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Point for discussion this month **Importance of wet lands**

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Eternal Words

I think the environment should be put in the category of our national security. Defence of our resources is just as important as defence abroad. Otherwise what is there to defend?

~Robert Redford,
Yosemite National Park dedication, 1985

Dear Readers,

The cover photograph is of Kaneri Lake – a very small water body created by forefathers of a well known politician of Maharashtra – Mr. Sharad Pawar – currently Agricultural Minister in the Union Government of India as temple tank. There are numerous such wetlands – temple tanks all over India. Piety of Indian minds protected these water bodies for hundreds of years which are able to support the biodiversity in their respective areas.

Security is very well sought after in every aspect of individual, social and national life. It may be defence, or it may be internal security or water, food etc. securities. Everybody talks about health, occupation, livelihood but nobody pays attention to the services which the natural environment provides for the fulfilment of human needs of health, occupation and education.

Ecotechnology is not a new word now. Journalists, free-lancers and writers are proficiently using this buzz word of today's technological arena of healthy environment. Healthy environment should be for everybody without any gender-wise and age-wise discretion of developed or undeveloped, rich or poor, educated or uneducated, employed or unemployed. A healthy environment is a right of every living being on this earth. It is ecotechnology which can help in developing, maintaining and restoring the healthy, liveable habitats for the modern Eco-man.

In this issue, we have tried answering frequently asked questions (FAQs) about Ecotechnology. It's a stream of knowledge which guides humanity towards the environment quality which suits healthy living by managing wastes efficiently using ecological processes.

Many are inquisitive about the details of ecotechnology, its applications, mechanisms, its suitability and workability. Sensing this, we have tried to simplify the technicality of this advanced knowledge of well-being for humans and ecosystems – i.e. Ecotechnology, to be understood by everybody. A book on Ecotechnology written by Sandeep Joshi is on the verge of being published.

Thank you,
Chief Editor

Frequently Asked Questions about Ecotechnology

1. What is Ecotechnology?

The term "Ecotechnology" refers to a technology which is specially designed to employ processes found in natural ecosystems for the purpose of waste-management. These techniques harness plants, soils, and associated microorganisms to remove contaminants from wastewater. They are generally reliable systems with a minimum of operational requirements and no anthropogenic energy sources or chemical requirements.

Treatment of wastewater using ecotechnologies also provides the scope to create or restore ecosystems for environmental enhancement, such as greenbelts, passive recreation associated with ponds, wildlife habitat, and other environmental amenities.

2. What are Green Lake systems?

These are wetland treatment systems wherein a combination of emergent aquatic plants (like cattail, bulrush, reeds etc.), floating plants (like duckweed, water hyacinth, and others), and submergent aquatic plants are used for the treatment of water pollution.

These systems have open water areas dominated by floating and submergent plants. It may be lined or unlined, depending on regulatory and / or performance requirements. These systems exhibit complex aquatic ecology, including habitat for aquatic and wetland birds.

3. What is Green Bridge Technology?

It is a horizontal filtration unit placed in the continuously flowing channel. It is made up of locally available materials like stones, gravel and natural fibres along with a specially developed mixture of bacterial consortia to retain suspended solids. Biodegradation and biosorption are facilitated by the microbial film which develops on the stones and green plants growing on and around the Green Bridge.

4. Who has developed Soil Scape Filter and Green Bridge Technologies?

Sandeep Joshi of Shrishti Eco-Research Institute has developed the simple Green Bridge technology through his 27-year-long research on rivers in urban areas. These systems have already been implemented successfully on polluted streams at various locations in India from 2003 onwards.

His other ecotechnological treatment systems - Soil Scape Filter and Hydrasch Succession Pond - are in use for industrial wastewater treatment since the last 15 years.

5. Are Ecotechnologies reliable? How do they treat pollution?

Ecotechnologies are effective and reliable water reclamation systems provided they are properly designed, constructed, and maintained. Records of systems that have been running for at least a decade indicate that they are able to remove most pollutants associated with municipal and industrial wastewater such as COD, BOD, metals including cadmium, chromium, iron, lead, manganese, selenium, zinc, and toxic organics etc.

6. What are the mechanisms of ecotechnological treatment of wastewater?

An ecotechnological system acts as a watershed filter, a sink for sediments and precipitates, and a biogeochemical engine that recycles and transforms some of the nutrients. An ecotechnological treatment technique utilizes the same processes like in conventional treatment systems such as physical separation of solids by sedimentation, filtration, bio-digestion, bio-oxidation, bio-reduction, bio-sorption etc. These processes occur sequentially or simultaneously as wastewater moves through the system.

7. What are other benefits of ecological treatment systems?

Other benefits are water reclamation, tackling water storage, recharging of surface water body and groundwater, carbon sequestration, wildlife habitat, passive recreation and environmental education. There are numerous other benefits including energy savings, which cannot be given by conventional mechanistic treatment systems.

8. Is it possible to achieve standards complying with discharge standards using ecotechnological systems?

Ecological treatment systems can be used to meet 30 mg/L BOD and TSS discharge standards. It goes beyond regulatory absolute values. It reduces the ecotoxicity of the pollutants to zero and promotes the growth of biodiversity as observed in SERI's Ahar River Ecological Restoration Project. Material inputs, land requirement and labour are determined by the quality of treated water to be achieved.

9. How much area is required for ecotechnological treatment systems?

There is no standard reply to this question since basically it depends on the effluent criteria to be met and buffer areas required. It is noted that designers have employed from <0.2 to over 20 hectares/MLD (i. e. 2 - 200 sq. m / m³ - day). For pond and lake systems the area requirement is 0.5 - 2 sq. m / m³ - day. The Green Bridge is a novel technology, which can filter an enormous quantity of water in a day.

10. Do these systems have to be lined to avoid soil and groundwater contamination?

The requirement for liners in ecotechnological treatment systems depends on regulatory requirements, the characteristics of surface and subsurface soils, and concentration of key pollution parameters. If soils are porous (e.g. sandy soils) and well-drained, then lining will be essential whereas for poorly drained soils composed mostly of clays, lining might not be required.

These systems would not only tend to produce a layer of partially degraded sediments on the bottom that would reduce infiltration with time but also improve the quality of groundwater by absorbing the pollutants.

11. Explain the role of plants in Ecotechnological Treatment Systems.

In Ecotechnological treatment systems, plants play several essential roles.

- to provide a canopy over the water column
- to engineer production of phytoplankton
- to increase the potential of re-aeration & translocation of oxygen for the microbial systems
- to enhance reduction of suspended solids and to some extent, also that of dissolved solids
- to take up nitrogen and phosphorus. The effects of litter-fall from previous growing seasons, as it moves through the water column and eventually decomposes into particles, gives good biofertilizer.
- to enhance the aesthetics of the installed systems
- to aid carbon sequestration by absorbing atmospheric carbon dioxide, thus reducing green-house gases.

12. When does an ecotechnological treatment system become fully operational and meet discharge norms?

Pond and Lake Eco-systems may take time to obtain the optimum vegetative density necessary for treatment processes. The duration is dependent on the original planting density, and adaptation of saplings to new environment. Experience indicates that water quality improves with time, implying that vegetation density and accumulated plant litter has a major role to play in making the treatment efficient.

13. Are these systems durable and perform as per expectations for longer periods?

These systems have been employed for treating industrial and domestic wastewaters since the last 10 years. They require minimum maintenance.

Treatment capacities of these systems have not shown any decrease in treatment effectiveness with time.

These systems are very affordable as far as electricity consumption is concerned because the electricity requirement is zero in most cases. These systems run on solar energy absorbed by plant species.

14. What are the problems associated with ecotechnological treatment systems?

Odours are associated with all types of the wastewater treatment systems. In STPs, the odour problem is more pronounced. But in ecotechnological treatment systems, it gets diluted because of decomposition over a relatively larger area, in association with the ecotechnological decomposition of plant material, algae, and other biological solids.

Normally mosquitoes are not a problem in properly designed and operated ecotechnological treatment systems. It has been observed that if a mixed effluent from industrial and domestic areas is provided with water hyacinth system, there is no nuisance of mosquitoes though they are growing in that habitat. But, the plants are selected in such a way as to ensure that they don't encourage the growth of nuisance insects. Even fish can be introduced to control mosquito breeding naturally.

15. Do these technologies have approval from pollution regulating authorities?

Ecotechnologies are simulations of processes of waste-recycling occurring in natural ecosystems. Effluents, having the concentration of COD/BOD as per the norms given by pollution regulating authorities, get further stabilized where they are discharged - either on land or in the water body.

SERI is working with the Central Pollution Control Board (CPCB) on some research projects. A team of scientists from the CPCB and the Planning Commission (Government of India) has visited SERI's installations and are satisfied with the results given by these systems.

Sr. No.	Comparison factor	Ecotechnology	Conventional
1	Process	Simple and Green	Complicated, artificial and energy-intensive
2	System byproducts	Not hazardous	Hazardous
3	Completeness	100% conversion of pollutants into utilizable products	Needs further stabilization of separated solids, hence incomplete process

4	Skill required for maintenance	Simple to maintain	Needs to be maintained delicately
5	Recurring expenses	Zero electricity required for the process, No dependency; Unskilled manpower for routine operations	Electricity-intensive and dependent process; Skilled manpower for routine operations
6	Savings	Clean utilizable treated water and useful byproducts such as green mulch and biofertilizer	Water for garden, solids after further stabilization
7	Physical performance		
	Odour	Nil	Odorous
	Appearance	Slight or nil turbidity	turbid
	Colour	Very faint yellow or none	Yellowish
8	Supplementary units required		
	Solid control	Nil	Sand/ Carbon filters
	Bacterial control	Nil	Should be nil
	Flow control	Nil	Flow-control unit
	Sewage feed and treated water use	Pumps only if no gravity	Pumps and tanks required
9	Machinery failure/ breakdown	Nil	Stalls the whole process till it is repaired again
10	Climate stability	Stable	Should be stable
11	Process control parameters		
	Temperature of untreated water	Ambient	Ambient
	pH	Neutral range – (5.5 to 9.0)	Neutral (6 – 8)
	Suspended solids	Organics – 100 to 400	For more concentration, frequent cleaning is required
	Total dissolved solids	Up to 20,000 mg/L	Less tolerance
	Flow variations	Stable	Unstable
	Shock loads	Up to 200%; no significant change in efficiency	Cannot accept hence performance decreases
12	Process restoration after damage	Within 7 days	Till the equipment synchronizes