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Physico-Chemical Analysis of various water sources stations and yearly variation of Dindori Town of (M.P.) India

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Abstract: This paper present to the physico-chemical study of river water, underground water and surface water of Dindori town, Madhya Pradesh state. The variable data of stations are within prescribed limits as suggested by World Health Organisation and Indian Standard institute and BIS desirable limit for drinking water for drinking purpose. Yearly variation in physical and chemical parameters like colour, odour, taste, total hardness, pH, total dissolved solids, total alkalinity, nitrate, chloride, sulphate, carbonate, bicarbonate, calcium, magnesium, BOD, COD in water, were analyzed for a period of year 2014 and 2015.
Key words - Physico-chemical study, waer variation, Dindori town, Madhya Pradesh.

I. INTRODUCTION

Water plays an essential role in human life**.** Although statistics, the WHO reports that approximately 36% of urban and 65% of rural Indian were without access to safe drinking water (Akoto and Adiyah, 2007). Fresh water is one of the most important resources crucial for the survival of all the living beings. It is even more important for the human being as they depend upon it for food production, industrial and waste disposal, as well as cultural requirement (Akpoveta, *et al.* 2011). Human and ecological use of ground water depends upon ambient water quality. Human alteration of the landscape has an extensive influence on watershed hydrology Gurunathan, 2006 (APHA, AWWA, WPCF, 2003). Ground water plugs a vital role in human life. The consequences of urbanization and industrialization leads to spoil the water for agricultural purposes ground water is explored in rural especially in those areas where other sources of water like dam and river or a canal is not considerable. During last decade, this is observed that ground water get polluted drastically because of increased human activities. Consequently number of cases of water borne diseases has been seen which a cause of health hazards. An understanding of water chemistry is the bases of the knowledge of the multidimensional aspect of aquatic environmental chemistry which involves the source, composition, reactions and transportation of water. The quality of water is of vital concern for the mankind since it is directly linked with human welfare. It is a matter of history that facial pollution of drinking water caused water-borne diseases. (Sharma, 2015; Gyananath, *et al.* 2000; Pratibha and Bhuktar, 2005; Pathak and Dwivedi, 2007; Dutta and Chowhan, 2009; Rana, 2015; Kashyap, 2015 & 2016). Present paper reports results of the study of waters for odour, taste, total hardness, pH, total dissolved solids, total alkalinity, nitrate, sodium, potassium, chloride, sulphate, carbonate, bicarbonate, calcium, magnesium, BOD, COD, of river water, underground water and surface water in a year of 2014 and 2015 Dindori town, M.P. India and river water are indicated by station A, underground water are indicated by station B and surface water are indicated by station C (Kushram, 2013).

Photograph showing authoress collecting handpump water.

II. MATERIAL AND METHODS

The water station were collected during the summer season of year 2014- 2015 of river water, underground water and surface water from Dindori town. Material requirement for sampling and analysis of water of Itinerary for the trip, personnel and station transport arrangement, area map, sampling site location map, Icebox, weighted bottle stationr, D.O. Station, Rope, B.O.D. bottles, station containers, special station containers, bacteriological and special station, heavy metals, D.O. fixing and traction chemical and glassware, thermometer, tissue papers, other field measurement are station identification forms, labels for sampling containers, field

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note book, pen, pencil, markers, soap and towel, match box, spirit lamp, torch etc. All analysis were carried out as per APHA, Indian standard institute and BIS desirable limit for drinking water. Some material and methods are depicted as follows (APHA, 1989, 1998 & 2005; WHO, 1984 & 1992; BIS, 1991 and Jasrotia and Singh, 2007):

A. Colour, odour and taste: Colour, odour and taste in water is determined by physically.
B. Total hardness: Hardness in water is determined by EDTA complexometric titration using EDTA solution, buffer solution, EBT indicator, disttilled water and titration apparatus etc.
C. pH value: pH value in water is determined by pH meter.
D. Total dissolved solid: Total dissolved solids in water is determined by TDS measurement apparatus.
E. Total alkalinity: Total alkalinity in water is determined by titration method using sulfuric acid solution, methyl orange and phenolphthalein use as a indicator etc.
F. Nitrate: Nitrate in water is determined by UV spectrophotometric method using spectrophotometer, nitrate free water, stock nitrates solution, standard nitrate solution, hydrochloric acid solution etc.
G. Calcium: Calcium in water is determined by EDTA titration method using NaOH, ammonium purpurate, standard EDTA solution, standard calcium solution etc.
H. Magnesium: Magnesium in water is determined by calculation from total hardness and calcium by EDTA method.
I. Chloride: Chloride in water is determined by argentometric titration method using potassium chromate indicator solution, standard silver nitrate titrant, standard NaCl solution etc. Sulphate: Sulphate in water is determined by Nephelometry
J. method using Nephelometric turbidity meter with station cells, magnetic stirrer, timer with in dicator of second etc.
K. Carbonate: Carbonate in water is determined by obtained measured value of pH and total alkalinity by titration method.
L. Bicarbonate: Bicarbonate in water is determined by obtained measured value of pH and total Alkalinity by titration method.
M. B.O.D.: B.O.D in water is determined by bottle incubation for 3-days at 27°C method using BOD bottle 300 ML, narrow mouth flare clip with tapered and pointed ground glass stoppers, water bath thermostatically controlled at 27 ± 1°C, plastic tube, screw - pin and 5-10L water container, phosphate buffer solution, magnesium sulphate solution, calcium chloride solution, ferric chloride solution, acid and alkali solution, glucose-glutamic acid solution, station dilute water etc.
N. C.O.D.: C.O.D. in water is determined by open reflux method using reflux apparatus, volume flask with flat bottle and with ground glass neck, standard potassium dichromate solution, sulphuric acid reagent, ferroin indicator solution standard ferrous ammonium sulphate standard potassium dichromate, mercuric sulphate powder, potassium hydrogen phthalate etc.

III. RESULT AND DISCUSSION

During present investigation the variation in various water samples were observed and discussed as follows-

Table - 1 : Showing variable and comparative average value of all parameters of different water stations 2014.

S.No.	Parameters	Station A	Station B	Station C	Mean	SD	p
1.	Taste	Unpleasant	Brackish	Soapy	-	-	-
2.	Odour	Odourless	Odourless	Mudysmail	-	-	-
3.	Colour	Colourless	Colourless	Colourless	-	-	-
4.	pH	6.2	8.6	6.8	7.20	1.25	1.04
5.	HCO_3^{2-} (ppm.)	25	125.00	61	70.33	50.65	1710.22
6.	T.D.S. (mg/l)	220	321	380	307.00	80.91	4364.67
7.	TH (ppm)	119	490	178	262.33	199.36	26496.22
8.	Cl^- (mg/l)	17	79	21	39.00	34.70	802.67
9.	T. Alkalinity (mg/l)	104	281	156	180.33	90.97	5517.56
10.	NO_3^- (mg/l)	3.39	5.2	12.92	7.17	5.06	17.08
11.	B.O.D. (mg/l)	29	13	3.5	15.17	12.89	110.72
12.	C.O.D. (mg/l)	49	71	96	72.00	23.52	368.67
13.	Ca^{2+} (mg/l)	17	30	23	23.33	6.51	28.22

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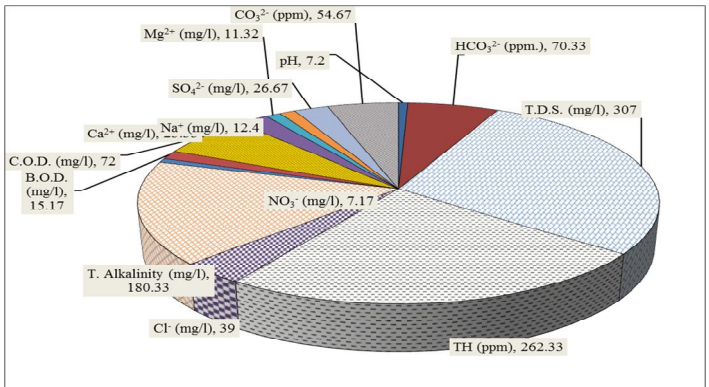
14.	Mg^{2+} (mg/l)	1.9	30.05	2.0	11.32	16.22	175.47
15.	Na^{+} (mg/l)	2.1	32	3.1	12.40	16.98	192.25
16.	SO_4^{2-} (mg/l)	17	42	21	26.67	13.43	120.22
17.	CO_3^{2-} (ppm)	2.0	109.00	53	54.67	53.52	1909.56



Graph. 1 : Show pie diagram for average all parameters of different water samples 2014

The table 1 shows values of river water, underground water and surface water i.e. pH ranges 6.2, 8.6, 6.8, value of TDS (mg/L) 220, 321, 380, colour of water colourless, colourless, colourless, odour of water odourless, odourless, Mudysmail, taste of water unpleasant, brackish, soapy, total hardness (ppm) of water 119, 490, 178, total alkalinity (ppm) 104, 281.0, 156, value of BOD (mg/L) 29, 13, 3.5, value of COD (mg/L) 49, 71, 96 value of Ca^{2+} (mg/L) 17, 30, 23, value of Mg^{2+} (mg/L) 1.9, 30.05, 2.0, value of Na^{2+} (mg/L) 2.1, 32, 3.1, Value of Nitrate (NO_3^-) (mg/L) 3.39, 5.2, 12.92, value of Cl^- (mg/L) 17, 79, 21 value of SO_4^{2-} (mg/L) 17, 42, 21, value of CO_3^{2-} (ppm) 2.0, 109.00, 53, value of HCO_3^- (ppm) 25, 125.00, 61 etc.

Table - 2 : Showing variable and comparative average value of all parameters of different water stations 2015.

S.No.	Parameters	Station A	Station B	Station C	Mean	SD	p
1.	Taste	Unpleasant	Brackish	Soapy	-	-	-
2.	Odour	Odourless	Odourless	Mudysmail	-	-	-
3.	Colour	Colourless	Colourless	Colourless	-	-	-
4.	pH	8.3	8.2	8.2	8.23	0.06	0.00
5.	HCO_3^{2-} (ppm.)	85.25	332	95	170.75	139.73	13016.63
6.	T.D.S. (mg/l)	256	853	248	452.33	347.01	80277.56
7.	TH (ppm)	37	370	84	163.67	180.23	21654.89
8.	Cl^- (mg/l)	75	103.60	63.9	80.83	20.48	279.70
9.	T. Alkalinity (mg/l)	86	334	96	172.00	140.39	13138.67
10.	NO_3^- (mg/l)	4.2	12.2	4.6	7.00	4.51	13.55
11.	B.O.D. (mg/l)	25	-	-	25.00	-	-
12.	C.O.D. (mg/l)	27	-	-	27.00	-	-
13.	Ca^{2+} (mg/l)	40	107.2	17.6	54.93	46.63	1449.53
14.	Mg^{2+} (mg/l)	13.1	24.78	9.72	15.87	7.90	41.63
15.	Na^{+} (mg/l)	4.1	55.70	37.9	32.57	26.21	457.98
16.	SO_4^{2-} (mg/l)	35	96.30	31.0	54.10	36.60	893.09
17.	CO_3^{2-} (ppm)	2.2	2.2	0.8	1.73	0.81	0.44

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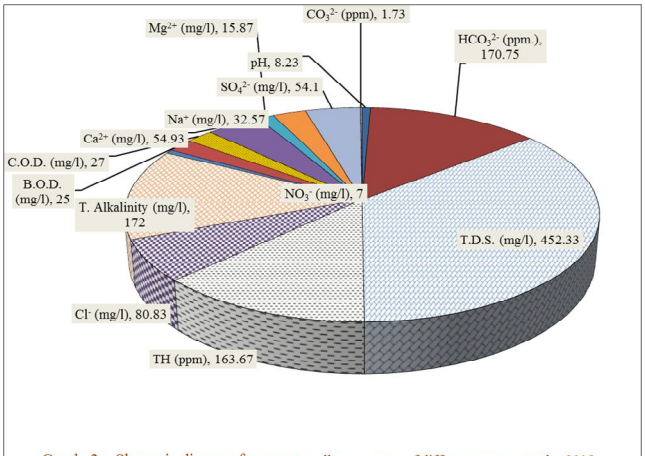

Graph. 2 : Show pie diagram for average all parameters of different water samples 2015

The table 2 shows values of river water, underground water and surface water i.e. pH ranges 8.3, 8.2, 8.2, value of TDS (mg/L) 256, 853, 248 colour of water colourless, colourless, pale yellow, odour of water odourless, odourless, odourless, taste of water Unpleasant, Brackish, soapy, total hardness (mg/L) of water 37, 370, 84, total alkalinity (mg/L) 86, 334, 96, value of BOD (mg/L) 25, nil, nil, Value of COD (mg/L) 27, nil, nil, value of Ca^{2+} (mg/L) 40, 107.2, 17.6, value of Mg^{2+} (mg/L) 13.1, 24.78, 9.72, value of Na^{2+} (mg/L) 4.1, 55.70, 37.9, value of nitrate (NO_3^-) (mg/L) 4.2, 12.2, 4.6, value of Cl^-(mg/L) 75, 103.60, 63.9 value of SO_4^{2-} (mg/L) 35, 96.30, 31.0, value of CO_3^{2-} (mg/L) 2.2, 2.2, 0.8, value of HCO_3^- (mg/L) 85.25, 332, 95 etc.

Table - 3 : Water Quality parameters and drinking water Standards.

S.No.	Parameters	Units	Drinking water WHO and ISI	
			Desirable	Maximum
1.	pH value	-	6.5 to 8.5	Nor elaxation
2.	Dissolved solids	mg/l	500	2000
3.	Colour	Hazen units	5	25
4.	Odour	-	Unobjectionable	-
5.	Turbidity	NTU	5	10
6.	Taste	-	Agreeable	-
7.	Total hardness	mg/l	300	600
8.	Alkalinity	mg/l	200	600
9.	Calcium	mg/l	75	200
10.	Manganese	mg/l	0.1	0.3
11.	NO_3^-	mg/l	50	No relaxation
12.	Cl^-	mg/l	250	1000
13.	Sulphate	mg/l	200	400

Table - 4 : Water Quality parameters and drinking water Standards.

S.No.	Parameters	BIS Desirable limit for drinking water
1.	pH	6.5-8.5
2.	TDS (mg/l)	500
3.	Total Hardness (mg/l)	300
4.	Total alkalinity (mg/l)	200
5.	Ca^{2+}(mg/l)	75
6.	Mg^{2+}(mg/l)	100
7.	Na^{2+}(mg/l)	<60

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8.	NO_3^- (mg/l)	45
9.	Cl^-(mg/l)	250
10.	SO_4^{2-}(mg/l)	200
11.	CO_3^{2-} (mg/l)	-
12.	HCO_3^- (mg/l)	250

IV. CONCLUSION

The result of yearly variation and physico–chemical study of river water, underground water and surface water stations indicate overall alkaline nature. The underground water with pH above maximum desirable limit can affect the mucous membrane. Some stations have TDS less than 1000 mg/l; hence suitable for drinking. Most of the stations have normal chloride, normal carbonate, normal sulphate and moderate to hard, very hard and hard in nature. The comparison of analysed data with WHO (1984), ISI (1991) and BIS desirable limit for drinking water indicate that all water s are more or less suitable for drinking.

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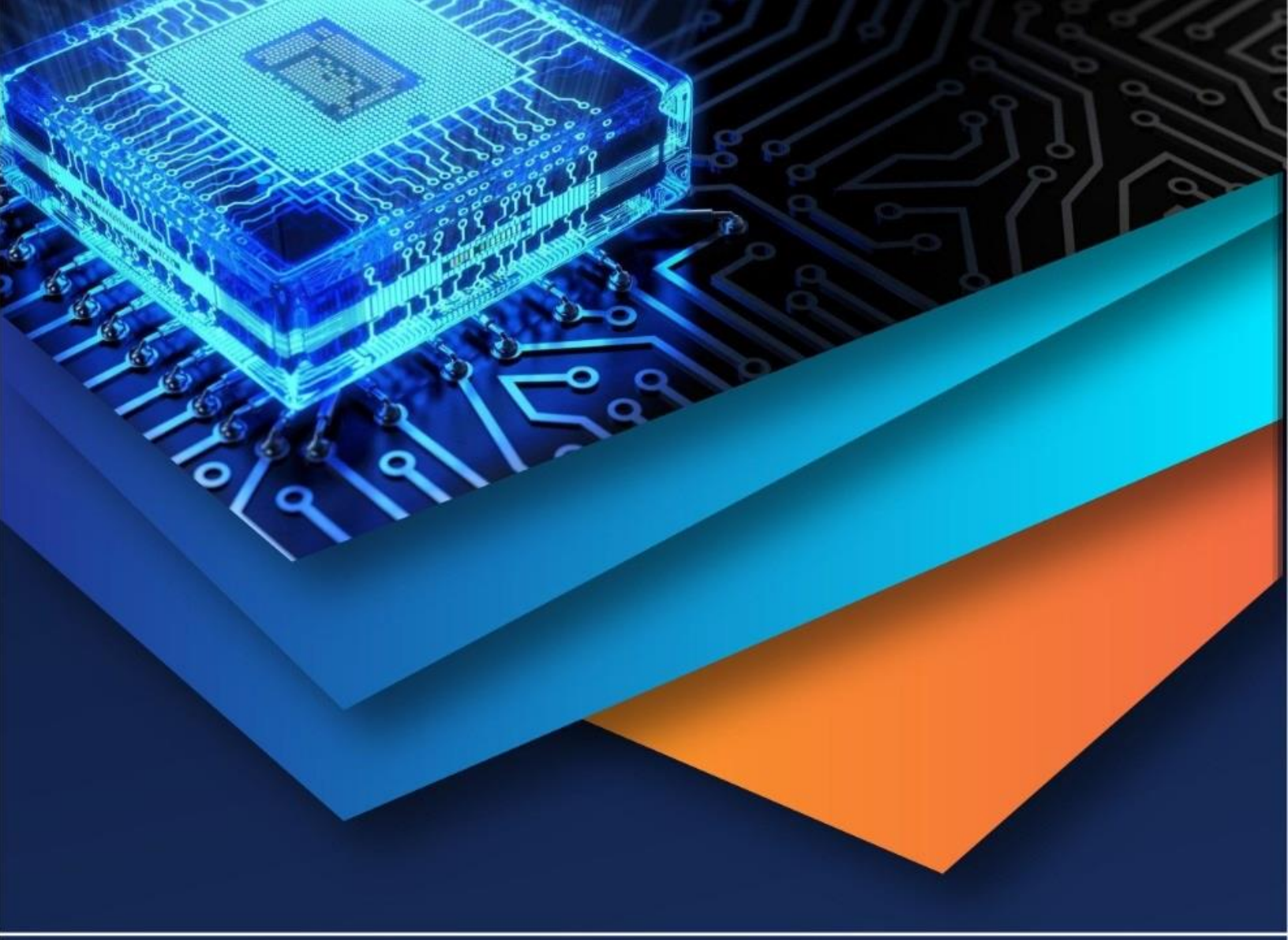

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