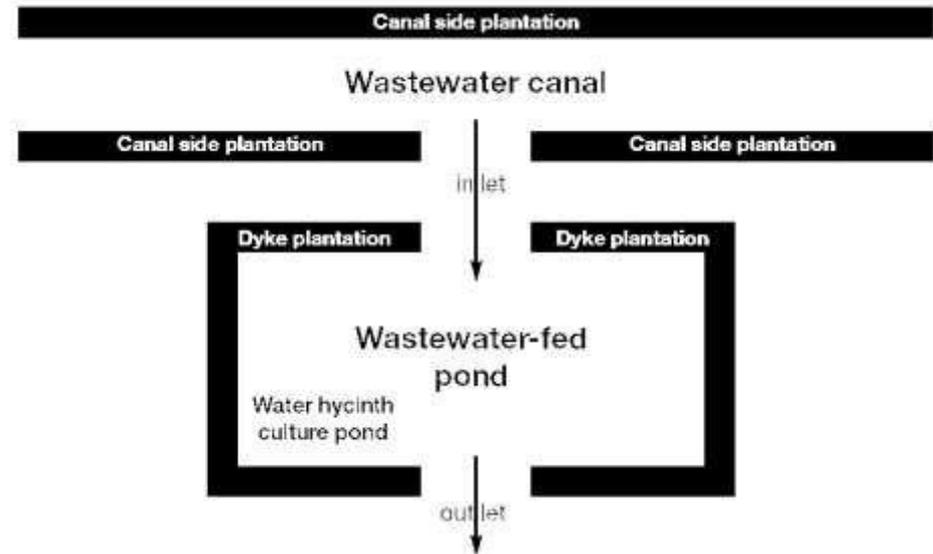


Fig. 13 (a) A schematic diagram of sewage – fed farming.

3) Stocking Before stocking, some fishes are kept in hapas in the pond to test pond condition through their survival. If the results are positive large scale stocking is undertaken i.e., 40, 000 to 50, 000 fingerlings/ha.

Species cultured-All the species of Indian major carps e.g. *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala* and Exotic carps e.g. *Hypophthalmichthys molitrix*, *Ctenopharyngodon idella*, *Cyprinus carpio* and also *Tilapia mossambica* and freshwater prawn, *Macrobrachium rosenbergii* are preferred to be stocked.



Fig. 14 A hapa being shown in pond before stocking to test pond condition.

4)Feeding of fishes

i.Immediately after application of sewage effluents, the BOD level of pond water rises considerably.

ii.The extent of increase depends on the amount of organic matter, enhances the primary productivity of the culture system through release of nutrients.

iii.Phytoplankton starts appearing within three to five days of sewage application and generally continues to grow up to 15 to 20 days depending on the availability of nutrients.

Due to the high contents of nutrients in sewage, the cultured fishes don't require any supplementary feed at all.

5) Harvesting of stocked fishes

- i. Fishes are stocked and harvested throughout the culture period leading to periodical stocking and regular harvesting.
- ii. After completion of one phase, fishes are restocked @1kg fingerlings/5kg harvested fish. Another harvesting phase starts after 15 days of restocking.
- iii. Generally drag nets are used for harvesting by encircling technique. Some fishes like *Tilapia* and common carp require hand picking technique.



Fig. 15 (a) Harvesting fish with net from a sewage fed pond in Kolkata.



☉☎ Various process of netting

6) Marketing of harvested fishes

Based on the market demand different sized fishes are harvested from sewage fed ponds and sold in live condition.

There should be proper facilities during transportation to market.



Fig. 16 (a) The bulk of the harvested fish consists of Indian major carps and tilapia.



Fig. 16 (b) Aluminium vessels, called “hundies”, are used to transport seed as well as live fish to market.



Fig. 16 (c) Large plastic containers are used in tricycles for the transportation of fish in live condition.



SOME MANAGEMENT TECHNIQUES

1. Transport and release of fingerlings are carried out during morning hours.
2. The stocked fishes are checked at the monthly intervals for their growth and health through sample netting.
3. Regular monitoring of physico-chemical parameters are undertaken.
4. Regular cleaning of pipes interconnecting the treatments pond and fish pond are done.



ADVANTAGES

- 1.The sewage fed fish culture uses the waste recycling process and maintains the good environment around the urban area.
- 2.Manuring and supplementary feeding is not required due to high content of nutrients in sewage.
3. Input cost is very low and production is very high.
4. This is the biological method of treating waste water before its final disposal in river.

DISADVANTAGES

- 1.The sewage contain high load of organic and in organic matters and toxic gases which may harm fish consumers.
- 2.As the raw sewage is used in fish ponds, there is a chance of infection and pollution to enter into human body through food chain. But this risk can be minimized if good managerial practice is followed.

CONCLUSION

The sewage fed fish culture uses the waste recycling process and maintains the good environment around the urban area. Unfortunately, this system is being lost due to urbanization without understanding its ecological, environment and economic benefits. The CIFA , Bhubaneswar has reported the development of an improved method of sewage fed fish culture which avoids direct use of raw sewage.

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THANK YOU