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Disposal of Nirmalya (Religious Refuse)—A Social Problem

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Abstract

For the beautification and conservation of the lakes in the city of Thane, the Thane Municipal Corporation has undertaken certain measures. Masunda lake, which is in the heart of the city, is a place of attraction and relaxationfor the populace. The municipal corporation has built an enclosure within the lake where people can dispose off the *nirmalya* (religious refuse like old floral offerings to God). The municipal workers clean this enclosure daily. Water samples were collected and analyzed fortnightly from the enclosure and the main lake. Dissolved oxygen levels were zero in the enclosure water samples, while it ranged from 4.5—11.2 mg/liter in the main lake water samples. Levels of CO_2, total hardness, SiO_2-S, PO_4-P values were found to be high in the enclosure samples as compared to the main lake samples. This indicates that prevention of organic substances from entering the main lake not only protects the lake but, also prevents eutrophication. Thus, this could be one of the remedial measures for the disposal of *nirmalya* and also to prevent the eutrophication of the lake.

Thane in Maharashtra (India) is known as the city of lakes, similar to Hyderabad in Andhra Pradesh. Once the city had 65 lakes, today only 15 exist. The rest have disappeared due to urbanization, dumping of solid wastes and encroachment. In fact, even now some of these have reached a state of eutrophication. Despite the fact that, a good clean fresh water body bestows incalculable economical, ecological and aesthetic benefits to a place, little efforts have been made for the protection and conservation of the aquatic ecosystem, particularly in the urban environment (1). The Municipal Corporation of Thane has decided and subsequently planned to the beautification and keeping the existing lakes clean.

Among the Hindus, there is a religious belief that, the *nirmalya* (religious refuse like old floral offering to God) should be disposed off by throwing it into the water. Hence, the lakes and creeks are veritable dumping places for the *nirmalya*. These lakes along with the pollutants also receive the *nirmalya*, which decays and adds to the organic matter leading to eutrophication of the lake. The quantum of *nirmalya* dumped into the lakes is quite high during festivals (Ganesh Utsav and Navaratri).

Masunda Lake is one such lake, which is situated in the heart of the city. To save this lake from eutrophication, the municipal corporation has taken certain measures, one of which is to build an enclosure within the water body for the purpose of *nirmalya* disposal. The enclosure was built in 1993 and is situated towards one side, such that the water from the enclosure does not mix with the main lake. It has been made compulsory that the *nirmalya* should be disposed within this enclosure which is cleaned every day. On normal day one fifth of a truckload of *nirmalya* is being removed which shoots up to a full truck load during the festival season of Ganesh Utsav and Navratri. Due to the daily cleaning of the enclosure, the decaying organic matter does not get mixed with the main lake water. This helped to keep the lake clean. Hence, it was felt to undertake the study of the effects of dumping of *nirmalya*, on the water quality by estimating the physico-chemical parameters, the results of which have been discussed in this paper.

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Methods

Masunda lake area is approximately 12,354.10 sq. m. The enclosure for *nirmalya* disposal is approximately 100 sq. m.

For a period ranging 6 months from July 1999 to December 1999, fortnightly water samples were collected from the main la e and enclosure. The physico-chemical analysis of the water samples was performed following the standard methods (2,3).

Results and Discussion

Although all the parameters were analyzed and studied during the study period, only those that are significant are presented in this paper (Table 1).

During the study period, the at mospheric temperature ranged between 21C—30C while the water temperature ranged between 21 C—31.5 C for both the main lake and the enclosure. It followed a common pattern.

Dissolved oxygen is an indicator of water quality. Singh (4) noted the DO values as low as 2.8—4.4 ppm in the sewage water discharged into river Ganga. Chakraborthy and Kushari (5) in their studies conducted on the eutrophicated Banka stream noted DO values ranging between 2.85—3.0 mg/liter. Salaskar and Yeragi (6) recorded persistent low values of DO (0.8—1.2 mg/liter in the Shenala lake (Kalyan). Bhosle et al. (7) while conducting a pollution survey of river Godavari recorded DO ranging between 5.9—6.35 mg/liter. According to them the readings deviate by 1.0—1.3 mg/liter from the standards laid down by ISI, indicating river pollution. Mani (8) recorded the values of DO from Masunda Lake as 2.5—12.7 mg/liter, Tulsi Lake 4.0—4.5-mg/liter and Pokharan Lake 2.5—12.0 mg/liter. During the present study (Fig.1), DO from the main lake ranged between 4.5—11.2 mg/liter while it was always zero (except in August 0.05 mg/liter) within the enclosure.

The maxima of DO recorded from the main lake is 11.2 mg/liter, which was only once during the rainy season, which might be due to heavy rainfall, creating a bubbling effect.

The minima of DO in the main lake was found to be higher than that recorded by Mani (8)—a sign of improvement in the quality of the lake water after the enclosure was built in 1993.

The DO values within the enclosure were always zero indicating its utilization by the decaying organic matter from the *nirmalya*. Such hypertrophic water does not support primary production representing a case of extreme degradation (9).

Shardendu and Ambasnt (10) in their study of urban and rural aquatic ecosystem, observed dominance of CO_2 only during the rainy season indicating its influx primarily through rains, in the form of carbonic acid as explained by Chakraborty et al. (11).. Singh et al. (12) observed that free CO_2 was as high as 14 mg/liter in the effluents from rubber and sugar factories released into Ramganga River.

Table 1. Monthly fluctuation of physico-chemical parameters of water from main lake and *nirmalya* enclosure. M, Main lake; N, *nirmalya* enclosure.

	Air temp. C.		Water temp C		pH		DO (Mg/l)	
	M	N	M	N	M	N	M	N
Jul	27	27	27	27	7.4	7.5	9.5	0
Jul	29	29	31.5	31.5	6.8	7	4.6	0
Aug	27.5	27.5	27.5	27.5	8.24	7.2	7	0.05
Aug	27.5	27.5	27.5	27.5	7.97	7.96	11.2	0
Sep	26	26	28	28	7.58	7.36	4.5	0
Sep	27	27	28	28	8.2	7.53	7.6	0
Oct	30	30	28	28	8.57	7.8	6.6	0
Oct	28.5	28	27.5	28	8.14	7.59	4.8	0
Nov	25	25	25	25	8.31	7.8	6.2	0
Nov	24	24	24	24	8.87	7.78	7.1	0
Dec	22	21	21.5	21.5	7.25	7.4	6.7	0
Dec	22.5	22.5	22.5	22.5	7.4	6.55	9	0

Table 1. Continued.

	CO_2 (mg/l)		SiO_2-S (mg/l)		NO_3-N (mg/l)		PO_4-P (mg/l)	
	M	N	M	N	M	N	M	N
Jul	0	1.98	1.65	4.9	0.1	0.05	0.0252	0.1404
Jul	1.1	1.19	1.65	4.95	0.08	0.08	0.020	0.1452
Aug	0	1.98	1.65	6.	0	0.08	0.0392	0.1928
Aug	0	1.98	6.6	14.85	0	0.08	0.0156	0.1452
Sep	1.1	3.3	3.3	12.87	0.1	0.1	0.0112	0.204
Sep	1.1	3.3	6.6	14.85	0.1	0.1	0.0392	0.173
Oct	1.1	3.3	11.55	12.87	0.05	0.240	0.0392	0.240
Oct	0.88	4.4	31.4	53.79	0.05	0.240	0.0064	0.3135
Nov	0.88	3.96	37.59	45.51	0.140	0.180	0.0516	0.1032
Nov	1.1	6.6	35.64	58.90	0.110	0.170	0.0876	0.4090
Dec	1.1	2.2	9.9	9.9	0.088	0.10	0.0112	0.0252
Dec	1.1	3.3	14.85	56.26	0.09	0.114	0.0064	0.078

Mani (8) reported CO_2 ranging between 0.1—4.0 mg/liter at Masunda lake, 6.0—9.0 mg/liter at Tulsi lake and 0.1—1.0 mg/liter at Pokharan lake.

During the present study free CO_2 ranged between 0—1.1mg/liter in the *nirmalya* enclosure (Fig. 1). This shows continuous production of large quantities of CO_2 during the decomposition of *nirmalya* within the enclosure and its non-utilization for photosynthesis by the phytoplanktons, which are present in negligible quantities. Further, it also indicates that the enclosure has helped in bringing down the CO_2 levels in the main lake than what was observed by Mani (8).

Tropical ponds and lakes are generally epilimnic. Hence, uniform pH can be expected in the equatorial lakes unless some biological and chemical events create some changes (10).

Alkaline pH is believed as ideal for growth and metabolism of microorganisms and other living organisms, while at lower pH of alkali-

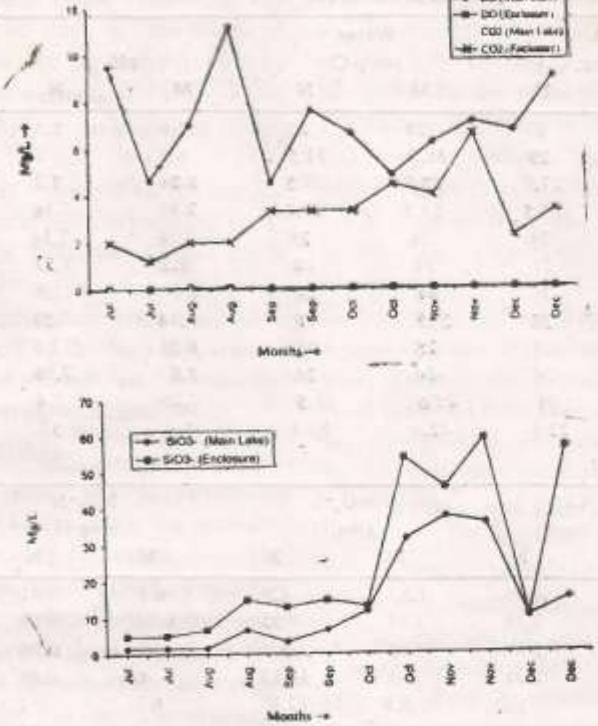

Figure 1. Monthly fluctuations of dissolved oxygen (*above*), and silicate (*below*) in the lake water.

ne range the activity of anaerobic bacteria increases (1ↄ). Mani (8) recorded pH range between 7.5—8.5 at Masunda lake, 6.5—6.8 at Tulsi lake and 6.5—8.2 at Pokharan lake. The pH of the main lake was always on the higher side reaching beyond 8, while that within the enclosure never reached 8 as observed during the current study. This suggests the activity of anaerobic bacteria within the enclosure.

During the study the total hardness was found to be between 100—148 mg/liter in the main lake and 120—260 mg/liter within the enclosure except during the rains. The values of hardness are much higher in the *nirmalya* enclosure. According to Mani (8) the values of hardness varied between 20.1—340 mg/liter at Masunda lake, 44—48 mg/liter at Tulsi Lake and 45—105 mg/liter at Pokharan lake. Singh (4) observed total hardness ranging between 276——124 ppm in sewage water discharged into river Ganga, while in the study of pollution survey on Godavari river, Bhosle et al. (7) recorded the total hardness of about 157 mg/liter.

Nutrients play an important role in the metabolic activities of the plants and animals.

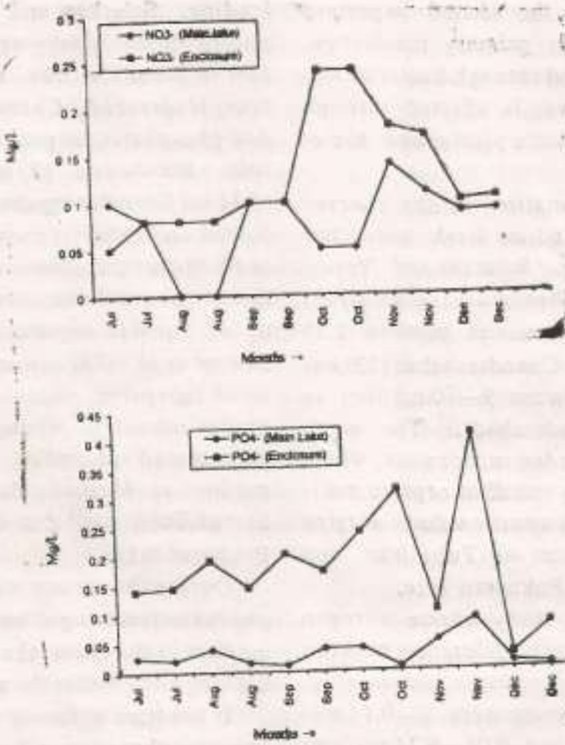

Figure 2. Monthly fluctuations of nitrate nitrogen (*above*) and phosphate phosphorus (*below*) in the lake water.

During recent years great interest has been shown in the study of nutrients which are essential for the productivity of ponds. Some of these nutrients are required in extremely minute quantities and have been reported to influence primary production (14, 15). Nitrogen and phosphorus are important contributors enrichment, but silicates also play a part in primary production.

During the present study, the silicate values were higher in the range of 4.9—58.9 mg/liter in the *nirmalya* enelosure than in the main lake where it ranged between 1.65—37.59 mg/liter (Fig. 1). Swarnalatha (16) recorded that, the average values of silicates did not rise beyond 4.6 mg/liter, in Banjara lake while, Goldman and Horne (17) recorded average value as 9.0 ppm with a range between 1.4—35 ppm; Singh et al. (12) recorded the silicate values in the range of 8 17—8.86 mg/liter in Ramganga river.

The present study reveals higher values of silicates as compared to other areas. As Thane's origin is of volcanic effusions (18) it could be a reason for high silicates in its water. While higher silicates with in the enclosure water could be due to the presence of siliceous grasses in the *nirmalya*, which while decaying release the silicates into the water and it is especially more after Ganapati and Navaratri festivals.

Nitrate-nitrogen is the second important nutrient responsible for primary production. It is mainly contributed through bacterial nitrification and its removal is affected through utilization by green aquatic plants and bacterial denitrification.

A wide range of variation in the concentration of nitrates in Indian fresh water has been reported (19—21). Salaskar and Yeragi (6) recorded that in Shendala lake (Kalyan) the nitrate concentration varied between 1.35—2.75 mg/liter, while Chandrashekar (22) has reported its range between 9—70 mg/liter in Saroornagar lake (Hyderabad). The maximum values were recorded in monsoon, which were linked with heavy runoff of organic matter. Mani (8) reported nitrate values varying from 0.71—0.77 mg/liter at Tulsi lake and 0.C04—3.6 mg/liter at Pokharan lake.

During the present study nitrate nitrogen values did not show much difference between the main lake and the enclosure waters (Fig. 2). The nitrates range between 0—0.14 mg/liter in the main lake and 0.05—0.24 mg/liter in the enclosure. As compared to 1994, the nitrates values in the main lake have reduced due to the strategy adapted by Thane Municipal Corporation, prohibiting the organic waste from entering the main lake by constructing the enclosure for collection of *nirmalya*.

Phosphorus is the third nutrient responsible for biological productivity (23, 24). Phosphate phosphorus is an important constituent not only for the growth of aquatic vascular plants but also for the growth of phytoplankton. Usually, it is found in the aquatic environment as inorganic and organic phosphorus. Ponds and jheels are considered as biological traps of phosphorus. Shallow waters have high phosphorus content. Edmondson (9) has classified lakes into good fair, bad, very bad and awful on the basis of percent phosphorus loading. Salaskar and Yeragi (6) recorded phosphate levels ranging from 1.5—1.65 mg/liter in Shendala lake, while at Saroornagar lake, Hyderabad, Chandrashekar (22) recorded phosphates ranging between 0.5—3.1 mg/liter. Bhosle et al. (7) reported higest values of 41 mg/liter during the pollution survey conducted on Godavari river. The higher values of phosphate phosphorus are reported either due to rain or domestic sewage or the decaying of aquatic vegetation (12, 22, 25—27). Sawyer et al. (28) considered the concentration of inorganic phosphorus above 0.03 mg/liter as enough to produce algal blooms. Mani (8) reported phosphate values of 1.15—1.89 mg/liter at Masunda lake, 0.875—0.975 mg/liter at Tulsi lake and 0.36—0.79 mg/liter at Pokharan lake.

During the present study, phosphate phosphorus values ranged between 0.0064—0.0876 mg/liter in the main lake while it was 0.0252—0.40 mg/liter within the *nirmalya* enclosure.

It has been observed that the values of inorganic phosphorus have been reduced at Masunda lake (main lake). It could be due to the building of enclosure. Schindler and Fee (29) have suggested that the phosphorus control is an efficient primary step in preventing the eutrophication problem.

In most of the pollution studies made, low values of DO along with high values of nitrates and phosphates show the typical case of eutrophication. Rural and urban runoff contributes more in the process of enrichment and also deterioration of water quality (30, 31). But the esthetic value of the lake is lowered with the enrichment of such nutrients and the subsequent growth of phytoplankton and aquatic weeds (32).

The current comparative study of the main lake and enclosure waters revealed zero values of DO, high values of hardness, silicates and phosphates within the enclosure. Since this water is prevented to a large extent from mixing with the main lake water, the main lake is protected. Thane Municipal Corporation has also taken steps to prevent domestic sewage from contaminating the lakes. This can be one of the remedial measures to protect the lakes from eutrophication without hurting the religious sentiments until some better measures are found out. *Nirmalya* enclosure method can also be used as a model to show the effects of decaying organic matter.

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