*International Research Journal of Environment Sciences*_____ ISSN 2319–1414
Vol. **2(7),** 1-4, July **(2013)** *Int. Res. J. Environment Sci.*

Analysis of Physico-Chemical Parameters of *Kshipra river* Water at Ujjain, India

Dubey Savita
Reader at the Department of Chemical Engineering IES IPS Academy Indore, MP, INDIA

Available online at: www.isca.in
Received 7th August 2012, revised 21st November 2012, accepted 22nd May 2013

Abstract

These Physico-chemical parameters of Wastewater disposed off in the river and outlet of ponds of entire Ujjain city were studied. In the present study sample of river water were collected during the year. Physico-chemical parameters namely pH, turbidity, TS, TDS, TSS, CaH, MgH, Cl, SO_4, NO_3, BOD, COD were analyzed using standard methods prescribed as in the APHA (1998). The result indicates that the water is unsuitable for both domestic and industrial use as there exist possibility of corrosion in boilers.

Keywords*:* pH, dissolve oxygen (DO), biochemical oxygen demand (BOD), turbidity, TS (total solid),TDS (total solid), TSS (total suspended solid),Ca H (calcium hardness), Mg H(Magnesium hardness).

Introduction

Most of the Indian towns and cities do not have access to safe drinking water. Naturally Ground water recharged through rain water. Ground water areas that are recharged at higher rate are generally more vulnerable to pollution. In Kshipra River was situated middle of the city but now a days it become convert in to sewage water (nalla). The waste water that flows after being used for domestic, industrial and other purposes is discharge in to it. Sewage contains water as the main component, while other constituent, and include organic waste and chemical. Sewage discharge is one of the problems presently. Sewage discharges are a major component[1] of water pollution, contributing to oxygen demand and nutrient loading of the water bodies. The wastewater is a mixture of sewage water, agricultural drainage, industrial waste effluents and hospitals facilities; it is well known that the wastewater from domestic origin contains pathogens, suspended solids, and other organic and inorganic pollutants. Industrial estates are established to fulfill the demand of the growing population in the country. The introduction of industries on one hand manufactures useful products but at the same time generates waste products in the form of solid, liquid or gas that leads to the creation of hazards. Most of the solid wastes[2] and wastewaters are discharged into the soil and water bodies and thus ultimately pose a serious threat to human and routine functioning of ecosystem. Main contributors to the surface and ground water pollution are the byproducts of various industries. High levels of pollutants in river water causes an increase in biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS), toxic metals[3] such as Cd, Cr, Ni, Pb and fecal coli form and hence make such water unsuitable for drinking, It is found that almost all rivers are polluted in most of the stretches by some industry or the other irrigation and aquatic life. Research efforts are underway for the development of treatment technologies suited to these decentralized communities.

Material and Methods

Study Area: The Ujjain district is one of the main tributaries of the holy river Kshipra. Several types of industries exist in the nearby city and the domestic and industrial waste of this major city is responsible for degrading the quality of river Kshipra.

Sampling Procedure: Municipal wastewater was collected during March 2011 to February 2012, which cover entire Ujjain city. The Table shows the physical and chemical parameters from the river in different months. The surface water quality changes from season to season and is easily polluted. For this purpose, samples were collected from throughout the year on a monthly basis. Samples were collected during the first week of each month, between 8.00 am to 10.00 am in clean plastic bottles, labeled properly and brought to the laboratory for analysis.

Methods of Sampling: Municipal wastewater sample is collected from about 40-50 cm below the surface, to avoid the collection of surface impurities, oils etc. Before sampling, 2-3L polythene bottles were rinsed with 0.1N chromic acid, than washed twice with distilled water. A separate sample was collected in bottle to measure the Dissolved oxygen (DO).

Parameters: The following 15 water quality parameters were analyzed: Temperature, pH, Turbidity, Total solids, Total dissolved solids, Total suspended solids, Total hardness, Calcium hardness, Magnesium hardness, Nitrate, Sulphate, Chloride, Dissolved oxygen, Biological oxygen demand, Chemical oxygen demand.

Results and Discussion

In the present study, a comparative analysis of physical and chemical characteristics of Kshipra river water based on physical characteristics like pH, Temperature, turbidity, conductivity and total dissolved solids in conjunction with chemical Characteristics such as DO, BOD, COD, hardness, alkalinity, nitrates, phosphates, sulphates, chlorides etc., the water quality has been assessed.

Temperature: A minor variation of temperature was recorded in the years of investigation. The higher seasonal value of temperature that is 32ºC in May was recorded in the sample. The observed values of temperature indicate that the municipal wastewater quality would be certainly affected[4] by this parameter. Among the various water parameters, temperature is one of the most important factors having profound influence on the biotic communities.

pH: Municipal wastewater was alkaline in nature in Pre monsoon, Monsoon and Post monsoon seasons with pH values ranging between 7.2 to 8.4 and within the permissible limits of pH for irrigation which vary between 6 to 9 as laid down in IS7.

Turbidity: The turbidity ranging from 54.1 to 66.1 NTU. These values indicate that this municipal wastewater is more turbid, much higher than the recommended values[5] of 10 NTU for irrigation water. Furthermore, the months of July to October, gave higher turbidity values. Higher turbidity in monsoon is probably due to the more water volume flow in the rainy season and also mixing of colloidal, suspended matter and plankton through the run off sewage.

Total Solids (Dissolved and Suspended solids): Total dissolved solids influence the qualities of drinking water and is most important parameter in irrigation water because, it has the capacity to control the availability of water to plants through osmotic pressure – regulating mechanism Settleable matter is able to inhibit the growth of flora and biota. The TDS varies from 734.12 to784.09 mg/l and TSS varies from 218.22 to 239.15 mg/l. The upper limit of TDS recommended for irrigation water is 1500 mg/l. So this water is safe for irrigation purposes. Extraordinarily high values of TDS in pre monsoon speak about a very high degree of eutrophication[6] in Municipal wastewater. Maximum permissible limit of TSS for irrigation is 200 mg/l as per IS: 3307, 1974. Rainfall in the monsoon season dilutes the municipal wastewater resulting in higher Suspended solids content.

Hardness: Water hardness is caused by the presence of calcium and magnesium salts. The results indicate that samples taken in months of July to October have total hardness below that recommended for portable water of 300 mg/l. Average monthly values varied from 225.12 to 356.12mg/l. Furthermore, the results suggest that the hardness is more due to the presence of calcium than magnesium. Generally the water can be said to be hard and therefore unsuitable for both domestic and industrial use as there exists possibility of scale formation in boilers and pipes.

Dissolved Oxygen (DO, Chemical Oxygen Demand (COD), and Biological Oxygen Demand (BOD): The presence of free oxygen in water is an indication of the ability of that water to support biological life. However DO concentration values can be affected by the water temperature as the solubility of O_2 is a function of temperature and photosynthesis. It may also be related to the concurrent changes in the formation and decomposition of organic compounds[7] and to the uptake of inorganic carbon and release of nutrient elements such as nitrogen, phosphorus. In the present study we got zero value of dissolved oxygen in both the years. This may be due to mixing of untreated industrial effluents and dumping of municipal solid waste into sewage water. Zero dissolved oxygen values may also be due to the stagnant and non-flushing conditions of the water with increasing waste load by regular addition of foods and pesticides. The BOD is an indication of the organic load of municipal wastewater. BOD varied 135 to154.25mg/l in monsoon to pre monsoon season. Comparatively lower BOD was observed during monsoon due to dilution of the effluent. The high value of BOD may be due to extensive use of organic nutrients. Usually the microorganisms require more oxygen to reduce the high organic nutrients present in sewage. The COD is another parameter used to characterize the organic strength of municipal wastewater. COD varied from 298.89mg/l to 328.06mg/l in season.

In 1979 Martin found that water with DO, BOD and COD values higher than 5 mg/l, 8 mg/l and20 mg/l of water is polluted. Biological treatment of water is needed if the ratio of COD/BOD is1.7 mg/l and acclimatization of the water is needed before biological treatment, if COD/BOD is in between 1.7-3.3 mg/l. In the sewage effluent the ratio of COD/BOD is 4.64 mg/l. So the municipal wastewater is unsafe and treatment is required for domestic, industrial and irrigation purposes.

Chloride: Chloride contents of above 600 mg/l in municipal wastewater are considering edexcessive[8]. Chloride concentration was higher during pre monsoon as compared to monsoon and post monsoon season. The reason for higher value of chloride observed in pre monsoon season may be due to contamination of inflow of wastes from terrestrial runoff or of anthropogenic in origin.

Nitrate: The concentration of different forms of nitrogen give a useful indication of the level of Micro nutrients in the waters and hence their ability to support plant growth. A high content of NO_3-N and NO_2-N in water may be toxic to babies when used for making up feeds from milkpowders NO_2-N causes the blue baby syndrome (Moglobinacmia). The observed nitrate[9] (NO_2-N) concentrations are ranging from 59.5 mg/l in monsoon to 63.05 mg/l in pre monsoon and are higher the WHO upper limit of 50 mg/l for domestic water.

Table-1
Observed Values of the parameters of all the sampling areas 1-10 during March 2011-February 2012

Para.	Unit	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Tem.	0C	23.14	26.17	32.19	31.52	23.15	24.05	25.12	24.3	22.12	21.15.	19.06	20.14
pH	NTU	8.34	8.37	8.42	8.40	7.21	7.29	7.38	7.36	7.32	7.52	8.14	8.28
Turbidity	Mg/l	55.12	53.15	54.20	54.26	66.10	65.25	64.14	65.15	61.14	58.20	58.10	54.19
T.S.	Mg/l	1032	1045	1024	1065	1025	1023	1034	1022	1034	1029	1051	1002
TDS	Mg/l	754.12	746.21	762.52	748.10	746.21	758.20	734.12	765.14	784.09	735.22	765.25	745.32
TSS	Mg/l	231.19	235.20	242.23	235.21	239.15	221.10	218.22	225.16	226.24	234.19	232.20	230.18
TH	Mg/l	356.12	324.16	352.12	342.4	225.12	254.10	231.6	242.9	248.25	321.05	298.15	275.5
Ca H	Mg/l	221.02	254.6	260.45	235.9	239.42	279.02	268.16	197.9	201.35	221.45	216.8	198.98
Mg H	Mg/l	115.32	152.22	121.21	142.5	98.32	105.56	119.8	123.11	124.1	118.9	120.5	121.52
Cl	Mg/l	178.12	175.6	179.32	174.32	161.5	165.92	172.4	176.21	172.27	176.54	174.56	169.98
SO4	Mg/l	252.65	245.84	264.29	282.52	243.7	275.15	249.28	234.83	254.10	231.21	243.5	219.8
NO3	Mg/l	60..32	61.2	62.8	60.84	61.45	63.05	59.89	60.26	62.14	60.56	59.58	60.23
DO		0	0	0	0	0	0	0	0	0	0	0	0
BOD	Ppm	154.25	142.12	149.25	142.8	135.64	138.59	143.6	142.89	147.58	146.67	148.27	139.89
COD	Ppm	321	312.08	311.88	325.9	328.06	321.56	319.5	326.12	298.89	315.2	325.7	326.9

Sulphate: The observed levels of sulphate content ranged from 219.8 mg/l in monsoon to 282.52.mg/l in pre monsoon. Generally the sulphate were lower in all the months and are nearly within WHO recommended values of 400 mg/l. Although SO_4 is classified as non toxic, intake of water containing high SO_4 content can cause diarrhea. High sulphate concentrations in water may contribute the corrosion of the metals in distribution system. It causes[10] gastro intestine irritation when magnesium or sodium sulphates are present. Presences of sulphate in municipal wastewater are due to the addition of detergent wastes from textile industries and washing of clothes in rivers.

Conclusion

The study of physical and chemical characteristics of water provides a considerable insight into the quality of water present in rivers, lakes, ponds, oceans, canals and ground water. The water quality is directly related to health and is important for determination of water utility. The increasing concentration of various chemicals generating from the industries and their subsequent release to their surrounding as well as the domestic water released into the drains raised a wide spread and increasing public concern over their adverse effects on human health and environment. Assessment of water quality is a critical factor for assessment of pollution levels. The results from the present study clearly pointed out that waters are highly polluted as they contain high levels of nitrates, phosphates, chlorides and sulphates. Further, the study of DO, BOD, COD, and total dissolved solids values are not within the permissible limits given by EPA.

References

1. Keun-Joo Choi and Sang-Goo Kim, Removal of antibiotics by coagulation and granular activated carbon filtration, *Journal of Hazardous Materials,* **151,** 38–43 **(2008)**

2. Luigi Rizzo, Annamaria Di Gennaro and Marialuisa Gallo, Coagulation/chlorination of surface water: A comparison between chitosan and metal salts, *Separation and Purification Technology,* **62,** 79–85 **(2008)**

3. Rosa M., Boleda M., Teresa Galceran, Francesc Ventura, Behavior of pharmaceuticals and drugs of abuse in a drinking water treatment plant (DW TP) using combined conventional and ultra filtration and reverse osmosis (UF/

RO) treatments, *Environmental Pollution,* **159,** 1584-1591 **(2011)**

4. Marcela Boroski, Angela Claudia Rodrigues and Juliana Carla Garcia, Combined electro-coagulation and TiO_2 photoassisted treatment applied to wastewater effluents from pharmaceutical and cosmetic industries, *Journal of Hazardous Materials,* **162,** 448–454 **(2009)**

5. Maria Huerta-Fontela, Maria Tere sa Galceran, Francesc Ventura, Occurrence and removal of pharmaceuticals and hormones through drinking water treatment, *Water Research,* **45,** 1432-1442 **(2011)**

6. Maria Klavarioti, Dionissios Mantzavino, Despo Kassinos Review article: Removal of residual pharmaceuticals from aqueous systems by advanced oxidation processes, *Environment International,* **35,** 402–417 **(2009)**

7. Marta Carballa, Francisco Omil, Juan M. Lema, Removal of cosmetic ingredients and pharmaceuticals in sewage primary treatment, *Water Research,* **39,** 4790 – 4796 **(2005)**

8. Meijie Ren, Yonghui Songa, Shuhu Xiao a, Ping Zeng a, Jianfeng Peng a, Treatment of berberine hydrochloride wastewater by using pulse electro-coagulation process with Fe electrode, *Chemical Engineering Journal,* **169,** 84–90 **(2011)**

9. Mohamed I. Badawy, Rifaat A. Wahaab, A.S. El-Kalliny, Fenton-biological treatment processes for the removal of some pharmaceuticals from industrial wastewater, *Journal of Hazardous Materials,* **167,** 567–574 **(2009)**

10. Niina Kulik, Marina Trapido, Anna Goi, Yelena Veressinina and Rein Munter, Combined chemical treatment of pharmaceutical effluents from medical ointment production, *Chemosphere,* **70,** 1525–1531 **(2008)**