Collection and Processing of Waste Water Samples by Physico-Chemical Analysis: A Study on Kamptee Rivers

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Abstract:

The present investigation was conducted to collect and processing of waste water samples by physico-chemical analysis. The water collected from different location of Kamptee rivers for various physico-chemical and chemical quality parameters includes pH, alkalinity, acidity, EC, TDS, BOD, DO, Ca^{2+}, Mg^{2+}, Na^{+}, K^{+-},NO_3^{-}, HCO_3^{-},SO_4^{2-},Cl^{-}.Most of these parameters as found in this study suggested the collected water is unsuitable for drinking, domestic and irrigation purposes. Studies on physico-chemical and biological factors to evaluate the water quality of river water and utility of river water for drinking, industries and irrigation purpose and shall be helpful in preparation of environmental management plan to control the pollution and restore the river water quality for its designated best use.

Keywords: Waste Water, Kamptee rivers, BOD, TDS, Physico-chemical analysis

Introduction:

Water, air and land with soil, mineral, plant, animal and climate are the main component of our environment. The social system in which we live is also important dimension of environment. Water is a compound made up of two parts hydrogen and oxygen this is true only for pure water. In addition with hydrogen and oxygen there are many substances that are present in water such water we called as impure water where as the substance other than hydrogen and oxygen called impurity. Waste water is a liquid waste discharge by domestic residential, commercial properties, industries, agriculture, which often contain some contaminated that results from the mixing of waste water from different sources. Waste water mostly consists of more than 95% pure water (1). A numerous processes that can be used to clean up waste water depending on a type and extent of contamination. The treatment of waste water is not only important for our own health but also to keep our environment clean and healthy without the proper waste water treatment. Man can live without food for two month but can live only for three to four days without water (2-4).

Many dreadful diseases, illness are associated with water directly or indirectly (5-6). Keeping this fact in mind, present study was undertaken with the objective to assess the chemical and physical quality of drinking water. The chemical formula of water is H_2O and its molecular weight is 18. According to chemistry water can be classified in to three forms.

a) Simple water with chemical formula H_2O but in fact it is a mixture of nine molecules.

b) Heavy water with chemical formula $D_2{}^{16}O$, $D_2{}^{17}O$and $D_2{}^{18}O$. It freeze at 3.8^{0}C boil at 101.4^{0}C and its density at 20^{0}C is 1.1059 g/cc.

c) Super heavy water with chemical formula T_2O has melting point +9^{0}C, boiling pt.104^{0}C and its density 1.33 g/cc.

Pure water is colorless or bluish green clear liquid having no odor & no taste. The pure water has freezing point 0.00^{0}C at 760mm of Hg and boiling point 100^{0}C. The dielectric constant and electrical conductivity at 18^{0}C are 81.0 and 4.3×10^{-8} ohm^{-1}(7). If pure water is heated from 0 to 4^{0}C its volume does not increase but contracts and thus attain its maximum density at 4^{0}C. Similarly if water is allowed to freeze it expands instead of being contracted and hence its density decrease, that`s why the big slab float on the water surface freely. Water is used as a universal solvent because of its high dielectric constant. The thermal conductivity of water is 0.00143 cal cm^{-1}deg^{-1}sec^{-1}.

The present work thus aims at carrying out studies on one river of Kamptee river located at Kamptee, district Nagpur, state Maharashtra. The river water is used for drinking purpose, irrigation purpose. Present study refers to the impact of the two big thermal power plants, NTPC's Mouda plant and Mahagenco'sKhaparkheda plant waste water on river water. Studies on physico-chemical and biological factors to evaluate the water quality, of river water and utility of river water for drinking, industries and irrigation purpose and shall be helpful in preparation of environmental management plan to control the pollution and restore the river water quality for its designated best use.

Experimental Techniques: Collection of water sample and processing

In this investigation water samples have been collected in polythene bottles with necessary precaution. Water samples were collected from seven (7) different locations to a depth of 10cm to 15 cm below from the surface water level. Water was collected in sampling bottle nearly one liter. The first sample (S1) was taken from the nearest point from discharge point and eventually the last sample (S7) was collected from most distant point from the discharge point. The sampling was done in 22 April 2014. Collected samples were brought to the laboratory and were analyzed for various physic-chemical properties *viz.* temperature, turbidity, total dissolved solid (TDS), pH, electrical conductivity (EC), dissolve oxygen (DO), BOD (Biochemical oxygen demand), (Cl^-) etc.

A thermometer having a quick response with 0.1^{0}C division, checked against a precision thermometer. Water pH was determined by glass electrode using pH meter. pH meter was calibrated by buffer solution borax and KHP. Electrode was dipped in water sample and pH was noted. Determination of parameters like odour, color, temperature, density, surface tension, viscosity, alkalinity, acidity, chloride, hardness, total dissolved solid (TDS), total suspended solids (TSS), DO, sodium , potassium and NO_3^- were carried out in the laboratory. Chloride is determined in a natural or slightly alkaline solution by titration with standard silver nitrate, using potassium chromate as an indicator. Silver chloride is quantitatively precipitated before red silver chromate is formed. Sulphate ions are precipitated as $BaSO_4$ in acidic media (HCl) with barium chloride (8). The absorption of light by this suspension is measured by spectrophotometer at 420nm or scattering of light by Nephelometer. The organic matter gets oxidized completely by $K_2Cr_2O_7$ in the

presence of H_2SO_4 to produce CO_2 + H_2O. The excess of $K_2Cr_2O_7$ remaining after the reaction is titrated with $Fe(NH_4)_2(SO_4)_2$ (9). The dichromate consumed gives the O_2 required for oxidation of the organic matter. Electrical conductance was carried out using pH-meter and conductivity meter respectively. Sodium and Potassium were determined by using flame photometer. Sulphate ion concentration (SO_4^{2-}) was determined by using Systronic-108 and 166 spectrophotometer. The chemicals used method while were AR grade. Double distilled water is used for the preparation of solutions and reagents. All equipment like pH, conductivity meter and spectrophotometer were checked and calibrated according to manufacturer's specifications.

Result and Discussion:

The physic-chemical analysis data of water samples of tobacco small scale industries area are shown in table. From results it is evident that, the values of electrical conductivity (EC) of the water samples ranged from 668 µS/cm 862 µS/cm with an average value of 777 µS/cm. The highest value of EC was found in sample 862 as µS/cm and lowest value of Electrical conductivity was found to be 668 µS/cm. Usually, lower values of EC indicate the presence of lower content of dissolved salts in water, whereas higher values of EC indicate the higher content of dissolved salts in water. Total dissolved solid (TDS) in water mainly composed of various salts like chloride, phosphates and manganese, and other particles. The Total dissolved solid in the collected water samples varied from 2110mg/l to 2431mg/l. The average value of TDS was 2313mg/l. Water having higher TDS is unpalatable and potentially harmful for health. Dissolved Oxygen (DO) is not only an important parameter for determine the quality of water but also it helps us to understand the natural self-purification ability of water as well as the impacts of urbanization and industrialization on water. For fisheries, the range of optimum values of Dissolved Oxygen (DO) is 4 to 6mg/l, below that most of aquatic organisms could not survive (10). The lower values of DO of water may be due to inclusion of high organic and inorganic load in the present water body which leads to oxygen depletion. The average value of Dissolve oxygen was 3.18mg/l. Biological Oxygen Demand is used to measure the effects of organic pollutant on water quality and biodiversity, by measuring the quality of oxygen used by microorganism (aerobic bacteria). In the water BOD values ranged from 8.10mg/l to 8.82mg/l. The average value of BOD was 8.33mg/l (11).

pH is an important ecological factor, which indicate hydrogen activity in water and express universally the intensity of the acid and alkaline condition of the water. The pH values ranged from 5.33 to 5.96.This means that the use of surface water around the industry is unsuitable for drinking purpose. The reason of low pH of water may be the over existence of acidic industrial effluents. pH of water can also lowered by organic acid for decaying vegetation and organic waste, or the dissolution of sulfide minerals. For aquaculture, the permissible limits of sodium (Na^+) are 2mg/l to 100mg/l and the permissible limits of potassium is 1mg/l to 10mg/l. The sodium and potassium values ranged from 15.34mg/l- 28.23mg/l and 9.34 mg/l -16.84 mg/l respectively. The highest sodium and potassium value found to be 28.23mg/l and 16.84 mg/l respectively.

For fisheries, the recommended values of calcium and magnesium concentration in water are 5-10mg/l. For drinking water, the permissible limit of calcium is 75mg/l; here the limit is 30-35mg/l for Magnesium. The concentration of magnesium and calcium ranged from 40.12mg/l to 60.23 mg/l and 23.15 mg/l to 38.33 mg/l respectively. The highest calcium and magnesium value found to be 60.23 mg/l and 38.33 mg/l respectively. The concentration of chloride (Cl^-) serves as an indicator of pollution occurred by sewage and industrial effluents.Though excessive chorine in drinking water is not particularly harmful. Excess Chlorine (more than 250mg/l) makes water salty. People who drink Chlorine rich water are often subject to laxative effects. In the present investigation, the concentration of Chlorine ranged from 62.33mg/l to 96.52 mg/l highest concentration of chloride found to be in water was 96.52 mg/l. For aquaculture, the recommended limit values of Bicarbonate (HCO_3^-) concentration in water is from 50mg/l to 300mg/l and values in the reservoir were within this limits, which indicate that this water is suitable for fisheries in terms of Bicarbonate (HCO_3^-) concentration. The concentration of Bicarbonate ranged from 204.81mg/l to 345.22 mg/l. When sulphate (SO_4^{2-}) concentration in water become around 1000mg/l, it create laxative effects and causes gastro-intestinal irritation. In the present study, the concentration of Sulphate was found to be in the range from 19.11mg/l to 27.49mg/l.

Table. 1-Physico-chemical parameters of the samples

Sample No.	EC(µS/cm)	TDS(mg/l)	DO(mg/l)	BOD(mg/l)
S1	771	2335	3.30	8.12
S2	862	2422	1.65	8.12
S3	668	2110	4.23	8.10
S4	721	2244	4.52	8.23
S5	860	2425	1.83	8.25
S6	796	2253	3.82	8.55
S7	730	2279	4.23	8.45
Min-Max	668 - 862	2110-2431	1.65 - 4.52	8.10 -8.82
Mean	777	2313	3.18	8.33

Table. 2- Chemical constituents of the water samples

Sample No.	pH	Cl^- (mg/l)	NO_3^- (mg/l)	SO_4^{2-} (mg/l)	HCO_3^- (mg/l)	Ca^{2+} (mg/l)	Mg^{2+} (mg/l)	Na^+ (mg/l)	K^+ (mg/l)
S1	5.94	81.85	35.33	23.39	310.44	41.23	27.55	23.12	12.35
S2	5.33	91.38	35.83	26.67	345.22	60.23	38.33	28.23	15.33
S3	5.74	62.33	30.52	19.11	225.23	36.34	23.15	15.34	9.34
S4	5.45	70.29	40.55	27.40	250.27	40.16	28.16	17.48	12.03
S5	5.83	96.52	32.23	26.56	321.12	52.60	34.89	27.07	16.84
S6	5.71	70.28	40.89	22.45	204.81	41.80	30.10	19.77	11.98
S7	5.47	71.29	40.58	27.49	250.20	40.12	28.18	17.45	12.10
Min-Max	5.33 -5.96	62.33 - 96.52	30.52- 40.89	19.11- 27.49	204.81- 345.22	40.12- 60.23	23.15- 38.33	15.34- 28.23	9.34- 16.84
Mean	5.67	61.18	36.56	24.69	281.52	45.54	30.24	23.58	13.19

Conclusion:

Water pollution is one of the most important issues facing the country. The harmful effects of water pollution are manifold. The thermal power plants polluted water can cause disease such as cholera, typhoid and many other enteric infections. To conserve the limited water resources for the limited water supplies as well as for developing industries considerable work is being done on the analyzed and treatment of waste from the thermal power plants.

During sampling it was found that nala's sites were much more polluted, municipality of Kamptee should take care about the nala and river's surrounding. It can be concluded from analysis that these seven sites are not good for drinking. From the above result and discussion it is concluded that the values of EC, TDS, BOD, Na^+, Cl^-, HCO_3^-, SO_4^{2-} were found higher than the standard level in the water samples in Kamptee around Thermal power plants area. So, the water around the experimental area should not be used for recreation, drinking, domestic and industrial purposes.

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