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Sustainable Algal Scum Management and Wastewater Treatment in Bangalore

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Bangalore has been experiencing unplanned rapid urbanisation during the last two decades evident from natural resources utilisation and waste (solid and liquid) management. The wastewater generated in the city is either partially treated or untreated enters storm water drains and ultimately reaching cascading human-made water bodies (lakes). The wastewater with nutrients has been enriching the water systems and resulting in the contamination of water affecting local people's health. In the south-eastern part of Bangalore, two large lakes, the Bellandur and Varthur receive approximately ~40 % [500 MLD] of the sewage generated in Bangalore. A strategic analysis of the causative phenomena suggests that the water bodies firstly undergo an initial anaerobic stage of wastewater decomposition where the N is largely ammoniacal and higher P in the form of condensed phosphates. A nutrient balance assessment of the two lakes suggests that microalgae are the key agents that convert and capture organic N and P found in the wastewater. A mass balance estimated for the system suggests that a large part of the nitrogen is generally in ammoniacal forms that facilitate micro-algal absorption leaving little chance for nitrification. A substantial part of the N appears to be lost due to volatilization and to some extent denitrification. The lake accounts for about 60% N capture and recovery into reusable intermediates and is therefore a candidate for evolving methods for near-100% N recovery by algal systems. The SEM–EDXA studies showed higher phosphate accumulation in case the algae as a result of luxury P uptake. With a growth rates such algae tend to accumulate lipid in their cells. Experiments conducted in the lab have also showed the potentials of these algae in heterotropically removing organic C (90%). An investigation on C allocation pattern in biomass with all variability's in environment would pave essential path for C abatement and GHG emission from the anoxic regions. The study indicates that these water bodies do treat water, when lakes are not invested with invasive water weeds. This study brings out the strategies to recover a large part of the C, N & P in urban wastewaters through algal systems at lower costs and higher energy efficiencies. Furthermore, it is possible to capture the nutrients as well as C in algal biofuel to achieve triple benefits-namely i) water purification ii). nutrients capture and iii). algal biofuel. This study shows that given the water spread area and the levels of nutrients released in Bangalore sewage, it is possible to devise a 7,000 tonnes per day (tpd) algal biofuel system to meet the growing need of liquid fuel.

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