Feasibility Check of Artificial Duplication of Self - Cleansing Property of Ganges on Mula - Mutha River Using Physio-Chemical Properties

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Abstract- *Ganges, which is considered as the holiest river has the self-cleansing property based on which the river cleans and decomposes all the pollutants added to it during its course of travel. The main cause of this high pollution is cremating rituals performed on the banks of the river and discharge of highly polluted industrial as well as domestic waste. But research shows that during its course the river cleans itself to an unbelievable extent naturally. This also has scientific explanations and presently is a trending topic of interest for many researchers. The water of Ganga is said to have a tendency to retain Dissolved Oxygen by 25 times more than any other river water and this capability of retaining DO is not found in any other river. If this highly effective cleansing property of Ganga River can be duplicated in Mula-Mutha River flowing through Pune city, then it will help to improve the cleansing so as to reduce the impact of the effluents discharged into it.*

In this study, the Physio-chemical properties of Mula-Mutha River at different locations were tested in laboratory and compared with those of Ganges which were extracted from literature. This study is based on the duplication of the self-cleansing property of Ganga River into Mula-Mutha River.

Keywords- Physio-chemical properties, Mula-Mutha, Self-cleansing property.

I. INTRODUCTION

In human history major civilizations have flourished around the world on the banks of river since water is essential for human survival. Over time, cities were built near these fresh water sources. For future generations to understand and respect the value of fresh water, people began worshipping rivers.

In India, rivers are considered sacred. An unwelcome outcome of the Industrial Revolution was the pollution of river waters. To cater to the ever growing human population cities kept expanding and, consequently, river water pollution increased. Worldwide, rivers became the dumping ground for both domestic (municipal) waste and industrial effluents. The release of toxic materials into the river waters adversely affected aquatic life.

The amount of waste discharged into the rivers is too much to handle and is beyond the capacity of the river to self-cleanse. Untreated water from the industries and household waste discharge directly into the rivers makes the water harmful and thus makes the flora and fauna of the river difficult to survive. Studies have been carried out on the entire stretch of Mula-Mutha Rivers through the city and many serious issues have come into appearance.

In western countries, the rivers flowing within the city serve as means of recreational activities as well as inland transportation. The intensity of River pollution in some of the western countries in nearly negligible based on visible inspection. But the situation is totally opposite in India. There is a need to overcome this situation in developing countries like India and as of now, many River rescue projects have been started. Some of them have been come up as a big failure and some on verge of being one.

Water is essential for life. An adequate, safe and accessible supply of water is every human's right. Every possible effort should be made to achieve a drinking water quality as safe as possible.

II. Ganges

Ganga River is one of the prime rivers of India. It flows east through the Gangetic plain of Northern India into

the country of Bangladesh. The river has immense religious significance and it has for long been considered the holy river of the Hindus.

Ganga River originates in the Himalayas, it begins at the Gangotri glacier in the state of Uttarakhand in the central Himalayas at the confluence of five headstreams - Bhagirathi River, Mandakini, Alaknanda River, Dhauliganga and Pindar at Dev Prayag. From here, it drains into the Bay of Bengal through its vast delta in the Sunderbans and also into Bangladesh. After entering Bangladesh, the main branch of the Ganges is known as Padma River till the Yamuna River the largest distributary of the Brahmaputra River joins it.

III. Mula-Mutha River

The Mula-Mutha is a river in India, formed by the confluence of the Mula and Mutha rivers in the city of Pune, which later meets the Bhima River, which itself later meets the Krishna River and finally emptying to the Bay of Bengal.

The river flows through the village of Kavadi in the Solapur district, which witnesses a lot of migratory birds. However, increase in pollution in the recent years has resulted in a reduction in the number of birds. Pollution from effluents released into the river at Pune has been found to cause high levels of pollution in the Bhima River, the reservoir of Ujani dam and Krishna River too, resulting in a lot of water borne ailments.

Due to high levels of pollution, including 125 MLD of untreated sewerage water being discharged into the river by the Pune Municipal Corporation, the Maharashtra Pollution Control Board has classified the water quality to be of Class-IV, based on the report submitted to MPCB by Klean Environmental consultants Pvt. Ltd. The Pune Municipal Corporation announced plans to clean up and restore the river by pumping in oxygen on the lines of restoration efforts undertaken in Mumbai for the Mithi River.

Tanmay Kate et al (June 2015), have focused on the current situation of the physiochemical properties of the Mula-Mutha River. The project study highlights pollution status and impact on Mula-Mutha River and damps on it. This paper highlights the present condition of the Mula-Mutha River and states possible control measures to improve the water quality of the river. Various physiochemical parameters like Dissolved Oxygen, Biochemical Oxygen Demand, Temperature and Total Solids were determined through lab experiments and are shown in a tabulated form. The pollution status of the river is discussed and various reclamation methods have been discussed which can help the river to regain its lost property.

D. Mukherjee et al (1993) have studied water qualities of the River Ganga (The Ganges) over a short stretch from Swarupganj to Barrackpore (in West Bengal) and are compared with the values reported by the National Environmental Engineering Research Institute of India for the periods 1972-74 and 1979-80. The water quality is generally bad, but not at such alarming levels as previously determined by other agencies. Biochemical and chemical oxygen demand (BOD and COD) levels were found to be high but within tolerable limits. Dissolved oxygen (DO) levels were fairly high, indicating a reasonable self-purifying capability for the River Ganga. However, nutrient loads containing N and P were found to be increased enormously over the long period of years

Pali Sahu et al, (2015), have focused their area of study under the title to analyze the river by dividing it into various sampling station. This study also identifies the critical pollutants affecting the river water quality during its course through the city. The indices have been computed for pre-monsoon, monsoon and post-monsoon season at four locations, Khadakwasla, Sangamwadi, Vithalwadi & Bund Garden. This study found that the water quality ranged from satisfactory to marginal category at Khadakwasla and fell under very poor category at all other locations. The author believes this research has a vast future scope as the rapid industrialization results in formation of toxic contaminants leading to enormous damages to environment directly putting the lives at risk and this gathered information would be handy and helpful for preventing or at-least reducing the hazardous impacts.

Parameters which were studied by the authors were pH, Total Hardness, Turbidity, Dissolved oxygen, Biochemical Oxygen Demand and Chemical Oxygen Demand. The author's conclusion regarding the pollution status of the rivers is the water quality has mainly deteriorated due to the domestic sewage in case of river Mutha and industrial effluents in case of Mula river. The pollution load in the river is very heavy and this needs to be focused seriously in order to regulate the river's flow as it used to be earlier.

D.G. Kanse, et al (2005) carried out physic-chemical analysis of the waters of Mula, Mutha ans Mula-Mutha. Six sampling stations were identified from Khadakwasla to Sanghvi and the samples were collected along the course of the river. The analysis was carried out for the parameters namely pH, Acidity, Alkalinity, Total Hardness, Calcium, Magnesium, Chloride, Nitrate, Sulphate and Phosphate. The

assimilative property of the environment and accumulation of pollutants on the ground water and soils is supposed to be due to continuous discharge of the industrial effluents and sewage. The author finds that the river, due to the discharge of untreated industrial effluents and sewage, has considerably got polluted and hence the water of these rivers is unsafe for consumption or human useand needs preventive action.

Eknath Navnath Chandanshive, (2013), writes in his paper about the seasonal variations of the physico-chemical parameters of the Mula-Mutha River of the Pune city. The paper highlights pollution status and impact on fish diversity in Mula-Mutha River and damps on it. Seventy two species was reported in 1942 in this river. However, it has been observed that fish diversity is gradually decreasing since last thirty years unprecedently, mainly due to manifold human activity. The author says fish diversity in midway of river is becoming rare and only four species have been reported form polluted stretch of river. The river Mula-Mutha is flows through city area and is one of the important sources of water body because of seven dams on it and its importance in agricultural, industrial and development of Pune city. The author also mentions about the perennial nature that supports abundance of aquatic life including fish fauna. About Sixty Three species of different fishes have been reported from upstream from January2003- December -2007 and only Four species of fishes in the downstream during winter and summer. The author mentions that the Mula-Mutha River and its tributaries are highly polluted due to domestic and industrial wastes. The physico-chemical aspects of water pollution of Mula-Mutha Rivers was analysed seasonally with respect to following parameters from July-2004 to May-2005. Water temperature, pH, Dissolved solids, Dissolved oxygen, free carbon dioxide, Acidity, Alkalinity, Chloride content, Nitrates, Phosphates, Biological oxygen demand & Chemical oxygen demand. It was observed that the level of these parameters was optimum during and winter and summer seasons.

Namrata Singh, (2010), carried out physico-chemical tests on the Ganges water at six different locations at Varanasi which included Assi Ghat, Shiwala Ghat, Chauki Ghat, Harishchandra Ghat, Rajendraprasad Ghat, and Raj Ghat. The results have been shown in a tabular format and can be used to compare with the results of Mula-Mutha as in both the cases, the stretches are polluted but in case of Ganges, the results are comparatively on the safer side which can be duplicated in Mula-Mutha River only by artificial means.

Table 1.

PARAMETERS	GANGES
pH	7.5-8.8
DO	2.2-9.8 (mg/L)
BOD	1.9-87.5 (mg/L)
COD	5.9-170.5 (mg/L)
Temperature	21.5-35.20 ºC

IV. Study Location

Four sampling sites were selected for the study namely Sangam-Sangamwadi, upstream; Mula-Kirkee, Mutha-Mhatre Bridge, downstream-Koregaon Park. The sites selected were approximately 5 KM from the Sangam on both the directions i.e. upstream as well as downstream so that individual rivers can also be tested for the water quality.

Table 2. location details of sample collection points.

LOCATION CODE	NAME OF THE PLACE	LOCATION	
		LATTITUDE	LONGITUDE
01	KIRKEE	18°33'14"	73°51'47"
02	KOREGAON PARK	18°32'31"	73°54'21'
03	MHATRE BRIDGE	18°30'5"	73°50'11"
04	SANGAMWADI	18°32'17"	73°51'56"

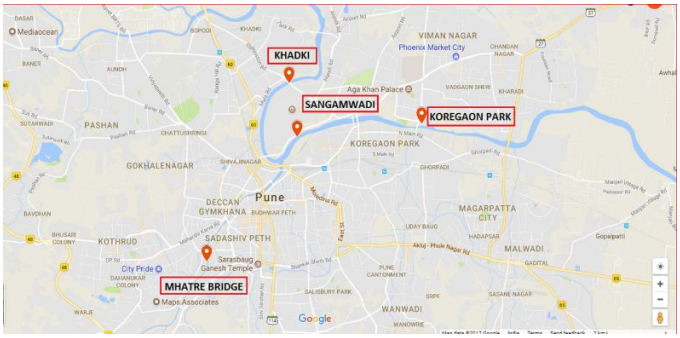

Figure 1. Location of sample collection points.

V. RESULTS

1. pH: The permissible pH range is 6.5-8.5 as per the Indian standards. The average pH of Mula-Mutha lies within the safety limits given by the Indian standards.

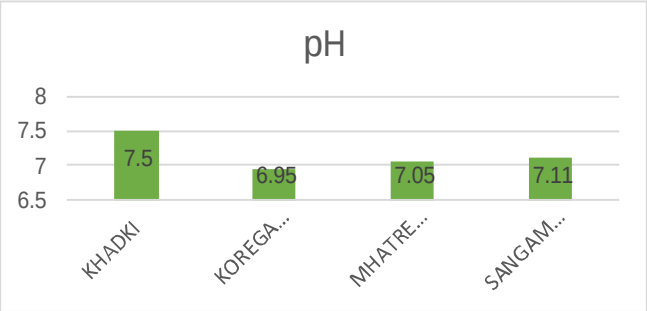

Figure 2.

2. Temparature: Temparature plays an important role in the growth of the organisms present in the river water. The temperature may vary from 0°C in winter to 30°C in summer. There is no specific standard as per the river temperature is considered. The safe limit may vary according to the flora and fauna present in the river water.

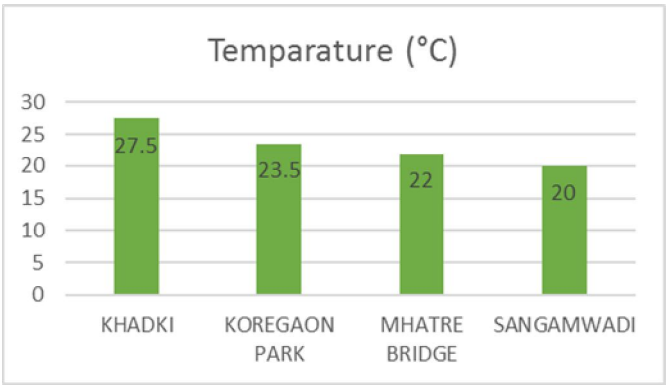

Figure 3.

3. Dissolved Oxygen: The safe limit or minimum DO should be 4-5 mg/L. DO below 3 mg/L cause harm to the aquatic life present in the river water.

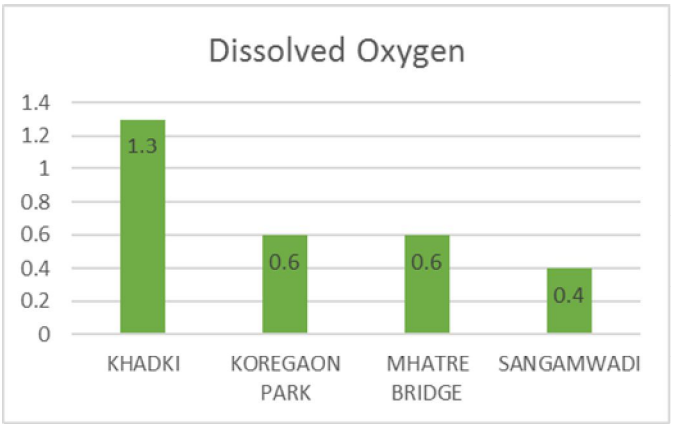

Figure 4.

4. Biological Oxygen Demand: The maximum permissible limit for Biological Oxygen Demand is 30 mg/L.

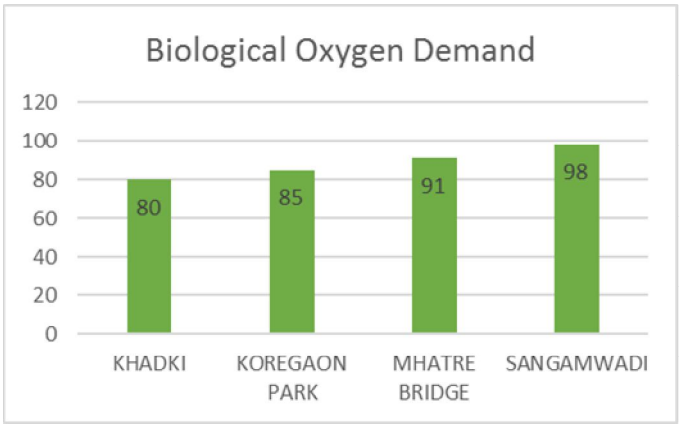

Figure 5.

5. Chemical Oxygen Demand: The maximum permissible limit for Chemical Oxygen Demand by CPCB is 250 mg/L.

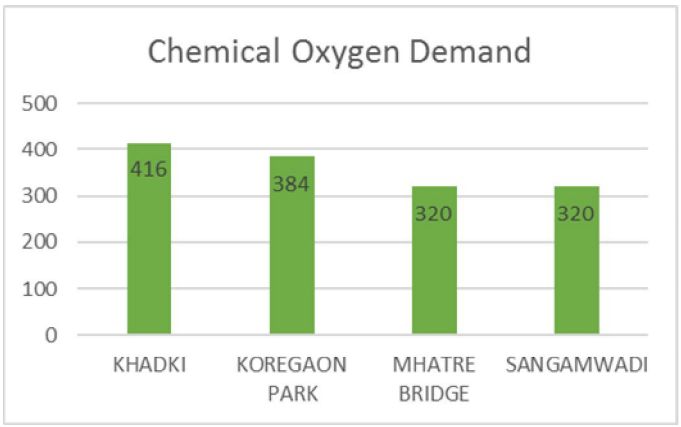

Figure 6.

6. Hardness:

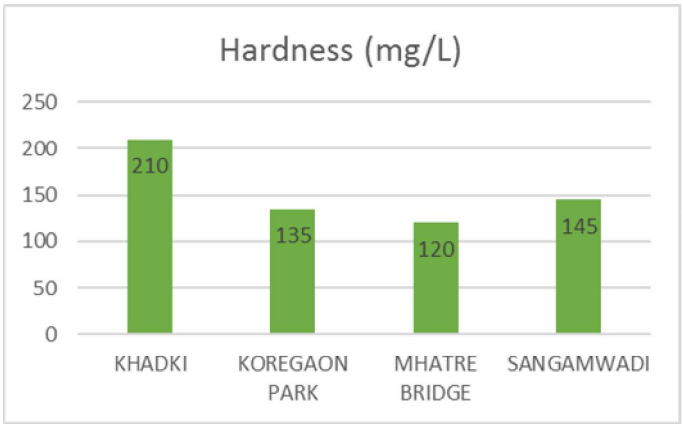

Figure 7.

VI. CONCLUSION

The target of the study was to replicate the self-cleansing property of the river Ganges. This included replicating the physical, chemical as well as the biological property of the river so as to improve the self-cleansing property of the Mula-Mutha River.

However, the physical property is very difficult to achieve because of the altitude difference of both the rivers from Mean Sea Level, Bed slope and the difference between flow velocities of both the rivers.

The physio-Chemical properties were tested for the Mula-Mutha sample in laboratory.

Table 3.

PARAMETERS	GANGES	MULA-MUTHA
pH	7.5-8.8	6.95-7.11
DO	2.2-9.8 (mg/L)	0.4-1.3
BOD	1.9-87.5 (mg/L)	80-98
COD	5.9-170.5 (mg/L)	320-416
Temperature	21.5-35.20 ºC	20-27.50

It can be depicted from the table that the DO content of the Ganges is much higher than that of Mula-Mutha River, this factor may influence the self-cleansing property of the river.

Increasing DO artificially in Mula-Mutha river will be uneconomical so chemical property of Ganges also becomes difficult for replication. This leads to carry out research on the Biological parameters and any new possibilities may be explored.

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