Study of Physico-chemical Parameters of the 'Jayanti Nalla'Kolhapur (Maharashtra)

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Abstract: Water quality is closely linked to water use and to the state of economic development. Water pollution occurs when unwanted pollutants are discharged directly or indirectly into water bodies without adequate treatment. Water pollution affects plants and organisms living in the water bodies and also to the natural biological communities. The present study was carried out to access the water quality of 'Jayanti Nala' Kolhapur (Maharashtra). Jayanti Nala flow in middle of the city which receives maximum untreated sewage and industrial waste. The water from Jayanti Nala discharged in 'Panchganga River' without any filtration and proper treatment, which is very harmful and unsafe to human consumption. In the present study, random water sampling was collected and physico-chemical parameters such as pH, temperature, turbidity, dissolved oxygen, carbon dioxide, phosphate and nitrate were analysed. The results obtained from physico-chemical analysis were out of permissible limits set by World Health Organization (WHO) and not suitable for aquatic animals, irrigation and agriculture purposes.

Index Terms **-** Physico-chemical, Water quality, Jayanti Nala, Kolhapur.

I. INTRODUCTION

Water is an important part of the ecosystem. The chemical composition of every water resource is different. It depends upon the characteristics (Physical, Chemical and Biological) of surrounding environments [1]. The quality of freshwater resources has weakened especially in the course of the most recent two decades. Contamination in water bodies is due to extending population, industry and urbanization [2]. Contamination of water resources by anthropogenic activities effects on the chemical and physical composition of water [3]. That promotes the destruction of aquatic biota, food web and the aquatic environment [4].

Water is valuable and very important liquid for every living on earth. Water has been used by humans since ancient times for various purposes like washing, drinking, also for hygiene, animal husbandry and agriculture [5]. In every country, most industries and commercial areas are near water bodies. It is due to the availability of the large amount water [6]. There are various industries like manufacturing plants, processing plants, food industry, nuclear project plant, mining sectors, paper industry, dairy industry, and chemical and fertilizer production, etc. [7]. This industries use the too much water and release large amount of polluted and contaminated water. The pollution of water adverse effect on the aquatic environment and also on human health. Most Indian rivers are treated like an open drain where citizens and industries [8]. Their sewage, garbage, plastic, etc. throwing directly into river without proper or adequate treatment. In the past few countries, urbanization and industrialization has directly affected the natural resources and environment [9].

The quality of water depends on the physical and chemical parameters. The major physico-chemical parameters in aquatic bodies are temperature, pH, oxygen, carbon dioxide, Hardness, nitrate, phosphate etc.[10] . These physico-chemical parameters act as a limiting factor for aquatic organisms [11]. The aquatic animals tolerate changes in water quality at threshold limit beyond these limit results into deleterious effect on organism. Many international and national agencies such as ICMR, USPHS and WHO have set standards for water quality. If the quality of water in river and other streams is not according to these parameters then it is unsafe for drinking and human consumption. Therefore, the present study was attempt to check the quality of water in major sewage flowing Jayanti Nalla in Kolhapur, Maharashtra (India).

RESEARCH METHODOLOGY

Kolhapur is the adjacent urban body located along the bank of the river with a population of 549283 and this city is located at 16° 42' N and 74° 14' E, having mean sea level of 570 m. Area of Kolhapur city is around 6682 Ha. Panchganga flows from the borders of Kolhapur. It originates in Western Ghats and is a major tributary to Krishna. It starts from Prayag Sangam. The Panchganga is formed, by four streams, the Kasari, the Kumbhi, the Tulsi and the Bhogawati. One more river stream Saraswati is believed to flow underground and together with the other four streams make river Panchganga. During its course to the east of Kolhapur, the Panchaganga River receives considerable streams of nallas within Kolhapur. The nallas like Jayanti, Dudhali, Line Bazar, Raman Mala, Rajhans in Klhapurand Kabnur, Chandur, Tilavani, Talange and Kala odha in Ichalkaranji carries significant volume of treated and untreated domestic wastewater and waste from Textile industries (CETP) and joins the Panchganga River. Though the attempts have been made to estimate the physicochemical parameters in the water of Jayanti Nalla.

Jayanti Nalla: Kalamba lake overflows is the original starting point of Jayanti nalla. At Hutatma Park, Gomati nalla mixes Jayanti nalla to form a big nalla basin. It receives sewage from nearby areas. It is the largest catchment and accounts for more than 60% of the total sewage generated in the city. A small tannery belt is also located in the basins which discharge the waste in nalla. At present a bund has been constructed on Jayanti nalla near Shahu Maratha pumping station. Hence the sewage flowing through Jayanti nalla is pumped to this pumping station and is eventually sent to STP at Kasba Bawda.

Water quality in jayanti nalla was determined by the study of physicochemical parameters such as temperature, pH, Dissolved Oxygen (DO), Dissolved Carbon dioxide (DCO_2), Hardness, Phosphates, and Nitrate from water used to hold the fishes and water collected from fish rearing centre Dhom during the collection of fingerlings. All the parameters were studied by standard methods of APHA (1985) [12].

For the present study, random water sampling were collected from three different sites-

1. Ramanand Nagar, Kolhapur
2. Gopal Krishna Gokhale College, Kolhapur.

3. RTO office, Dasara Chowk Kolhapur.

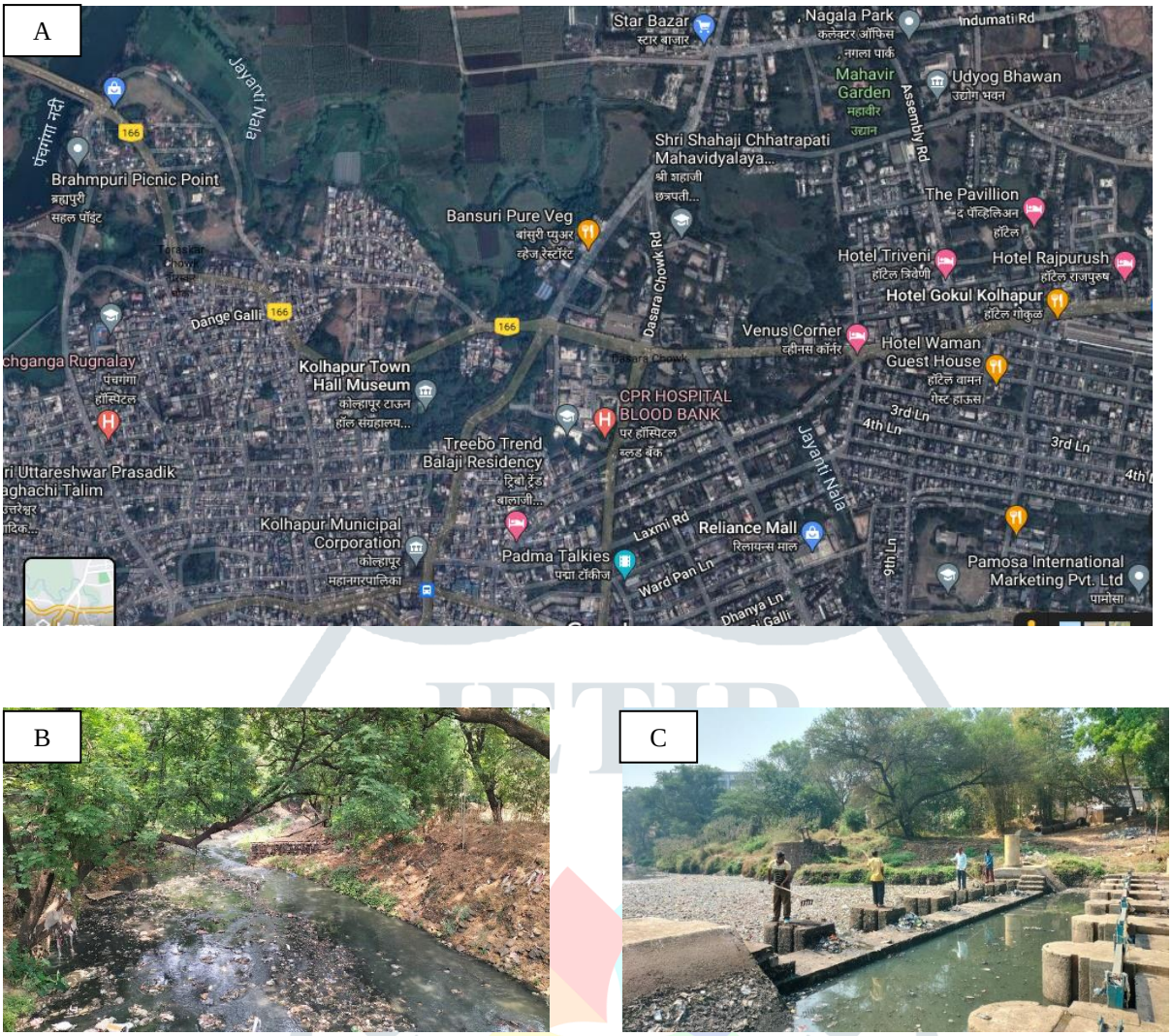

Fig. 1. Location Site of Jayanti Nalla. **A.** Map of Jayanti Nalla in Kolhapur city **B.** Sewage water collection site of Jayanti Nalla in Gopal Krishna Gokhale College, Kolhapur. **C.** Sewage water collection site of Jayanti Nalla in back side of RTO office Kolhapur.

RESULTS AND DISCUSSION

In the present study, physicochemical characters of sewage water from Jayanti Nalla of Ramanand Nagar, Gopal Krishna Gokhale College and RTO office, Dasara Chowk Kolhapur was analyzed by standard methods of APHA [12]. To analyze the quality of water physicochemical parameters such as temperature, pH, dissolved oxygen, dissolved carbon dioxide, hardness, nitrate and phosphate were selected. The results of all these parameters were presented in Table No.1. and Figure No.2.

Table no. 1 Result of Physicochemical Parameters of Jayanti Nalla

Parameters	Temperature (^oc)	P^H	Turbidity (NTU)	DO (mg/l)	CO_2 (mg/l)	Hardness ($CaCO_3$) (mg/l)	Phosphate (mg/l)	Nitrate (mg/l)
Ramanand Nagar	22.12 ± 2.46	6.00 ± 0.11	50.16 ± 10.58	0.3 ± 0.2	4.40 ± 1.96	180.25 ± 2.85	5.64 ± 0.34	80. 43 ± 0.64
G.K.G College, Kolhapur	22. 45 ± 2.03	8.25 ± 1.54	100.76 ± 20.86	0.4 ± 0.63	3.52 ± 1.58	205.12 ± 3.01	5.89 ± 0.13	92.81 ± 2.06
Dasara Chowk	24. 68 ± 2.11	10. 43 ± 1.85	230 ± 30.83	0.2 ± 0.13	3.11 ± 1.22	209.25 ± 2.13	6.32 ± 0.43	103.45 ± 3.05
WHO Standards	25.00- 30.00	6.5- 8.5	Below 10	4.00- 6.00	22-50	100-200	0.1-1.0	45-100

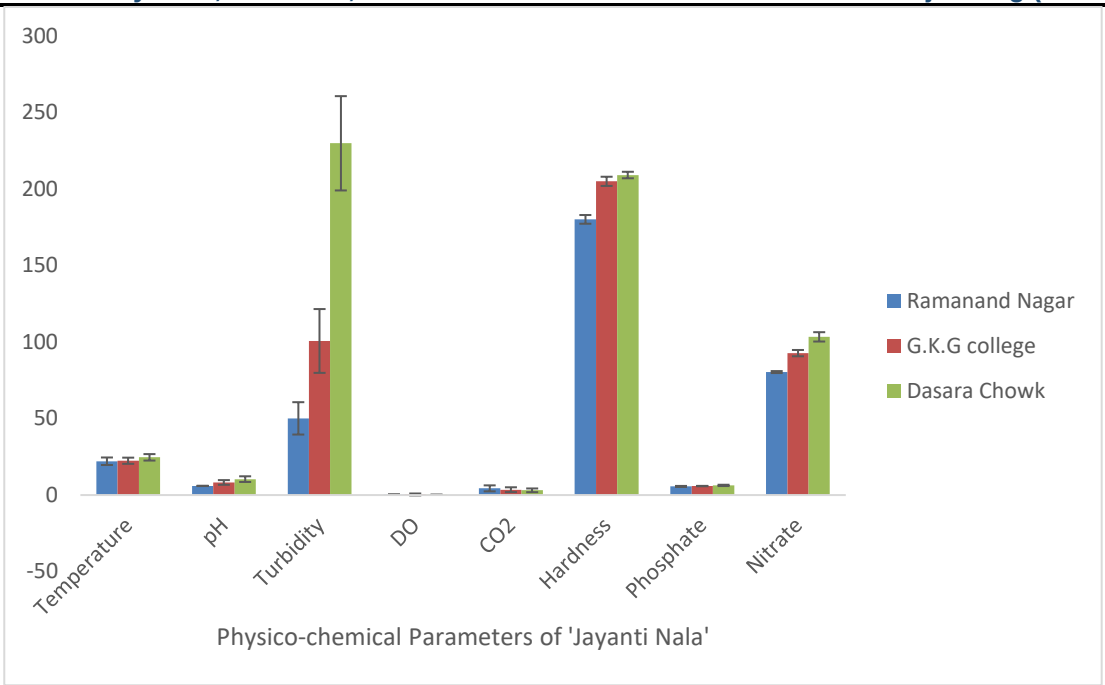

Fig. No.2 Graphical representation of the result of Physicochemical Parameters of Jayanti Nalla.

Temperature is a major environmental physical factor which controls the aquatic environment in freshwater [13]. In the present investigations, the temperature of water isolated from Ramanand Nagar , G.K.G College and Dasara Chowk water was 22.12 ± 2.46 ^{0}C, 22.45 ± 2.03 ^{0}C and 24.68 ± 2.11 ^{0}C respectively (**Table No. 1**). There was no significant fluctuation during the temperature. The pH of water determines the number of hydrogen ions as well as acid-base balance. The fishes were normally grown and survive only at a specific range of pH. The pH of water collected from Ramanand Nagar , G.K.G College and Dasara Chowk was 6.00 ± 0.11, 8.25 ± 1.54 and 10.43 ± 1.85 respectively. Turbidity is the cloudiness of water caused by a variety of particles and is another key parameter in drinking water analysis. It is also related to the content of diseases causing organisms in water, which may come from soil runoff. The turbidity of water collected from Ramanand Nagar , G.K.G College and Dasara Chowk was 50.16 ± 10.58 NTU, 100.76 ± 20.86 NTU and 230 ± 30.83 NTU respectively.

The dissolved oxygen in aquatic water bodies is the most essential chemical parameter for aquatic life. The sources of oxygen for aquatic bodies are atmospheric air and photosynthesis of aquatic plants [14]. The dissolved oxygen in the water from atmospheric air is approximately 35%. The amount of dissolved oxygen in water depends upon the water temperature, pressure and dissolved salts [15]. In the present study, the amount of dissolved oxygen of water collected from Ramanand Nagar , G.K.G College and Dasara Chowk was estimated and expressed in mg/litre. It was 0.3 ± 0.2 mg/l, 0.4 ± 0.63 mg/l and 0.2 ± 0.13 mg/l respectively. The amount of CO_2 in collected water from Ramanand Nagar , G.K.G College and Dasara Chowk was estimated and displaced in Table No.1. The free CO_2 in collected water was 4.40 ± 1.96 mg/l, 3.52 ± 1.58 mg/l and 3.11 ± 1.22 mg/l. Hardness is the most important chemical character of water. It indicates the amount of multivalent metallic ions of calcium and magnesium. Total hardness includes both temporary and permanent hardness [15]. Temporary hardness is due to the presence of carbonates, however in permanent hardness is due to chlorides, nitrate and sulphate of magnesium and calcium [16]. In the present study, the amount of total hardness in collected water from Ramanand Nagar , G.K.G College and Dasara Chowk was as estimated and expressed in mg/l $CaCO_3$. The total hardness of collected water was 180.25 ± 2.85 mg/l, 205.12 ± 3.01 mg/l and 209.25 ± 2.13 mg/l however, in laboratory water it was 148 ± 2 mg/l. Phosphorus is an important macronutrient essential for plankton and aquatic plant. The major sources of phosphorus in aquatic bodies are sewage, agricultural runoff, detergents, land pollution etc. phosphorus in aquatic bodies present in the form of phosphate of iron and calcium [17]. If an increasing amount of phosphate in water bodies can cause eutrophication and decrease the level of dissolved oxygen [18]. In the present study, the amount of phosphate in collected water was 5.64 ± 0.34 mg/l, 5.89 ± 0.13 mg/l, and 6.32 ± 0.43 mg/l however, in laboratory water, it was 0.7 ± 0.11 mg/l. Nitrate in aquatic bodies indicates the presence of oxidized organic nitrogenous matter from sewage, agricultural fertilizer, decaying matter, domestic and industrial effluents and atmospheric precipitation. In the present study, 80.43 ± 0.64 mg/l, 92.81 ± 2.06 mg/l, and 103.45 ± 3.05 respectively, nitrate in collected water.

In the present study, analyses the physic-chemical composition of wastewater at three different site in a Jayanti Nalla in kolhapur city, Maharashtrai, before being discharged into natural receptors, which in this case are the panchganga rivers. No sewage treatment existed, except the mechanical separation. Possible relationships between concentrations of various chemical residues in wastewater and with pollution sources are also investigated. In the present paper we have analyzed the variation of several physico-chemical parameters of the wastewater. At three collection site that have been characterized as domestic, industrial and mixed, according to the type of collecting area. Most of the chemical parameters are not within accepted ranges. The overall conclusion is that wastewater with a high domestic load has the highest negative impact on water quality in a river. On the other hand, industrial wastewater brings an important nutrient load, with potentially negative effect on the basins where it is discharged.

The higher values of the physicochemical parameters observed at the study areas indicate higher pollution level compared to the control area. This might not be unconnected to the fact that waste from domestic, mechanic workshops, filling stations, block making industries, blacksmith workshops, car wash and other trade wastes find their ways into the drainage channels thereby resulting into higher pollution levels.

The higher values obtained for some physicochemical properties of sewage water revealed that Necessary mechanism should be put in place to monitor and evaluate periodically sewage water content used for irrigation purposes in order to prevent potential risk to the receiving soil and subsequent transfer to vegetables grown on such sewage water irrigated soils. Other sources of irrigation water like boreholes, tube wells should be developed by the farmers or be provided to the farmers by government and other environmentally concerned national/international organizations.

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