

# Studies on Physical Properties of Sediment in Reference to Suitability to Benthic Organisms of Tapi River at Galteshwar, Surat, Gujarat

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**Abstract:** - Tapi River is one of the most important river of Gujarat. It received organic matter, agricultural waste and domestic waste. The study was conducted at Galteshwar near Kamrej, Surat (Riverine zone). To study on physical properties of sediment I reference to suitability to benthic organism of Tapi River the study was carried out for 6 months (March 2015 to August-2015). Samples were collected monthly during morning hours. Sediment samples were analyzed for Temperature, Moisture, Bulk density, Particle density, Porosity, Texture, and Water holding Capacity. Nematode community was observed abundantly in compared to other benthic organisms.

**Keywords:** -Tapi, Galteshwar, Sediment, Physical properties, Benthos.

## I. INTRODUCTION

Rivers play an important role in the life of the people because these are mostly used as a source of water for drinking, bathing, irrigation, recreation and other miscellaneous purposes (De, 2010). Tapi and its tributaries constitute large river system in India. The River Tapi is one of the major rivers supporting agriculture and domestic usage. It also carries the discharged waste.

Depending on the river morphology and hydrological condition, suspended particle with associated contamination can settle along the watercourse and become part of the bottom sediment, often for many kilometers downstream from the chemical sources (D. Ciszewski, 1997). Since sediment pollution in river has become an issue of increasing environmental concern. Such pollution comes from polluted runoff in agricultural areas and human activities

Galteshwar is located at Kamrej near the bank of Tapi River on Lat. 21°16' 51.1572" N and Long. 73°5'0.4776" E. It is freshwater zone where inlet of agricultural waste, Sand mining, and waste from temple is also occurs. This site was selected for the study because it is less polluted site and no other human activity is done. This study was aimed to find the suitability of physical quality of sediment against benthic organisms. The sediment quality affects the lifecycle of benthic organisms which play an important role in ecosystem. Benthos is the integral and inseparable associates of the biotic component of an aquatic system. They are ubiquitous in existence and found from arctic region (Tundra) to tropical and sub-tropical parts of the world. (Sinha and Das, 1993). The result of this study serve as baseline information of

availability of benthic organisms like nematodes, polychaetes, molluscs in their suitable environment in which they can easily survive .

## II. MATERIALS AND METHODS

To fulfill the objectives and aims of the study, monthly collection (March 2015 to August 2015) was taken from selected site in the morning time. The sediment was taken from the site for the analysis of physical properties. The sediment samples were collected as described by Nybakken (1988). Sediment samples were collected by using 30 cm long acrylic core of 7.5 cm diameter which was pushed into mudflats up to 5cm and the sediments were scooped out per m<sup>2</sup> area. At each sample spot, two sediment samples were collected, pooled and stored in polythene bags. One sediment sample was dried and preserved for selected physical parameters. Second set was used to extract benthic organisms using isotonic solution of NaCl (modified method described in Nybakken, 1988). It release them from the particles and pour off the water and it was constantly stirred up so the organisms were dislodged which were filtered on a very fine mesh and preserved in 5% formalin and they were identified with the help of (Higgins and Thiel, 1988), (Nybakken, 1988), (Olave Giere, 1993).

Table I. Methods For Analysis Of Sediment

Sr. No	Parameters	Method	Source
1	Temperature	By Soil Thermometer	Carter – 1993
2	pH	Electrometric Method	Trivedy and Goel -1986
3	Moisture	Gravimetric Method	Gupta-2002
4	Density and Porosity	Laboratory Method	Gupta-2002
5	Texture	International Pipette Method	Gupta-2002
6	Water holding capacity	Soak and Drain Method	Carter – 1993

III. RESULT AND DISCUSSION

Table II. Sediment Quality (March-2015 To Aug- 2015)

Parameters	March 2015	April 2015	May 2015	June 2015	July 2015	Aug 2015
Temperature (°C)	23	27	25	30	25	27
pH	7.2	7.2	7.3	7.1	7.2	7.4
Moisture (%)	20.6	22.7	21.3	21.95	18.37	20.63
Bulk density (gm/cm <sup>3</sup> )	1.56	1.41	1.33	1.64	1.37	1.72
Particle density (gm/cm <sup>3</sup> )	2.79	2.64	2.56	2.88	2.71	2.41
Porosity (%)	44.08	46.59	48.04	43.06	49.44	47.36
Clay (%)	6	7	10	9	6	4
Silt (%)	8	11	13	12	14	20
Sand (%)	88	82	77	79	80	76
WHC (%)	51	56	62	59	55	57

During the study the temperature was ranges maximum 30 °C to minimum 23°C in June-2015 and march- 2015 respectively. pH was ranges from Maximum 7.4 to minimum 7.1 during the August- 2015 and June- 2015 respectively. Moisture was ranges from maximum 22.7 % to minimum 18.37 % during the month of April-2015 and July- 2015 respectively. Bulk density of the sediment was ranges from maximum 1.72 (gm/cm<sup>3</sup>) to minimum 1.33 (gm/cm<sup>3</sup>) during the month of August- 2015 and May-2015 respectively. Particle density was ranges from Maximum 2.88 (gm/cm<sup>3</sup>) to minimum 2.41 (gm/cm<sup>3</sup>) in the month of May-2015 and August- 2015 respectively. Porosity was ranges from maximum 49.44 % to minimum 43.06 % during July-2015 and June-2015 respectively. In sediment texture Clay quantity was ranges from maximum 10 % to minimum 4 % during May- 2015 and August-2015 respectively. Silt quantity was ranges from Maximum 20 % to minimum 8% during August -2015 and March-2015 respectively. Sand quantity was ranges from maximum 88 % to minimum 76% during the month of March -2015 and August-2015 respectively. Water Holding Capacity of the sediment was ranges from maximum 62% to minimum 51% during the May-2015 and March- 2015 respectively.

With this Physical quality of sediment different Benthic Organisms were found like nematodes, polychaete worms and molluscs during the study. Three of them are very important indicators for study the environmental factors. Nematode indicates the anthropogenic pollution. Maximum

presence of polychaete community indicates the organic pollution. Maximum presence of molluscs also indicates the environmental pollution.

At the maximum value of temperature (30°C), pH (7.4), Moisture (22.7%), Bulk density (1.72 gm/cm<sup>3</sup>), Porosity (49.44%), and silt (20%) and minimum value of pH (7.1), Moisture (18.37%), Particle density (2.41 gm/cm<sup>3</sup>), Porosity (43.06%), Clay (4%), Sand (76%) nematodes were found more in number polychaetes were recorded more in number at the maximum value of Particle density (2.88 gm/cm<sup>3</sup>), Clay (10%), Water holding capacity (62%) and minimum value of Bulk density (1.33%). At the maximum value of Sand (88%) and minimum value of Temperature (23 °C), Silt (8%) and water holding capacity (51%) molluscs were found more in number than nematodes and polychaetes

During the month of March-2015 molluscs were found more in numbers than nematodes and polychaete worms. And during the month of May-2015 polychaete worms recorded more in number than nematodes and molluscs. But during the month of April- 2015, June-2015, July-2015, and August-2015 Nematodes community were found more in number than other benthic organisms. So averages of six month of study nematodes were dominant community with this type of sediment quality. It also indicates the anthropogenic pollution at selected site. Nematodes have successfully adapted to every ecosystem from marine to freshwater to soil. Nematodes are free living benthic organisms. They feed on bacteria, fungi, protozoans and even other nematodes, and play a very important role in nutrient cycling and release of nutrients

Table III. Biological Parameters (March -2015 To August- 2015)

Parameters	Value	Month	Nematodes	Polychaetes	Molluscs
Temp. (°C)	Max. (30)	June-15	+++	++	+
	Min. (23)	March-15	++	+	+++
pH	Max. (7.4)	Aug-15	+++	++	+
	Min. (7.1)	June-15	+++	++	+
Moisture (%)	Max. (22.7)	April-15	+++	+	++
	Min. (18.37)	July-15	+++	++	+
Bulk Density (gm/cm <sup>3</sup> )	Max. (1.72)	Aug-15	+++	++	+
	Min. (1.33)	May-15	++	+++	+
Particle Density (gm/cm <sup>3</sup> )	Max. (2.88)	May-15	++	+++	+
	Min. (2.41)	Aug-15	+++	++	+
Porosity (%)	Max. (49.44)	July-15	+++	++	+
	Min. (43.06)	June-15	+++	++	+
Clay (%)	Max. (10)	May-15	++	+++	+
	Min. (4)	Aug-15	+++	++	+

Silt (%)	Max. (20)	Aug-15	+++	++	+
	Min. (8)	March-15	++	+	+++
Sand (%)	Max. (88)	March-15	++	+	+++
	Min. (76)	Aug-15	+++	++	+
WHC (%)	Max. (62)	May-15	++	+++	+
	Min. (51)	March-15	++	+	+++

Temperature and pH are important parameters for the growth of benthic organisms. Different benthic organisms are adapted to different range of temperature and pH. At this site range of temperature (23-30 °C) and pH of (7.1-7.4) freshwater benthos are mainly adapted. Moisture is important physical parameter for the sediment quality. At the study site less moisture was recorded. Presence of clay in the sediment increases the water holding capacity, where as sandy substrate holds less moisture (MZ Shaikh *et.al.* 2012). The result shows that sediment texture of selected site is sandy. In sandy sediment Nematodes are easily adapted because they are slender and easily live in small sized sands. (Hongayo, *et.al.* 2012)

Bulk density has a little value as an indicator of the space in soil inhabitable by nematode (Jones and Thomasson. 1976). Circulation of water through the pore space in the sediment is important because this is responsible for the renewing the oxygen supply (Nybakken 1988). Porosity affects several things but of particular importance in estuarine system is how the number of pores affect the exchange rates of oxygen, Nutrients and particulates between overlying water and benthic organisms. (Garono et al; 2006). At the selected site this range of porosity and density of sediment is favorable for the nematode community.

Nematodes are good bioindicator for Pollution. They can be Pathogenic or non-pathogenic. It also serves as a food for higher trophic level. In many aquaculture practices they are used as a supplement feed. The culture of non pathogenic nematodes with the help of this quality of sediment is most useful for the aquaculture. Nematodes are potentially useful for setting management priorities in unique and valuable habitats. The relative rareness of indicator species could

provide useful information more rapidly (Bongers, *et al.*, 1999).

#### IV. CONCLUSION

The present study may be concluded as; the physical quality of sediment of Tapi River at the site of Galtheshwar indicates the anthropogenic pollution due to the some human activities. It has been also observed that this quality of sediment is moderately suitable for the polychaetes and then molluscs. But it is very favorable for the growth of nematode communities. They can also live in the adverse condition of environment. By using this physical quality of sediment Aquaculture practices could be more improve for the culture of benthos and productivity.

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