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Treatment To Mutha River Using Baffle Walls

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Abstract - The Mutha river is a river in Western Maharashtra, India. It arises in the Western Ghats and flows Eastward until it merges with Mula river in the city of Pune. It has been Dammed twice, first at the Panshet dam can be Ambi river; used as a source of drinking water for Pune city and irrigation. The water released here is dammed again at Khadakwasla and is an important source of drinking water for Pune . One more dam has been built later on the Mutha river at Temghar. According to our research, the major source of pollution of river Mula Mutha are presence of dissolve salts and carbonates of the surrounding soil ,waste from temples, additional flow of domestic waste ,industrial waste and agricultural waste which is mainly organic matter , and other solid waste into the waste. Increase in globalization and industrialization country faces the various challenges for providing clean and safe water to public with a superior combination of strength and corrosion residence. It produces a large sound image and accurately track sound elements with the onscreen action. To eliminate (water flow) dead spots in the water treatment basin, baffle walls were needed. Using baffles to slow, calm and distribute the water can help solve this problems. Baffle can lengthen the flow path and distribute the flow more widely. They significantly increases the amount of sediment captured and trap much smaller particles than open basins.

***Key Words*:** Baffle Wall, Froude's Law, Water Pollution, Solids, Turbidity

1. INTRODUCTION

The Mutha River is a river in western Maharashtra, India. It arises in the Western Ghats and flows eastward until it merges with Mula River in the city of Pune. It has been dammed twice, first at the Panshet dam on Ambi River and is used as a source of drinking water for Pune city and irrigation. The water released here is dammed again at Khadakwasla and is an important source of drinking water for Pune. One more dam has been built later on the Mutha River at Temghar. The entire Pune city is covered by three rivers viz., Mula, Mutha and Pavana.

Now a days , Mutha is almost a dead river because it is not flowing. It flow is dependent upon the will of irrigation department. The citizens are also responsible for high pollution through the use of many detergents and cleaning products. These chemical detergents are harmful for marine biodiversity even had PMC had failed to treat 100% sewage water. Pollution in river Mutha has been consistently rising and has reached alarming levels turning the river into a dead river body at many stretches. According to research, the major source of pollution of river Mula-Mutha are presence of dissolve salts and carbonates of the surrounding soil , waste from temples, additional flow of domestic waste ,industrial waste and agricultural waste which is mainly organic matter, and other solid waste into the waste[1].

In present scenario, the river water has become waste water due to disposal of city waste through which it flows.

Fig-1: Present Scenario of Mutha River

1.1 Problem Statement

Growing urbanization and industrialization brings many changes in quality of Mutha River water. Mutha is almost a dead river because it is not flowing. So, for future of fresh water it becomes necessary to treat waste water by better and efficient method. Therefore by providing baffle walls we can treat waste water of Mutha River in an economic way.

1.2 Scope of the Work

The major source of pollution of river Mutha are presence of dissolved salts and carbonates of the surrounding soil, waste from temples, additional flow of domestic waste industrial waste and agricultural waste which is mainly organic matter, and other solid waste into the water.

1.3 Objectives

1. To improve the quality of Mutha River which will ultimately helps to reduce the adverse effect on the environment.
2. To reduce the waste pollutants from water.
3. To check the feasibility of position of baffle walls and also orifice into the baffles.

2. PREVIOUS RESEARCH WORK

1. Analysis of the some physico- chemical parameters of Mula- Mutha river at Pune (Maharashatra) S. D. Jadhav, M. S. Jadhav(2016): Physico-chemical characteristics of Mula-Mutha river water were studied in the three stages viz. monsoon, pre-monsoon and post-monsoon in the year 2016. The analysis was done for the parameters like pH, DO, BOD, COD, chlorides, nitrates, sulphates, turbidity, calcium, magnesium, hardness etc .Water is an important and most abundant substance. All animals and plants posses water as an essential constituent. The purest form of the water is probably the rain water. Water is used for industrial purposes and for municipal supply. To ensure the right quality and quantity. Efforts to improves or maintain a certain water quality and quantity often compromise between the quality and quantity demands of different users. The data of physic-chemical parameters of Mula-Mutha river contains pH of water in the range from 5.34 to 8.72 which shows slight alkalinity at Vittalwadi sampling station. Good water should have the solubility of oxygen 7.6 and 7.0 mg/l at 30 c and 35 c respectively. The results were compared with the drinking water standers of who and ISI (10500-91) which indicates the detoriation of quality of water body after mixing the sewage water into the main course of water body. The study indicates the need for monitoring of river water for physico-chemical characteristics in study area.

2. Report on using bioabsorbents to reduce river water pollution by Snehlata B. Khalkar, S. R. Korke (2015): The chlorides and nitrates concentration of Mula-Mutha river was studied as per as outline method by APHA 10. For this study 6 sampling stations were selected. The water collected along the course of river from Vittelwadi to KP. From the results it was found that river receives the domestic waste along the heavy loads and industrial influents. Hence from the observation it is conform that Mutha River is most polluted river than Mula river and it passes through Pune city and it receives industrial and domestic heavy loads too. Chloride and nitrates are very common pollutants in river stream. Chloride concentration can be very problematic in high concentration. Nitrate (NO3-) is also one of the most harmful pollutant in water rising conc. Of NO3- in ground water is huge problem and attract wide area of research. By using different materials and methods the water pollution can be reduced.

3. Physico-chemical analysis and curative approach to Mutha river pollution by Pali Sahu, Sonali Karad, Sagar Chavan, Sourabh Khandelwal (2015):
Increased urbanization coupled with industrialization during the past few decades are depleting water ecosystem irreparably in Pune. Studies on the river water quality are an essential step to protect useful natural water resources. Untreated toxics such as domestic detergents and other cleaning products which enter the river make the water more harmful, killing the fauna and flora of the river. It is necessary to study the physic-chemical characteristics of the river and adopt suitable remedial approach to this issue; contaminated water is the biggest health risk and continues to threaten both quality of life and public health. Water quality decreases with the flow. Various parameters like pH, temperature, chlorides, phosphorous, turbidity, solids, BOD, COD, dissolved oxygen were studied and analyzed in papers. The water quality was analyzed per station on daily basis for 7 days with sample collection done thrice a day. The water parameters change during the time of the day and thus samples were collected in the morning, afternoon and evening to maintain accuracy in the test results. The results were used to design the treatment units. Flow of water is calculated by considering the population and water supply from the area. Starting with screening which removes large floating matter from the flow and reduce the inorganic matter. Sedimentation tank settles the small size particles and the remaining inorganic and organic matter present in the water treated by the process of advanced oxidation by hydrogen peroxide.

4. Report on water quality status of Mula-Mutha river by A. B. More, C. S. Chavan, Ajoy Gurung (2014): Water pollution is an acute problem in all the major rivers. The dirty water is biggest health risk and continuous to threaten both quality of life and public health. Mula-Mutha river is a rivers which passes through centre of Pune city with growing urbanization and industrialization. Indian faces challenges of providing clean and safe water to all citizens. Following test were performed

1) DO
2) BOD

As per result they find out some points are highly polluted. Some points are polluted by some particles some points polluted by chemical particles. They also conclude some remedies.

1) By awareness
2) By increasing
3) By eco technology
4) Drainage line on both side of river

As per the study on Mula-Mutha River, it is seen that river can be clean up permanently in future with some effect by the government of Maharashtra. The conclude that to clean up river permanently. It is necessary to take a proper decision by the government.

3. METHODOLOGY

In this project, following methods are followed:

1. Selection of Site:

A Mutha River in Pune is flowing through by covering almost every part of suburban area of this city. While flowing, river also carries waste effluent materials which gets disposed of into the river by industries, small scale factories, daily disposal of household wastes, garbage etc. Point of inflow of waste disposal is present at every point of river. So in this project, site has been selected along the length of the river which was accessible & also covering maximum sources of drainage inflow. As side bunds are fixed having inner to inner wall distance is 30 m, length can be varying according to the feasibility of model design.

2. Collection of Data:
   i. Annual, Seasonal, Daily, Average Rainfall Data
   ii. Fixed Dimensions of river bunds
   iii. Velocity of river water
   iv. Discharge of river water

3. Model Design:

In order to solve the problem of turbidity & solid content, Froudian model is designed based on the data collected from site. Similar to prototype in all respects design of the model has been done based on Froude's Model Law. By considering similarity, the scale of the model has been reduced to suitable dimensions on the basis of different trials. The suitable scale was selected & model was fabricated with this scale.

The arrangement in the tank contains baffle walls at equal spacing & an orifice positioned in alternate opening such a way that the water should follow zig-zag path as shown in figure 3.3 & 3.4. After all the testing, the most optimum design of tank is finalized.

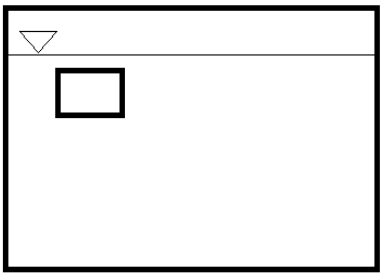

Fig-2: Orifice provided at Left Side of Baffle

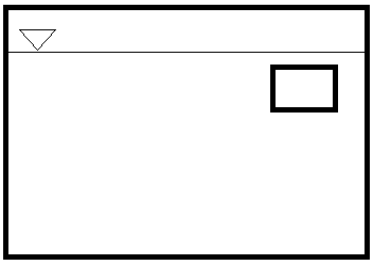

Fig-3: Orifice provided at alternate Side of Baffle

4. Model Design:

In this case, to simulate the model with its prototype Froude's Model Law has been applied by considering geometric, kinematic similarity & dimensionless number.

a. Geometric Similarity

The geometric similarity is said to exist between the model & prototype when the ratio of all corresponding linear dimension in the model & prototype are equal. In this case, length ratio, depth ratio, area & volume ratio were considered.

b. Kinematic Similarity

In this case, velocity, discharge, time etc. are the parameters considered that should possess kinematic similarity.

c. Dimensionless Number

Here time scale ratio has been taken.

By using all these similarities, calculations were done with number of trials. The suitable scaled model has been selected using the parameters as shown in Table 1.

Table -1: Values of different parameters for Designed Model

Sr. No	Parameters	Values for model design
1	Tp	1500
2	Tm	12
3	Tr	
4	Qm (m^3/s)	0.0768
5	Qp (m^3/s)	15.7
6	Qr	
7	Xr=Lr	61.54
8	Lm (m)	1.2
9	Lp (m)	750
10	Zr=dr	
11	Dm	0.16
12	Dp	1.5
13	Volume of Tank in ltr (ltr)	29
14	Volume of Tank in ltr (m^3)	0.0288
15	Vp (m/s)	0.5
16	Vm (m/s)	0.1

5. Design of Orifice

a. Orifice within Baffle

For the flow of water from one compartment to another compartment orifice is designed using following formula:

Theoretical discharge = Area of orifice * $\sqrt{2gH}$

Where, H= depth of water from centre of orifice.
Q= Discharge through orifice
a = area of orifice
C_d = co-efficient of discharge

b. Orifice at Inlet of the Tank

A bucket of 50 litres is used as inlet tank. An orifice is provided at the bottom of tank. It is necessary to design an orifice for controlling the velocity of flow & also the discharge. Following formula is used for fixing the diameter of an orifice:

Time required for emptying tank through an orifice at bottom can be calculated by

$$T = \frac{4L}{3cd * a * \sqrt{2g}} [(2R)^{3/2} - (2R - H1)^{5/2}]$$

Where, D = Diameter of tank = 2.5 cm

A = Area of tank = $(\prod/ 4) * 2.5^2 = 4.90\ cm^2$

H_1 = Depth of water level in tank = 40cm

Cd = coefficient of discharge = 0.6- 0.95 (say 0.6)

By solving above equation, we get

T = 12.17 min

Therefore, by trial and error method using above formula "T=12.17" min was feasible model for sustention.

Hence, an orifice of diameter 2.5 cm is provided at the bottom of tank (bucket).

4. RESULTS

With the variation of orifice sizes, testing was carried out which gives following results:

Table -2: Variation of Turbidity with the compartment of Model

Compartments	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
1	38	37.5	36.3	36.4	37.9
2	29.4	29.6	30.1	28.8	27.9
3	18.9	18.9	19.4	19.2	19.7
4	5.7	6.2	6.5	5.9	6.0
5	4.1	3.8	3.6	3.9	4.0

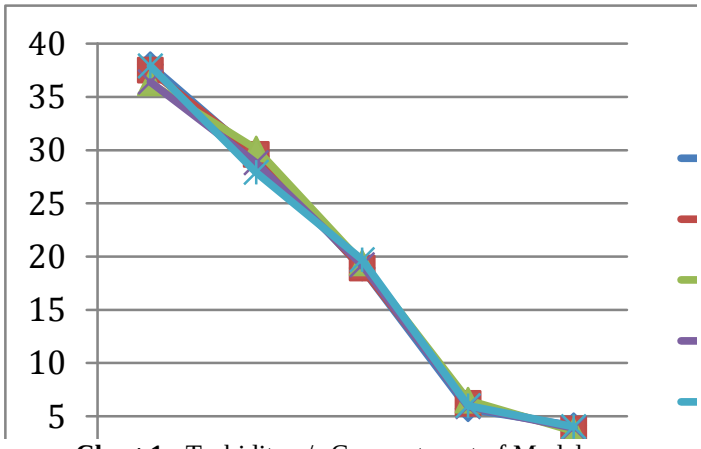

Chart 1: Turbidity v/s Compartment of Model

5. CONCLUSIONS

An undistorted model is designed similar to prototype using Froude Model Law. Model with baffles having orifice size of (4 X 3) cm are used for testing the samples for the parameters as solids & turbidity of sample at outlet.

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