

WATER POLLUTION: CAUSES, EFFECTS AND REMEDIES USING CHEMICAL PARAMETERS/METHODS

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Abstract: In this paper, we have given the detailed informations about water pollution its causes, effects and remedies using chemical parameters/methods of different cities including specially Jaipur and Lucknow cities. The standard parameters of WHO and IBS (Indian Bureau Standard) are given to compare the pollutions and how it can be removed for health point of view and lead our normal life satisfactorily.

Keywords: Water pollution, causes, effects, remedies, chemical methods.

1. Introduction

Water pollution occurs when harmful substances like chemicals or microorganisms contaminate river, lake, ocean or other water bodies degrading water quality and harmful to humans and environments. Water is natural solvent in which most pollutants are dissolved in it easily than any other liquid on earth. Toxic substances from farms, towns and factories readily dissolve into it and mix with it causing water pollution.

Categories of water pollution - Ground water, surface water, ocean water, sewage and waste water, oil pollution, radioactive substances etc. are the main categories of water pollution.

Causes of Water Pollution

Main causes of water pollution are :

- (i) Industrial waste
- (ii) Sewage and waste water
- (iii) Mining activities
- (iv) Marine dumping
- (v) Accidental oil leakage
- (vi) The burning of oil fuels
- (vii) Chemical fertilizers and pesticides in agriculture
- (viii) Radio active waste

The surface and ground water are mainly used for domestic and industrial purposes in India and world. All living organism need water and air for their survival and growth on earth. In general, surface water sources are not acceptable for drinking purposes as these

are often polluted by several organic, inorganic and biological constituents as investigated by Kumar et al.[6]. Ground water is mainly due to accumulation of water below the ground surface caused by rainfall. In cities, we generally use ground water for drinking purposes. Bhatnagar [1] has pointed out that hardness of water is due to presence of high dissolved minerals usually calcium and magnesium. Kulshrestha and Singh [5] have mentioned that water pollution is due to the rise in nitrate level in some parts of Jaipur city. Prajapati and Singh [9] have systematically analysed physico-chemical characteristics of ground water quality of different locality of Jaipur city and found that water pollution is caused due to the presence of nitrate, fluoride and heavy trace metals like calcium and magnesium etc. Nitrate contamination of ground water is a major problem specially in a region where large doses of fertilizers are applied to lawn, parks and agricultural lands adjacent to the cities. Dutta et al. [4] have revealed the occurrence of nitrate and fluoride in ground water of Pushkar Valley in Rajasthan and cause water pollution. Dash et al. [3] have analysed the physico-chemical analysis of drinking water of Balasore area (Odisha) and pointed out that fluoride, turbidity, alkalinity and total hardness are more the permissible limits for drinking water. Mann et al. [7] have attempted to describe various causes and remedies for water pollution Sulamann et al. [11] have explained the main sources of water pollution and protection for sustainable use of water for drinking purposes. Recently, Prajapati [10] has evaluated physico-chemical parameters and trace metal contents of Ground Water of Jaipur city during post monsoon season in 2016. Nazhat and Singh [8] have analysed physico-chemical characteristic of Gomati river at Lucknow city. According to WHO [12] about 80% of all the diseases in human beings are caused by contaminated water. It is therefore becomes imperative to regularly monitor the quality of water and to devise ways and means to protect it.

The main purpose of the present work is to analyse the suitability of drinking water for human consumption based on computed water quality parameter as per standard parameters given by WHO [12] and BIS [2].

Material and Methods

Samples are collected in sterilized bottles using the standard procedures as per method mentioned by WHO [12] and BIS [2]. The details of parameters analysis are given in Table I.

Table 1 : Parameter Analysis

Parameters	Methods
pH	pH Meters
Temperature (0 ⁰ C)	Thermometer
Alkalinity	Titrimetric
Chloride (as Cl)	Titrimetric
Nitrate	Spectrophotometric
Phosphate	Spectrophotometric
Sulphate	Titrimetric
Fluoride	Orion ion meter
Conductivity	Conductometer

Total hardness (as CaCO ₃)	Titrimetric
Magnesium (as MgCO ₃)	Titrimetric
Dissolved Oxygen	Winkler's method
Chemical Oxygen Demand	Standard Chemical method
Biological Oxygen Demand	Standard Chemical method
Total Dissolved Solid (TDS)	Gravimetric
Total Suspended Solid (TSS)	Gravimetric

Table 2

Parameters	BIS (1991) Bureau of Indian Standard	WHO (1984) World Health Organization	Analysed samples from Macherla- Karempudi area (n = 187)	
			Range	Percentage of samples beyond desired limits
pH	7.0 - 8.5	6.5 - 8.5	7.0 - 8.5	–
Total dissolved solids (TDS) (ppm)	500	1000	91 - 7100	19
Total Dissolved Oxygen (TDO)	6.5 - 8	6.5 - 8	6.5 - 8	80 - 120%
Hardness (ppm)	300	–	83 - 2256	35
Calcium (ppm)	75	500	< 10 - 500	43
Magnesium (ppm)	30	–	< 5 - 222	28
Sodium (ppm)	–	200	<5 - 918	21
Bicarbonates (ppm)	300	–	40 - 830	43
Chlorides (ppm)	250	250	< 10 - 2130	19
Sulphates (ppm)	150	400	< 10 - 750	9
Fluorides (ppm)	0.6-1.2	1.5	< 1 - 3.8	9
Copper (ppm)	2.0	2.0	< 0.005 - 0.072	nil
Zinc (ppm)	3.0	3.0	< 0.005 - 3.90	1
Lead (ppm)	0.01	0.01	< 0.010 - 0.060	4
Iron (ppm)	1.0	2.0	< 0.005 - 8.5	55
Manganese (ppm)	0.4	0.5	< 0.010 - 1.08	1

Table 3

Group	Parameter	Unit	Maximum Concentration Limits
Physical	Turbidity	NTU	5 (10)**
	pH		6.5-8.5*
	Color	TCU	5 (15)**
	Taste & Odor		Would not be objectionable
	Total Dissolved Solids	mg/l	1000

	Electrical Conductivity	µc/cm	1500
	Iron	mg/l	0.3 (3)**
	Manganese	mg/l	0.2
	Arsenic	mg/l	0.05
	Cadmium	mg/l	0.003
	Chromium	mg/l	0.05
	Cyanide	mg/l	0.07
	Fluoride	mg/l	0.5-1.5*
	Lead	mg/l	0.01
	Ammonia	mg/l	1.5
	Chemical	Chloride	mg/l
Sulphate		mg/l	250
Nitrate		mg/l	50
Copper		mg/l	1
Total hardness		mg/l	500
Calcium		mg/l	200
Zinc		mg/l	3
Mercury		mg/l	0.001
Aluminum		mg/l	0.2
Residual Chlorine	mg/l	0.1-0.2*	
Micro Germs	E-Coli	MPN/100ml	0
	Total Coli form	MPN/100ml	95% in sample

Note : *These standards indicate the maximum and minimum limits.

Note : ** Figures in parenthesis are upper range of the standards recommended.

Source : Nepal Gazette (26 June 2006).

Table 4

Parameter*	BIS Standards		WHO standards
	Desirable	Max. Permissible	
Color	5	25	–
Odor	Unobjectionable	Unobjectionable	–
Taste	Agreeable	Agreeable	–
pH	6.5-8.5	6.5-8.5	6.5-9.2
TH	300	600	300
TA	200	600	
TDS	300	1500	500
Cl ⁻	250	1000	250
SO ₄ ²⁻	250	400	200
NO ₃ ⁻	45	45	50
F ⁻	1.0	1.5	0.5
Ca ²⁺	75	200	100
Mg ²⁺	30	100	150

K ⁺	–	–	200
Na ⁺	–	–	200
NH ₄ ⁺	–	–	1.5
Phenol	–	–	0.0
B	–	–	0.3
Fe	–	–	0.3

*Except pH and color (hazen unit) all unit are in mg l⁻¹

Table 5

Parameters	Maximum WHO permissible limit
Al	0.2 mg/L
Ca	75 mg/L
Fe	0.3 mg/L
Mg	50 mg/L
NO ₃	50 mg/L
pH	6.5 - 8
TDS	1000 mg/L

Results and Conclusion

pH is a term used to express the intensity of the acid or alkaline condition of water. The pH values of water samples should be 6.5 to 8.5 as per WHO and 7.0-8.5 as per BIS. The parameters that usually determine the quality of ground water are nitrate, sulphate, chloride and fluoride. The acceptable range for Nitrate (50 mg/L), Sulphate (250 mg/L), Chloride (250 mg/L), Fluoride (1.0-1.5) as per WHO standards. The maximum permissible range for other parameters are given in Table 2, 3. To maintain healthy life, we should follow WHO and BIS guidelines.

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