

Physio- Chemical Properties of the Water of River Ganga at Kanpur

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Abstract:

We present an extensive investigation of physico-chemical parameters of water samples of Ganga River at Kanpur. Water samples under investigations were collected from Jalsanstan Benajhawar Kanpur sampling station during pre monsoon (April - May), monsoon (July - August) and post monsoon (October - November) seasons in the year 2012. Correlation coefficients were calculated between different pairs of parameters to identify the highly correlated and interrelated water quality parameters and t-test was applied for checking significance. The observed values of different physico-chemical parameters like pH, temperature, turbidity, total hardness (TH), Iron, Chloride, total dissolved solids (TDS), Ca²⁺, Mg²⁺, SO₄²⁻, NO₃⁻, F⁻¹, total alkalinity (TA), Oxygen consumption (OC), Suspended solids (SS) of samples were compared with standard values recommended by world health organization (WHO). It is found that significant positive correlation holds for TA with Cl⁻, Mg²⁺, Ca²⁺, TH, TDS, fluoride and OC. A significant negative correlation was found between SS with chloride, Mg²⁺, TDS, fluoride and OC. All the physico-chemical parameters for pre monsoon, monsoon and post monsoon seasons are within the highest desirable or maximum permissible limit set by WHO except turbidity which was high while NO₃⁻, Cl⁻¹ and F⁻ are less than the values prescribed by WHO.

Keywords: Physico-chemical parameters, correlation, t-test.

I. INTRODUCTION

Water is the principal need of life on earth, and is an essential component for all forms of lives, from micro-organism to man. The unplanned urbanization and industrialization (Singh et al¹, 2002) has resulted in over use of environment (Petak², 1980) in particular of water resource. A kind of crises situation has made getting clean water a serious problem. It is a known fact that when pure water is polluted its normal functioning and properties are affected. Ganges is a sacred river of India. The increased anthropogenic activities due to industrialization have contributed to decline in water quality of Ganges. Several works have been reported on water quality of river Ganges at Kanpur (Sinha et al³, 2000; Pandey and Pandey⁴, 19803 and Tare et al⁵, 2003) and other parts of country (Pahwa, and Mehrotra, 1966). The authors studied river Ganges from Kanpur city, west state UP, to Rajmahal city east state Jharkhand, covering total length of about 1090 kms. The maximum turbidity (1100-2170 ppm) was observed in monsoon and minimum (less than 100 ppm) during January to June. The minimum value Ph of the river water ranged between 7.45 (minimum) observed during June to August and 8.30 (maximum) during January to May. A comprehensive study of physico-chemical properties of Ganga water at Buxar (Unnao) UP (Sinha⁶, 1986), Narora and Kannauj, U.P (Khan et. Al⁸, 1984)6, in and around Haridwar (Kaur and Joshi⁹, 2003) has also been reported. The seasonal analysis of Kanpur (Zafer and Sultana¹⁰, 2007)8 water showed that extent of pollution varied in different seasons.

It is a fact that good water quality produces healthier humans than one with poor water quality. Ganga River is life line of Kanpur and its water is used for domestic and agriculture purposes therefore, effective maintenance of water quality is required through appropriate measurements. Physico-chemical and microbiological characteristics may describe the quality of water (Sinha¹¹, 1986), therefore, an analysis on physico-chemical parameters of Ganga water was made by many workers (Mehrotra¹², 1990; Sinha et.al¹³. 2000) regular monitoring of all the parameters is very difficult and laborious task even if adequate manpower and laboratory facilities are available. Therefore, statistical correlation technique has been used for comparison of physico-chemical parameters.

The present work deals with the study of 15 physico-chemical parameters like pH, temperature, turbidity, TH, Fe, Cl⁻, TDS, Ca²⁺, SO₄²⁻, NO₃⁻, F⁻, TA, Mg²⁺, OC, SS of Ganga river water in Kanpur. The observed values of various physico-chemical parameters of water samples were compared with standard values recommended by World Health Organization (WHO¹⁷) and are given in Table-2. The objective is to minimize the complexity and dimensionality of large set of data. Systematic calculation of correlation coefficient between physico-chemical parameters has been carried out and significant correlation has been further verified by using t- test. (Bhandari and Nayal¹⁴, 2008; Garg et.al¹⁵, 1990; Sarkar et. Al¹⁶. 2006)

II. EXPERIMENTAL

Water samples were collected from Jalsansthan Benajhawar Kanpur sampling station during pre monsoon (April - May), monsoon (July - August) and post monsoon (October - November) phase in year 2012. During sampling pH, temperature, and turbidity were determined using digital pH meter, thermometer and turbidimeter respectively. F- And nitrate was estimated using colorimetric method. The laboratory analysis of samples was done using standard methods (APHA¹⁸, 1998), titrimetric method was used for the determination of total alkalinity and gravimetric method for total dissolved solid and total suspended solids Mohr's argentometric titration method was used for chloride (Vogel, 1978). Sulphate was estimated using turbidometric method. (Vogel¹⁹, 1978) Where as Ca²⁺, Mg²⁺ and TH was determined by EDTA titrimetric method (Vogel, 1978). Atomic absorption spectrophotometer was used for determination of Fe and Cr contents. All the chemical used were of AR grade. Shows water quality parameters in Table 1.

Table-1: Water quality parameters and analytical methods used in analysis of water samples.

Parameter Analytical method	
WT (°C)	Mercury thermometer
Tu (NTU)	Turbidimeter[10b]
pH	pH-meter
TA (CaCO ₃ mg/l)	Titrimetric
Cl ⁻ (mg/l)	Argentometric Method [10a](Silver nitrate method)
NO ₃ ⁻ (mg/l)	Colorimetric method
TH (CaCO ₃ mg/l)	EDTA Titrimetric Method[10c]
Ca ²⁺ (mg/l)	EDTA Titrimetric Method[10c]
Mg ²⁺ (mg/l)	EDTA Titrimetric Method[10c]
TDS (mg/l)	Gravimetric method
SO ₄ ²⁻ (mg/l)	Aplab turbidity meter[10b]
Cr (mg/l)	Atomic absorption spectrophotometer
Fe (mg/l)	Atomic absorption spectrophotometer
F ⁻ (mg/l)	Colorimetric method
* WT: temperature; Tu: turbidity; TA: alkalinity; Cl ⁻ : chloride;NO ₃ ⁻ : nitrate; TH: total hardness; TDS :Total dissolved Solids,	

Table 2. The average values of physico- chemical parameters of Ganga River water at Kanpur. HDL: Highest Desirable Limit; MPL; Maximum Permissible Limit]

NO.	PARAMETERS	UNITS	DRINKING WATER WHO Standard		Experimental Values (Range)
			HDL	MPL	
1	Temperature	°C	----	-----	21-30
2	Turbidity	NTU	5	10	18-471
3	pH value	-	6.5 to 8.5	No relaxation	8.3-8.8

4	Total hardness (as CaCO ₃)	mg/l	300	600	123-213
5	Iron	mg/l	0.3	1.0	0.2-0.7
6	Chlorides	mg/l	250	1000	6.9-26.8
7	Dissolved Solids	mg/l	500	2000	255-501
8	Calcium	mg/l	75	200	27.8-47.9
9	Sulphate	mg/l	200	400	51-90
10	Nitrate	mg/l	50	No relaxation	0-1.763
11	Fluoride	mg/l	1.0	1.5	0-0.39
12	Total Alkalinity	mg/l	200	600	12.7-245
13	Magnesium	mg/l	30	150	9.24-27.12
14	Oxygen Observed from KMnO ₄ at 370C in 3 hrs.	mg/l	3.0	No relaxation	2.3-7.9
15	Suspended Solids	mg/l	20	150	69-281

III. RESULTS AND DISCUSSION:

The observed pH value ranging from 8.3 to 8.8 show that the present water samples are slightly alkaline in pre-monsoon season. These values are within maximum permissible limit prescribed by WHO (www.lenntech.com/drinking-water-standards.htm.) Other parameters like turbidity (18 - 471 NTU), TH (123 - 213 mg/l), Fe contents (0.2 - 0.7 mg/l), Chloride (6.9- 26.8 mg/l), TDS (255 - 501 mg/l), The Ca²⁺ (27.8 – 47.9 mg/l, SO₄-2 (51 – 90 mg/l), NO₃-(0-1.763 mg/l), F-1 (0-0.039 mg/l), TA (12.7 -245 mg/l) , Mg⁺² (9.24-27.24 mg/l), OC (2.3-7.9 mg/l), SS (69 -281 mg/l) are found within the highest desirable or maximum permissible limit set by WHO.(Trivedi and Goel²⁰, 1986 and Trivedi et al²¹, 2009) However, turbidity and Fe contents are observed to be on higher side in all seasons and pre-monsoon and monsoon seasons respectively.

IV. CONCLUSIONS

A large number of factors and geological conditions influence the correlations between different pairs of physico - chemical parameters of water samples directly or indirectly. All the physico-chemical parameters of Ganga river water at Kanpur for pre monsoon, monsoon and post monsoon for year 2012 are within the highest desirable limit or maximum permissible limit prescribed by WHO except turbidity, Fe contents and pH which recorded high values in all seasons, pre monsoon and monsoon season and pre monsoon season respectively . From the results of present study we conclude that Ganga water of Kanpur is though fit for drinking purposes yet it need treatment to minimize the contamination especially turbidity and Fe contents . To minimize the contaminations of Ganga River water at Kanpur the values of correlation coefficients and their significance level will help in selecting the proper experimental methods used for treatment of water. To create increasing awareness among the people to maintain the Ganga river water at its highest quality and purity levels, the present study may prove to be useful in achieving this goal.

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