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Analysis of Physicochemical Characteristics of River Water in Raigad District.

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Abstract: According to the UN report, India is estimated to be the most severely affected as the global urban population facing water scarcity is projected to increase from 933 million in 2016 to 1.7-2.4 billion people in 2050, there is a water shortage problem worldwide. Common people in India are facing a bigger to a higher level of water scarcity. The NITI Aayog, an Indian government policy think tank, recently gave a report on the dependency of India on the irregular Monsoon for the water required to fulfill the challenges of water scarcity. There is an increasing trend of degradation and pollution of the environment because of industrialization, agricultural product, and urban life development. This kind of development is adversely affecting the water reservoir in India which is important for sustaining human health, social development, and ultimately life. According to global data, an estimated amount of 80% of industrial and municipal wastewater is discharged into the environment without any required treatment, adversely affecting human health and the ecosystem. The least developed countries are having higher percentage because sanitation and wastewater treatment is lacking.This paper explains the research work done on the physical and chemical characteristics of industrial wastewater collected from two industries; Taloja MIDC and Khopoli MIDC.As per the study, it has been found that some industries are responsible for polluting the surrounding area including Textile, Petrochemical, Chemical, pharmaceutical, and paper industries.There is the same situation in Raigad district of Maharashtra. As per the recent news data, there are 67 villages and 193 'wadis' (smaller areas) in the Raigad district are facing acute water shortage.

The present research work deals with the study of some of the important physicochemical parameters of industrial wastewater effluents collected from Taloja MIDC as well as Khopoli MIDC of Raigad district of Mumbai. The study reveals that engineering, paper mill, fine chemical, dyes, paint, pharmaceutical, petrochemical, and textile industries are some of the major industries responsible for polluting the surrounding rivers of this area.

The parameters like Turbidity, temperature, chloride content, pH, and COD have been considered in two seasons of the year, one in the winter and another in the rainy season in two different industrial areas of the Raigad district.

The results and analysis are discussed here.

Keywords: Water pollution, water treatment, Physico chemical contamination

I. INTRODUCTION

Raigad district is in Maharashtra and one among the four coastal districts located along the western coast of the state between north latitude 17°51'00" and 19°08'00" and east longitudes 72°50'00" and 73°40'00"; Thane district is situated in the north, Ratnagiri district in the south, Pune district in the east and Arabian Sea forms the western boundary having a length of about 250 km.

Maharashtra Industrial Development Corporation (MIDC) is the nodal investment promotion agency under the Government of Maharashtra that provides businesses with infrastructure such as land, roads, water supply, drainage facilities, street lights, etc. The residents of the MIDC area always do protest against water-related issues. Maharashtra pollution control board issues notice to some companies in this area for violating the pollution control norms.

Therefore the need to raise the concerns about contribution of different toxic elements in various health-related issues is very high. This paper has discussed the contamination of river water with effluents of industries and a preliminary physicochemical water analysis has also been discussed.

2. Collection of water samples:

Standard bottles were used to collect samples of wastewater from near the two industrial areas in two different seasons, one near the industrial area and another far from the industrial area to observe the effect of effluents. The areas selected were Taloja industrial area and Khopoli industrial area. The bottles were cleaned properly with hydrochloric acid, followed by washing with tap water to make it free of acid, then after it is washed with distilled water twice, rinsed with the water sample to be collected and finally the bottles were filled up with sample water.

Figure 1: Water samples collected from different places in different seasons in Raigad district.

2.1 Preliminary tests on the physiological properties

Whenever the water has to be used for drinking, domestic, agricultural, and industrial purposes, it must be tested with different parameters. Water must be tested with different physicochemical parameters. The parameter selected is entirely dependent on the purpose for which water is going to be used and what the requirement of quality and purity is. Water may contain different types of floating, dissolved, suspended, microbiological and bacteriological impurities. General physical tests like temperature, cooler, pH, turbidity, and odor tests should be done while chemical tests like BOD, COD, and DO, alkalinity, hardness, and other characterizations must be performed. If more quality, and purity of water is required, it should be tested with trace metals, heavy metals, and organic pollutants. Water being used for several processes should pass all the criteria tests and it should have the required amount of designated characteristics. If more quality and purity of water is required, it should be tested with trace metals, heavy metals, and organic pollutants. Only developed countries follow all these criteria strictly. For measuring very small amounts of heavy metals or trace elements, highly analytically sophisticated instruments are required.

Below are the physical and chemical characteristics, which are tested for determining the quality of water.

2.2 Physical Characteristics of water samples

	Rainy season				**Winter season**			
	Taloja MIDC (Near to Industrial area)	Taloja MIDC (Far from Industrial area)	Khopoli MIDC (Near to Industrial area)	Khopoli MIDC (Far from Industrial area)	Taloja MIDC (Near to Industrial area)	Taloja MIDC (Far from Industrial area)	Khopoli MIDC (Near to Industrial area)	Khopoli MIDC (Far from Industrial area)
Turbidity	yes	No	No	No	Highly turbid and very much Viscous	No turbidity	Yes, very high turbidity	No turbidity
Colour	Pink	Opaque and yellowish	yellowish	Very clear	yellow	yellowish	Translucent, not clear	Clear, transparent
Odour	yes	yes	yes	No	yes	yes	yes	No
Temperature	34.5	32.5	33.1	34.0	31.2	32.3	31.3	31.0

Table 1: Physical characteristics of samples

The wastewater shows different colors depending upon the type of industry, it is coming from. The wastewater collected was colorless in the sample collected far from stations Khopoli MIDC. Moreover, the wastewater was pale yellow in color in the rest samples. The water was very turbid and collected near Taloja MIDC and Khopoli MIDC. The turbidity is caused by a wide variety of suspended materials that range in size from colloidal to coarse dispersion [1]. In this study, an unpleasant odor was noted almost all samples.

Among several parameters, temperature is one of the most important features because it controls the solubility of gases and salts in water. The life of all living organisms is a complicated set of biochemical reactions which is influenced by physical factors such as temperature. When temperature increases, all microbial activities increase. An increase in temperature also acts as a barrier to fish migration and seriously affects the migration of species. In the present study, the temperature of water samples varies according to weather between a minimum of 31 ℃ in winter to a maximum of 34.5 ℃ for the samples collected during the rainy season.

2.3. Chemical Characteristics due to chemical impurities

	Rainy season				Winter season			
	Taloja MIDC (Near to Industrial area)	Taloja MIDC (Far from Industrial area)	KhopoliMIDC (Near to Industrial area)	KhopoliMIDC (Far from Industrial area)	Taloja MIDC (Near to Industrial area)	Taloja MIDC (Far from Industrial area)	Khopoli MIDC (Near to Industrial area)	Khopoli MIDC (Far from Industrial area)
pH	8.12	7.39	8.3	7.1	11.1	7.1	5.6	6.59
Chloride (mg/l)	15076.1	9867.6	7392.34	6983.8	16524.0	10902.4	7732.92	7712.93
COD (mg/l)	2596	1533	180	160	3112	2533	208	192

Table 2: Chemical Characteristics due to chemical impurities

pH is a scale that measures the acidity or alkalinity of materials. pH is a simple and stable parameter but is extremely important because reactions taking place in an aquatic medium is influenced by it. Highly acidic or alkaline water can kill aquatic life and is not suitable for drinking, agricultural or industrial purposes. The toxic effect of different heavy metals is also influenced by different pH. The pH is a prime factor for determining the quality of wastewater. Waters with pH value of about 10 are exceptional and may reflect contamination by strong bases such as NaOH and Ca $(OH)_2$[2]. The range of desirable pH of water prescribed for drinking purposes by ISI[3] and WHO[21]is 6.5 to 8.5. The pH values of water samples collected from different places and different season show variation between a minimum 5.6 in the water samples near Khopoli MIDC collected in the winter season and a maximum of 11.1 in the water sample collected near Taloja MIDC collected in the winter season. In all the cases, pH values were deviated from the permissible limit.

Chlorides are also present in all natural waters in different concentrations. Excessive chloride in potable water is not particularly harmful and the criteria set for this anion are based primarily on palatability and its potentially high corrosiveness[4]. Chloride present in higher amounts (> 250 mg/L) gives a salty taste to water.

The presence of chloride content is also related to the hardness of water samples. The hardness of water samples at all eight samples varied according to the locations and seasons i.e. higher values during winter season due to a decrease in water volume and lesser hardness in monsoon might be due to heavy rainfall. The high values of total hardness in the water samples near Taloja MIDC can be directly linked to the high pollution load in this area.

All organic compounds with few exceptions can be oxidized by the action of strong oxidizing agents under acidic conditions. The Chemical Oxygen Demand (COD) measures the oxygen required for the oxidation of organic matter present in water by a strong chemical oxidant. It is one of the important parameters to measure the pollution of wastewater. During COD determination; oxygen demand value is useful in specifying the toxic condition and presence of biologically resistant substances. It is an important, rapidly measured parameter for industrial wastewater studies and control of waste treatments. The COD test is used to measure the load of organic pollutants in industrial wastewater.

COD and BOD both are oxygen-dependent measures of the pollution level of wastewater. COD is similar in function to BOD, in that both measure the amount of organic compounds in water. In the present study, COD values varied from 2500±500 of water samples collected near Taloja MIDC to 200±50 mg/liter at the sampling location near to Khopoli MIDC. COD values showed tremendous variations and indicated the presence of an ample quantity of chemically oxidizable organic matter in the water due to untreated industrial effluent. It is required that if COD is persistently greater than 250mg/l surrounding any industry, such industry units are required to identify chemicals causing the pollution.

Summary

Temperature, pH, BOD, COD, and turbidity are the important parameters for the evaluation of wastewater treatment efficiency and compliance to discharge requirement. Turbidity is an important parameter in measuring the quality of water post-treatment.

The temperature of wastewater samples ranged from 31 to 34.5 °C (Table 1), which was not within the recommended WHO range of 20 to 32 °C. The pH of wastewater samples ranged from 7.1 to 11.2 and similarly was not within the WHO range of 6.5 to 8.5.

Temperature, pH, presence of organic substances, and types of microbes control microbial degradation in water. Therefore, increased temperature in wastewater indicates increased bio-degradative reactions in the presence of increased organic substances. The organic substances and types of microbes in the wastewater were not determined in this study. According to UN Environment, over 80% of the world's wastewater is discharged into the environment without proper and adequate treatment, polluting the fields where they are released, lakes, and rivers. Such pollutants can easily flow from the environment into humans directly or indirectly. There is a clear need to treat the water before discharging it in the environment openly.

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