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Study on possibilities of low cost waste water management in urban India with special reference to Kolkata, West Bengal

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ABSTRACT

Cities in India have been in under tremendous pressure of population growth as well as with huge production of wastewater. Wastewater treatment projects have found vulnerable due to various constraints. In result natural bodies around the cities have been used as disposal site hence contaminated severely. So, controlling pollution through managing the wastewater as well as resource recycling has gained increasing urgency in recent decades. An effort has been made in this paper to critically examine the status of wastewater generation in urban India, its possibility of management through recycling with a special attention to Kolkata. It has been observed that city wastewater has been used as revenue earning combination of agriculture and aquaculture in Kolkata. The entire system created and developed by the local people in the area is the unique of its kind and serve as a 'Natural Kidney' of the Megacity Kolkata where sustain resource recovery system in the form of vegetable farms, fish ponds and paddy fields. Despite of various constraints fisheries have been functioning successfully in this area with producing employment opportunity for two persons per hectare. Therefore, the study shows that disposal of waste water in other Indian cities as well as in other parts of Kolkata can be used as low cost resource recovery process for future sustenance.

Keywords: Waste Water, Pollution, Recycling, Low Cost, Kolkata

Introduction

Developing countries like India have been adopted rapid development process to meet the immediate demands of their teeming population (Cseindia.org). The problems are also magnified by the pattern of civilization which is heading towards rapid urbanization. But a shortcoming in this development process and lack of environmental foresight has led to massive ecological destruction through pollution over the last few decades. Pollution can simply be defined as 'using of

scarce natural resources and producing wastes in form of solid, liquid and gasses as the bi-product'. As development is needed the society cannot be able to either close the use of them or manufacture these valuable resources. Among the other natural resources water is one of the major valuable resource of the day. Fresh natural water is used in every segment of life from household to industry, business to agriculture and produce wastewater as bi-product, management of which has become a severe problem. It was estimated by the United Nations in 1997 that about 1.1 billion people in the world have lack of clean water and 2.2 million children under five die each year due to contaminated water borne diseases. They also estimated that two thirds of world population would be affected by water shortages by 2025 (Sos-arsenic.net).

So the management of wastewater is an important way towards upholding the people as well as whole ecology. Keeping in view the potentiality, the wastewater may be considered as a resource. Recycling of wastewater may be able to serve the both purposes i.e. management and resource recovery. In view of the above, an effort has been made in this study to critically examine the status of wastewater generation in urban India, its possibility of management through recycling with a special attention to Kolkata.

Data Base and Methodology

The present study has been conducted based on both secondary as well as primary data. The secondary source includes government publications, publications by NGOs and other relevant published sources. The primary data has been collected from different wastefed fisheries include Banhooghly Fishermen's Co-operative Society Limited, Kolkata, West Bengal.

Table 1: Decadal trend of urbanization in India

Sl. No.	Year	Decadal growth of population of India (%)	
		Urban	Overall
1.	1961	17.97	21.64
2.	1971	19.91	24.80
3.	1981	23.34	24.66
4.	1991	25.71	23.86
5.	2001	27.78	21.34

Source: censusindia.net

Results and Discussion

Cities in many parts of the developing world are growing at twice the rate of overall population growth. Every day 1.6 million people in the world are migrating from

rural areas to cities (Theworldpopulation 2001.htm). India has also been facing the similar problem of rapid urban population growth. Table-1 indicates that growth of urban population in India has been increasing at a higher pace than that of overall population growth in every decade except in between 1981 to 1991.

Table 2: Fresh natural water use in India

Sl. No.	Natural water users	Volume of fresh natural water use (BCM)	
		2005	2050 (Estimated)
1.	Agriculture	524	807
2.	Industry	30	81
3.	Household	30	111
4.	Others	45	181
Total		629	1180

Source: wrmin.nic.in

Simultaneously the fresh water use in India has also been increasing into a massive intensity. Every year India receives 4000 BCM (Billion Cubic Metre) rainfall from all sources among which only 1122 BCM is useable for any purpose where as useable fresh water requirement of India will be estimated as 1180 BCM/ year in 2050 (Table- 2). The intensity of water use can be reduced but the overall reduction in the volume of water use is almost impossible due to the population boom. In an estimate it has been found that 80% of health problems and 1/3rd of deaths in India are attributed for waterborne diseases (answers.google. com). So the recycling of wastewater is absolutely necessary to bridge the gap between useable water and water use.

There is evidence of indiscriminate use of water in urban India and similarly the production of wastewater is also very high. It has been estimated that 16,000 MLD (Million Litres Daily) of wastewater is generated from class-1 cities (population more than 100,000), and 1600 MLD from class-2 cities (population between 50,000 and 100,000) (cpcb.nic.in). It can be observed in Table-3 that 4 metropolitan cities in India have been generating a huge volume of wastewater among which a small portion (16.12%) is treated. The remaining amount of wastewater is disposed to the natural bodies situated at the periphery of these cities (Table 3) and which 165.26% are overburdened. Therefore, an immediate management of wastewater in these cities calls for the day for future sustenance.

Table 3: Existing status of wastewater in 6 major cities in India in 2003

Sl. No.	Name of the city	Total population (Million)	Wastewater (MLD)			Capacity (MLD)	Place of release
			Generated	Treated	Disposed		
1.	Mumbai	16.36	2456.0 (100)	246.0 (10.02)	2210.0 (89.98)	109.0	Sea
2.	Kolkata	12.79	1432.2 (100)	357.3 (24.95)	1074.9 (75.05)	1411.0	River, Wetlands
3.	Delhi	9.81	1270.0 (100)	254.0 (20.0)	1016.0 (80.0)	981.0	Agriculture
4.	Chennai	6.42	276.0 (100)	19.0 (6.89)	257.0 (93.11)	257.0	Agriculture
Total			5434.2 (100)	876.3 (16.12)	4557.9 (83.88)	2758	

Figures in the parentheses indicate percent over total

Source: cpcb.nic.in

Indian cities generally do not have necessary resources to treat wastewater before disposal. Institutional as well as legislative support for pollution control are available but still in vogue. Even where expensive wastewater treatment plants are installed, only a small percentage of the volume of total wastewater is treated before discharge which results in contamination of rivers, lakes and aquifers. In reality, the treatment of wastewater is still very low in India (only 22.72%) (cpcb.nic.in). In practice, Indian cities have adopted conventional wastewater treatment plant over the last fifty years. These plants have performed poorly with frequent breakdowns, and they usually turned up into abandoned projects. Some of the reasons behind this failure are improper operation and maintenance, and also the shortage of municipal funds to meet the high operational cost for such plants (Ballou, 2002).

On the other hand, it has been found that wastewater has high potential for reuse in agriculture; an opportunity for increasing food and environmental security, avoiding direct pollution of rivers, canals and surface water; conserving water and nutrients, thereby reducing the need for chemical fertilizer; and disposing of municipal wastewater in a low-cost, sanitary way (Tandon *et al.*, 2003). With a little effort at upgrading the existing disposal system, the task of turning municipal sanitation into a revenue-earning project can be achieved in India. The local people of Kolkata have developed similar resource recovery system from wastewater since 1930 at the wetlands situated mainly in eastern part of Kolkata commonly known as East Kolkata Wetlands (EKW). They have been using city wastewater for the

fisheries in *bheries* (wetlands), irrigation water for vegetable gardens and finally irrigation water for agricultural crop (mainly paddy) production consecutively at the eastern part of the city. There are 264 fish farms (*bheries*) are operating on a commercial basis in EKW and they cover a total area of about 2858.65 ha (Ghosh, 1999).

The technical system developed in EKW for treatment of wastewater works as follows. The wastewater of the city brought by the canals to these *bheries* and passed through the few small sedimentation tanks (anaerobic tank) and where the water is treated manually using either liming by CaO (Calcium Oxide) or biochemical. Water hyacinth is usually grown in these anaerobic tanks to facilitate absorption of the oil and grease in the effluent. Then the water allowed entering into the *bheries* for pisiculture and the excess water left out through sluice gate into the crop field for their irrigation. The regular netting and rowing (by paddle boat) at some fisheries helps in re-oxygenation from the atmospheric oxygen in the water bodies. Vegetable gardens situated nearby on the garbage substrate also use this water as irrigation water from bheries. Through this system EKW recovers nutrient for fish, crop and vegetables as well as fresh water of primary treated quality. An estimated 13000 MT of fish per year and 150 MT of vegetables per day produced in this area (dfid.stir.ac.uk).

Table 4. Production, productivity and return from sale of fish of BFCSL during 1999-2000 to 2003-2004

Year	Production		Productivity		Return from sale of fish		
	Total (M.T)	CGR (%)	MT/ha	CGR (%)	Total return (₹)	Return/ha (₹ /ha)	CGR (%)
1999-00	66.30		6.63		16,67,995.00	1,66,799.50	
2000-01	83.30		8.33		22,88,275.85	2,28,827.58	
2001-02	69.40	1.46	6.94	2.40	18,31,822.10	1,83,182.21	5.90
2002-03	74.29		7.42		20,06,456.05	2,00,645.60	
2003-04	75.50		7.55		23,72,335.50	2,37,233.55	

Source: Bonhooghly Fishermen's Co-operative Society Ltd.

It has been estimated that establishment of wastewater treatment plants for secondary wastewater treatment with 'Reverse Osmosis' system requires a huge investment of ₹ 1.81 crore/Million Litre Daily (MLD) as initial cost as well as ₹ 43,000/MLD as operating cost (cseindia.org). On the contrary, the initial investment in west fed aquaculture is much less amounting to ₹ 30 lakh/MLD. It may also provide an additional year-round employment at the rate of 2 people/ha besides treatment of wastewater (Ghosh, 1999). Analysis of wastewater in different times at this place proved that each hectare of wetland removes 237 kg of BOD per day (Ghosh, 1999). However, water-testing centres have yet been

established in EKW area for monitoring the water quality round the year. It is presumed that the residue of chemicals may persist at the end products (i.e. fish, vegetables, paddy etc.) that may cause health hazards.

Besides turning 'bad water into good' fisheries in Megacity Kolkata, are generating a huge turnover per annum as we can find in Bonhooghli Fishermen's Co-operative Society Ltd (BFCSL), situated at Baranagar area of Kolkata. The BFCSL has been operating their business on 10 ha of water area out of 12.1 ha leased in land. Here daily loading of wastewater is 3.5 million litre and BOD level reduced from 150 mg/lit. to 10 mg/lit. The basic objective of BFCSL is pisiculture in sewage-fed wastewater. The production and productivity of pisiculture as well as return from the sale of fish of BFCSL during 1999-2000 to 2003-04 has been presented in Table-4. The compound growth rates of production and productivity are 1.46% and 2.40%, respectively, which indicate commendable performance of the society. It has been observed that the return from sale of fish has increased over the years under review except 2001-02. The compound growth rate of total return from the sale of fish has been observed to be 5.90% which is also very praiseworthy.

The sewage fed wastewater supplied by KMA (Kolkata Metropolitan Authority) to different societies may be considered as an important input of the production system of those societies. The societies generally pay rents for the respective water bodies (viz. BFCSL pays ₹ 3740.00 for 12.21 ha of leased in area during 2003-04) which are fixed arbitrarily. However no price is paid to KMA for supplying sewage water which is the main component in these production systems. If some price is paid for this sewage water it can be as a project fund for the renovation of wastewater carriers and the wetlands which are suffering from many problems viz. siltation, lack of water testing centres etc.

Conclusion

Indian Cities have been in under tremendous pressure of population growth as well as with huge production of wastewater. Wastewater treatment projects have found vulnerable due to various constraints. In result natural bodies around the cities have been used as disposal site hence contaminated severely. So, controlling pollution through managing the wastewater as well as resource recycling has gained increasing urgency in recent decades.

Keeping this point in mind an alternate way has made known by Kolkata where city wastewater has been used as revenue earning combination of agriculture and aquaculture. The entire system created and developed by the local people in the area is the unique of its kind and serve as a 'Natural Kidney' of the Megacity Kolkata where sustain resource recovery system in the form of vegetable farms, fish ponds and paddy fields. Despite of various constraints fisheries have been

functioning successfully in this area with producing employment opportunity of two persons per hectare. Therefore, similar technique can be adopted in case of disposal of waste water in other Indian cities as well as in other parts of Kolkata as low cost resource recovery process for future sustenance.

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