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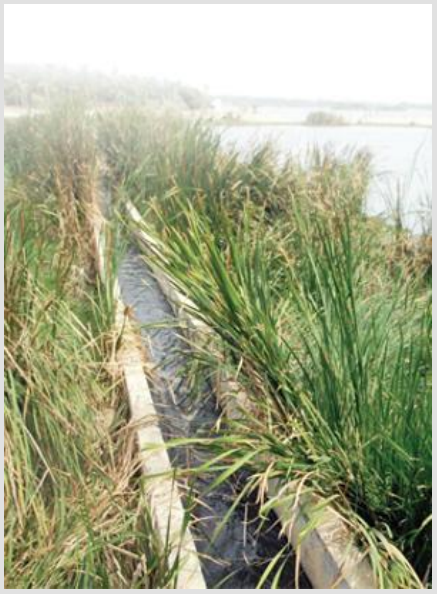
# IISc team turns sewage into drinking water

By Niranjan Kaggere, Bangalore Mirror Bureau | Apr 25, 2014, 02.00 AM IST



Sewage is let into the wetland for purificationbefore reaching Jakkur Lake (in the backdrop)

*If adopted across lakes in the city, it holds the promise of replenishing and purifying the declining water table*

Water scarcity in summer, and flooding in low-lying areas during the monsoon are at the two extremes of Bangalore's environmental reality. Researchers have pointed fingers at destruction of water bodies, mismanagement of lakes, and overuse of underground water. Ecologists have been experimenting with various models to address these problems. One of them, by scientists at the Indian Institute of Science (IISc), deserves a closer look for at once being simple and effective. It's known as the Integrated Wetland System, and it's been set up at Jakkur Lake by the Environmental Information System (Envis), Centre for Ecological Sciences, IISc. Recycled toilet water meets up to 30 percent of Singapore's water requirements. Therefore, the IISc project holds promise for Bangalore, if it passes muster with the regulators.

**THREE-STEP PROGRAMME**

In layman's language, the project works like this. Out of the 49.63-hectare span of Jakkur Lake, 4.63 hectares have been set aside adjoining the BWSSB's existing sewage treatment plant (STP) to create a man-made wetland integrated with an algal pond. First, sewage is treated at the plant using the regular process. In the second stage, the treated water is let out into the man-made wetland where aquatic plants and algae remove contaminants. In the final stage, wind and sunlight do another round of cleaning before it's released into the lake proper.

T V Ramachandra, Coordinator, Energy and Wetlands Research Group at IISc, gives us the scientific perspective. "The STP cannot fully remove the nutrients (nitrogen and phosphorous) from the sewage. Hence it has to be purified in a natural way using wetlands. When raw or partially treated sewage is let into a wetland containing aquatic plants and algae, through contact with biofilms, roots and rhizomes, process contaminants like nutrients, heavy metals, etc. are removed. Microbial activity aided by wind, sunlight and other factors, further clear the contaminants, and the water flows into the main lake spanning over 45 hectares."

Sounds elegant, but does it work? For the past eight months, a team of six scientists led by Ramachandra, have been trying to find out exactly that. They fanned out into groups to monitor and analyse the water quality. "At about nine locations within the lake we used to collect water samples twice at 45-day intervals. The pH was measured at the spot and algal samples too collected for analysis based on colour and other characteristics," Ramachandra said.

The results are now out. "There was gradual increase in the quantity of dissolved oxygen level in the water after algal treatment. Besides, the level of total dissolved solids was also found reduced in the centre of the lake," Ramachandra said. To put it in simple words, the team found that while the STP and the man-made wetland remove 70 percent of the contaminants in about 4-5 days, wind, sunlight, and plankton in the lake proper do the rest of the cleaning. "The water is potable with disinfection (solar). If arrangements are made for activities in the lake (like washing clothes), the water is fit for domestic use," Ramachandra said. The team will soon submit a report to both the state and union governments to replicate the model in other lakes as well.

For those interested in scientific nitty-gritty, Ramachandra breaks down the process further. "Collectively the artificial wetland with macrophytes and algae helped in removing 45 per cent of COD (chemical oxygen demand), 66 per cent of BOD (biological oxygen demand), 33 per cent of nitrogen and oxides, and another 40 percent of phosphorous and related oxides. The water is further purified naturally in the main lake by radiation." And will it pass muster with the regulators? "The synergistic mechanism...helps in the complete removal of nutrients to acceptable levels according to the Central Pollution Control Board," Ramachandra explained.

**THE FRIGHTENING REALITY**

The timing of the project is fortuitous. The team is of the view that if replicated in other lakes, it will lead to replenishment of purified water into the city's underground water table. We are staring at some pretty harsh reality. "Between 2001 and 2011, the population in Bangalore shot up from 5.6 million to 9.5 million. Similarly, the 203 wetlands in 1973 were reduced to a mere 93. Also, water is pumped from the Cauvery, located 100 km away from the city, by using 75-100 Mw of power. Water demand in Bangalore is roughly about 150 litres per day per person, while domestic requirement for the whole city is about 1,400 million litres per day (MLD). But the water available from all four stages of Cauvery and Arkavathy is only 975 MLD. Besides, the number of borewells has alarmingly shot up from 5,000 to 4.08 lakh in the last three decades, allowing 40 percent of Bangalore to directly depend on them. Between 2001 and 2007, groundwater level in Bangalore declined by seven metres at the rate of about one metre per year," the researchers said in their report entitled Integrated Wetlands Ecosystem: Sustainable Model to Mitigate Water Crisis in Bangalore. The co-authors of the report, besides Ramachandra, are Asulabha KS, Sincy Varghese, Durga M Mahapatra, Sudarshan P Bhat, and Bharath H Aithal.

The scientists are hopeful that their efforts will not go waste. "Reports gather dust in government offices rather than get implemented. Hopefully, BWSSB will look at this result once you disseminate the information," Ramachandra said.

***The Process***

*The water treated at BWSSB's sewage treatment plant is let out into the Integrated Wetland System. In this man-made system, aquatic plants and algae remove contaminants. In the final stage, wind and sunlight do another round of cleaning before it's released into the lake proper.*

***SINGAPORE FEAT***

*Globally, Singapore leads the efforts to use treated sewage water for consumption. According to the country's public utilities board (PUB), reclaimed water — popularised under the brand name NEWater — meets up to 30% of that country's water requirements. According to PUB, NEWater is primarily used for industrial purposes. But a small percentage of the recycled toilet water is blended with reservoir water, treated, and supplied to consumers as tap water. NEWater production in Singapore is an estimated 114 million imperial gallons (mpg). PUB says "NEWater has passed more than 100,000 scientific tests and surpasses World Health Organisation requirements".*