

Waste Water Treatment v/s Phyco Remediation Using Nano-Scale-Nutrient N-S-N

The table below compares the two processes:

Parameter	WWTPs	N-S-N– Diatoms – Phyco Remediation
How does it work	Waste water treatment is the process of removing contaminants from water , including household sewage and effluents. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce an environmentally safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse.	N-S-N causes the native diatoms present in all water bodies, including sewage, to grow. The oxygen produced by diatoms causes the native bacteria to grow and these work in the same way as the bacteria in aerobic process WWTPs and bioremediation solutions
Oxygen Release/Aeration	WWTPs use high powered aerators to induce air into waste water. The air comprises Nitrogen and Oxygen and not pure oxygen. Consequently, increase in DO levels is less and energy consumption is high	Diatoms release pure oxygen during photosynthesis. The dissolvability of pure oxygen is much higher than that of air as in WWTPs. Higher DO levels lead to cascading improvement in water quality, aquatic life and bio diversity.
Technology Source	While peripheral manufacturing may happen indigenously, the core is imported. In most cases the advanced systems are fully imported.	Technology developed in India after 12 years of research and development. Now patented in USA and India. No one in the world has the technology to load 10 micro nutrients (cations and anions) in a single complex for delivery as an integrated package. Product being exported to many countries including USA.
Impact on Aquatic Life		Diatoms are the natural food

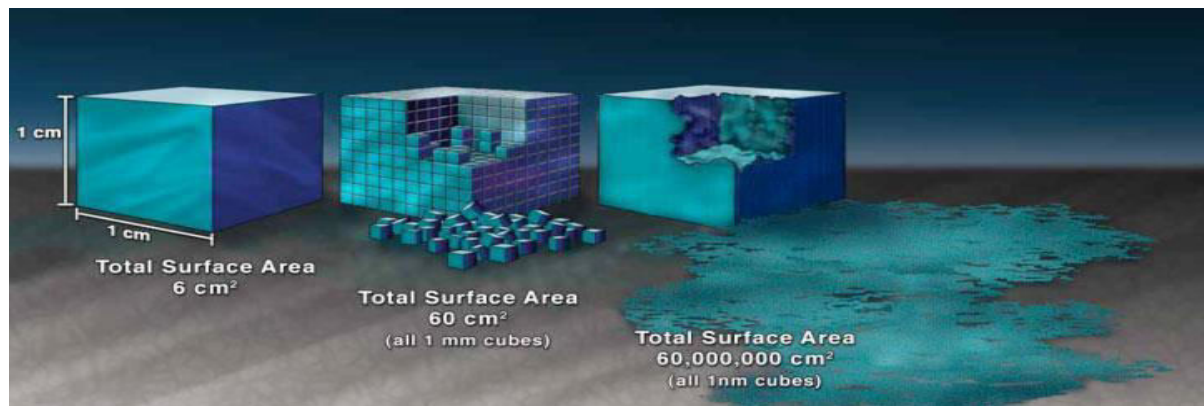
and Bio Diversity	No direct benefit on aquatic life.	for fish . Fish population, protein level and fish mass increases manifold thus offering a source of living for many fishermen along the river. Aquatic biodiversity index increases. Such bio diversity is critical for rivers.
Method of Treatment	Off Site. The waste water is treated off site and then introduced into the river. The treatment does not keep pace with requirement	On Site. N-S-N can be dosed into drains and tributaries feeding into the river, as well as the river itself. Increase in dosage can treat higher volumes of waste water thus keeping pace with increasing BOD load due increasing population along the river. As the river works are implemented, it is likely that more and more people will settle along the banks for occupations like river navigation and fishing and therefore the load would increase beyond current projections.
Impact on River Bed Sludge	Sludge is produced in the WWTPs and has to be disposed off. Any nutrients like dissolved nitrates and phosphates flowing out with the treated sewage will cause bacteria and algae to grow in the river and this will increase sludge in the river.	The diatoms at benthic level promote aerobic bacteria and therefore the organic sludge on the river bed gets consumed and the river maintains its depth. Dredging efforts are minimised except for navigational purposes.
Civil Works/ Environmental Impact (EI)	Interceptor drains, setting up of WWTPs require land acquisition, civil construction	Minimum EI. No civil works required, N-S-N can be poured directly into the lake

	works along sensitive eco regions leaving a strong EI. Power generation results in emission of CO₂.	or small tanks can be build to dose N-S-N. Diatoms consume CO₂ to produce O₂.
Impact on Invasive Plant Species	Not Known. Nutrients in treated sewage may cause plants to grow in the river.	Water hyacinths and other waste water growth is reduced progressively to optimal thereby allowing for better water flow in the river.
Impact on Agriculture	Not Known. Sludge can be used as fertilizer but transporting is expensive.	N-S-N contains micro and secondary nutrients which have a very beneficial impact on agriculture. Crop growth will improve significantly as Ganga / Yamuna water would be rich in nutrients required for plant growth.
Impact on Water Borne Vector Diseases and Coliform Levels	Positive effect	Water borne mosquito larvae is consumed by aquatic life in the water. Coliform levels fall very significantly.
Impact on Climate Change and Carbon Fixing	To Be Quantified	Diatoms produce 25% of global oxygen and fix 23% of world carbon. Ganga and other river treatments can cause significant contribution to India's share of climate change. Precise calculations have to be done.
Restrictions on Water Type	Not Known but brackish and salt water may pose maintenance issues.	N-S-N works in salt and brackish waters as well besides fresh water and sewage base. Thus the entire length of river can be remediated including the river deltas where fresh water mixes with sea water.
Gestation Time	Very Large due land acquisition and civil works.	Can start immediately.

Capital Costs	Not Known exactly but understand it may cost Rs 1 to 2 cr per MLD. For Ganga with a load of about 12000 MLD it may cost as much as Rs 24,000 cr	ZERO capital cost.
Operational Costs	Operational availability of WWTPs is low. System subject to high Mean Time between Failures (MTBF) and very high Mean Time to Repair and Refit (MTRR). O &M costs are as high as 10 % per annum in actual conditions to our understanding. Annual O&M costs may be 2400 cr	N-S-N dosing for 12000 MLD would be less than the O&M cost alone for WWTPs. Also there is no capital cost. Moreover, cost on N-S-N is offset by rising income due fish growth. The growth in fish population and fish biomass would almost neutralise N-S-N cost.
Environmental Quality of Water	Un natural way of treatment leads to reduced energy levels of water making it dead water	Enhanced energy levels of water leading to better agriculture and health of live stock and people.
Basic concept / Bottom line	Nutrients are pollutants that need to be got rid of at any cost.	Nutrients are resources that can be used to grow fish and earn a profit.

The Process

On dosing N-S-N, the nano-nutrients in the N-S-N bottle spread rapidly into the water body on its own on the surface as well as at the plankton and benthic level. The coverage is very high as the constituents are at nano scale. To give an idea of advantages in nano scale we attach a diagrammatic representation. It shows that at nano scale just 1 cu cm of N-S-N would cover a surface area of 60 million sq cm of water area. This is the benefit of reducing nutrients to nano scale:



During photosynthesis, diatoms consume Nitrates and Phosphorous, as also use up CO₂ from the atmosphere. In the process, they release oxygen (pure oxygen in water) to almost saturation levels, which will help the water body regain its original levels of Dissolved Oxygen. The absorption of CO₂ will also mitigate the water acidification and pH levels would move towards more basic levels. The high levels of DO would set up a chain of benefits, primarily it promotes aerobic bacteria which would digest the excess nutrients in water and convert them into the base constituents. Such high levels of DO would also oxidise the heavy metals which would precipitate out of water, where other bacterial strains would consume them. N-S-N will also trigger growth of Zooplanktons, which consume diatom algae. The zooplanktons are consumed by fish, thus ensuring that the diatom algae exits the water as fish biomass and does not decay in water like other cellulose algae. Diatoms have silica shells and the zooplankton and fish love to eat this live food as it helps them to build up their body constitution.

Dosage

Even a small volume of N-S-N dose can cover an exceptionally large surface area.

Each litre of N-S-N treats about 10 million litres of affected water in a flowing river and about 2-4 Million Litres in sewage water. Such a large effect is possible because of the nano scale of our nutrients. For a 12000MLD load and a river length of 2000km (treatment section) for a flow speed of 3 km/h the amount of N-S-N required in a river would be just about 2400 Litres per day at 4 to 6 stations along the river starting with upstream of Hardwar. Such dose can also be adjusted up or down based on the analysis results downstream.

Safety

N-S-N is absolutely safe and a toxicology report from the Indian Institute of Toxicological Research (IITR), Lucknow is enclosed. The product is absolutely non toxic and has no negative effect on aquatic life or water quality. It can be dosed in any water body without hesitation.