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Ground Water Quality of Kashmir Valley (J & K)

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ABSTRACT

The present study was carried on the ground water quality of Kashmir valley to determine the portability of the water. The samples from twelve shallow and deep wells were analyzed during the summer season of 2004. For the portability, the data obtained on various physico-chemical parameters was compared with the standards of MWH (1975), WHO (1984), BIS (1991) and GWS IS: 10500 (1991). While most of the samples crossed the desirable values of drinking water quality, they remained within the permissible ranges. However, for iron 75% samples collected crossed the permissible limits.

Key words: Ground water, portability, desirable values, permissible limits, Kashmir valley

INTRODUCTION

In contrast to surface freshwaters, ground water has some excellent natural qualities, being free from pathogens and environmental contamination, and can thus be consumed directly without treatment. However, groundwater is not always absolutely safe and free from contaminants, which sometimes are present in excessive quantities and prove hazardous. Although the valley of Kashmir is gifted with numerous surface freshwater resources, yet the people especially those living in rural areas, where the populations are dispersed and the infrastructure needed for treatment is not available, use groundwater as their sole source of drinking water. It is, therefore, in this context the groundwater samples from different areas in Kashmir valley have been analyzed to determine the probability vis-a-vis the standards set by MWH (1975, c.f. Agarwal, 2002), WHO (1984), BIS (1991) and GWS IS:10500 (1991).

STUDY SITES

In total twelve wells (11 bore and one open) were selected randomly in six districts of Kashmir Valley. The brief description of the sites is given in Table 1.

MATERIAL AND METHODS

The present study was carried during the summer season of 2004. Water samples were collected in one litre polyethylene bottles from twelve sampling stations. The samples were analysed in the

Table 1. Description of groundwater sampling sites

Sampling station	Location	District	Source (Type of well)	Depth (m)
I	Shopian	Pulwama	Bore well	15.5
II	Pulwama	Pulwama	Bore well	10
III	Pinglina	Pulwama	Bore well	08
IV	Yaripora	Anantnag	Bore well	06
V	Khanabal	Anantnag	Bore well	18
VI	Habak	Srinagar	Bore well	10
VII	Kangan	Srinagar	Bore well	45
VIII	Narabal	Budgam	Bore well	12
IX	Lolipora	Budgam	Bore well	40
X	Bandipora	Baramulla	Bore well	07
XI	Sopore	Baramulla	Open well	09
XII	Handwara	Kupwara	Bore well	13

laboratory within 24 hours for different parameters adopting standard methods of Mackereth (1963), Golterman and Clymo (1969) and APHA (1998).

RESULTS AND DISCUSSION

A perusal of data depicted discernable variations in various physico-chemical characteristics of water samples (Table 2). The pH was circumneutral in all the cases ranging from 6.68 for sampling station IV (Yaripora) to 7.62 for sampling station X (Bandipora). The electrical conductivity was more than 500 µS/cm in ten out of twelve samples with the maximum value of 881 µS/cm recorded for sampling station II (Pulwama) and the minimum of 149µS/cm for sampling station IV (Yaripora). The total hardness ranged from 112 mg/l for sampling station IV (Yaripora) to 430 mg/l for sampling station IX (Lolipora). The higher value for total hardness may be due to carbonaceous or lime rich bed rock of the valley (Kaul *et al.*, 1978; Hynes, 1979; Zutshi *et al.*, 1980; Pandit, 1980, 99). Calcium content varied from 39mg/l for sampling station IV (Yaripora) to 113 mg/l for sampling station VI (Habak). Magnesium showed fluctuation between 3 mg/l for sampling station IV (Yaripora) to 51 mg for sampling station VII (Kangan) and sampling station VIII (Narbal). Unlike surface water samples where the ratio between Ca and Mg ranges between 3:1 to 4:1, in ground waters large fluctuations in the ratios were registered, ranging between 1.25:1 for sampling station VII (Kangan) to 13:1 for sampling station IV (Yaripora). The chloride content was found within the desirable range, being lowest (10mg/l) for sampling station IV (Yaripora) and highest (38 mg/l) for

Table 2. Physico-chemical characteristics of ground water at various stations

Sampling Stations	pH	Conductivity (µS/cm)	Hardness (mg/l)	Ca^{++} (mg/l)	Mg^{++} (mg/l)	Cl^{-1} (mg/l)	Na^{+} (mg/l)	K^{+} (mg/l)	NH_3-N (µg/l)	NO_2-N (µg/l)	NO_3-N (µg/l)	Iron (mg/l)	Sulphide (mg/l)
I	7.60	729	414	85.0	48	21	90	46	150	2.0	100	10	18
II	6.86	881	420	92.0	46	20	95	104	152	1.0	205	8	20
III	7.02	820	407	107.0	33	24	30	14	210	3.0	3020	1.3	18
IV	6.68	149	112	39.0	3.0	10	21	7.0	49	1.5	150	1.0	12
V	7.24	464	276	71.0	24	14	46	29	51	1.4	90	8.0	11
VI	7.17	657	352	113.0	17	26	13	9.0	40	1.0	1140	1.0	10
VII	6.89	770	380	67.0	51	38	52	1.0	35	4.5	4850	8.0	17
VIII	7.06	671	390	72.0	51	28	73	8.0	42	2.0	850	12.0	5.0
IX	7.50	734	430	119.0	32	20	60	18	1640	8.0	4500	1.7	6.0
X	7.62	701	398	100.0	36	27	14	8.0	440	7.0	1420	1.2	14
XI	7.22	640	226	72	9.0	16	27	12	380	7.0	1950	1.8	12
XII	7.10	726	330	101.0	19	32	40	20	500	6.0	950	0.09	8.0

Table 3. Comparison of ground water quality of Kashmir valley with different set standards

Parameters	Present data (range)	WHO Standards (1984)		MWH (1975)		BIS (1991)		GWS: ISI 10500 (1991)
		Highest desirable	Permissible	Acceptable	Cause of rejection	Desirable limit	Permissible limit	
pH	6.68 – 7.62	7.0 – 8.5	6.5 – 9.2	7.0 – 8.5	6.5 – 9.2	—	—	6.5 -8.5
Conductivity (µS/cm)	149 – 881	—	—	—	—	—	—	—
Hardness (mg/l)	112 - 430	100	500	200	600	300	600	300
Calcium (mg/l)	39 - 119	75	200	75	200	75	—	75
Magnesium (mg/l)	3 - 51	30	150	30	150	30	—	30
Sodium (mg/l)	13 – 95	—	—	—	—	50	—	—
Potassium (mg/l)	1 -104	—	—	—	—	—	—	—
Chloride (mg/l)	10 - 38	200	600	200	1000	100	250	250
Ammonical – Nitrogen (µg/l)	35 - 1640	—	—	—	—	—	—	—
Nitrite – Nitrogen (µg/l)	1 – 8	—	—	—	—	—	—	—
Nitrate – Nitrogen (µg/l)	90 - 4850	4500	4500	4500	4500	4500	—	4500
Iron (mg/l)	1 - 12	0.1	1.0	0.1	1.0	—	—	0.3
Sulphate (mg/l)	5 - 18	200	400	200	400	—	—	200

WHO = World Health Organization

MWH = Ministry of Works and Housing (c. f Agarwal, 2002)

BIS = Bureau of Indian Standards

GWS = Ground Water Quality Standards

sampling station VII (Kangan), which is in agreement with the results obtained by Bhat and Yousuf (2002) on spring water samples. Sodium was recorded to be lowest 13 mg/l for sampling station VI (Habak) and highest 95mg/l for sampling station II (Pulwama), while the potassium ranged between 1 mg/l for sampling station VII (Kangan) and 104 mg/l for sampling station II (Pulwama).

NO_2-N was present in meagre quantities and ranged from 1µg/l for sampling station VI (Habak) to 8 µg/l for sampling station IX (Lolipora). NH_4-N was present in higher concentration than NO_2-N and fluctuated between 35 µg/l for sampling station VII (Kangan) to 1640 µg/l for sampling station IX (Lolipora). NO_3-N, being the most abundant form of nitrogen, showed the highest concentration of 4,850 µg/l for sampling station VII (Kangan) against the lowest concentration of 90 µg/l for sampling station V (Khanabal). The present data depicted higher values of NO_2-N compared to NH_4-N in all the samples except sampling station I (Shopian), the values of the former at sampling stations III, VII and IX slightly exceeding the limit given by Wetzel (1983) for ground waters. However, the concentration of NH_4-N is moderate against the very low levels of NO_2-N at all the stations. The very high concentration of iron was recorded in all the samples and ranged between 0.8 mg/l at sampling station VII (Kangan) and 12 mg/l at sampling station VIII (Narabal). Sulphates were present in very less quantities fluctuating between the lowest value of 5mg/l at sampling station VII (Narabal) and highest value of 20mg/l at sampling station II (Pulwama).

Comparing the present data with the set standard of MWH (1975; c. f., Agarwal, 2002), WHO (1984), BIS (1991) and GWS IS: 10500 (1991) most of the water samples depicted many parameters crossing the desirable concentrations and falling with in the permissible levels. However, iron is the only element that was found to exceed the maximum permissible limit for drinking water. Total hardness was found within the permissible range as per WHO standards (1984), but as per GWS IS: 10500 (1991), all the samples exceeded the permissible limits. Further for Ca^{++} and Mg^{++} ions as per the latter standard 59% of samples exceeded the permissible limits. The difference in the water quality of various samples may be related to varying lithology (bed rock type). On a whole, the water quality showed the values falling within the permissible levels except for iron. In conclusion the ground water of various districts of Kashmir Valley seems to be portable.

REFERENCES

Agarwal, S. K. 2002. *Pollution Management. II. Water Pollution.* A.P.H. Publishing Corp., New Delhi – 02.

A.P.H.A. 1998. *Standard Methods for Examination of Water and Waste Water.* 20th Ed. American Public Health Association, Washington, D.C.

Bhat, F. A. and Yousuf, A. R. 2002. Ecology of periphytic community of seven springs of Kashmir. *J. Res. Dev.*, **2**: 47-59.

BIS, 1991. Specification for Drinking Water, IS : 10500: 1991, Bureau of Indian Standards, New Delhi.

Golterman, H. L. and Clymo, R. S. 1969. *Methods for Chemical Analysis for Freshwater*. IBP Handbook No. 8. Blackwell Scientific Publications, Oxford.

Ground Water Quality Standards (IS : 10500). 1991 Indian Standards Institute.

Hynes, H. B. N. 1979. *The Ecology of Running Waters*. 4th Ed. Liverpool University Press.

Kaul, V., Fotedar, D. N., Pandit, A. K. and Trisal, C.L. 1978. A comparative study of palankton populations of some typical freshwater bodies of Jammu and Kashmir State. p. 249 – 269. *In: Environmental Physiology and Ecology of Plants*. (D.N. Sen and R.P. Bansal eds.). B. Singh M.P. Singh, Dehra Dun, India.

Mackereth, F. J. H. 1963. *Some Methods of Water Analysis for Limnologists*. Freshwater Biol. Assoc. Sci. Publ. No. 21. London.

Pandit, A. K. 1980. *Biotic factor and food chain structure in some typical wetlands of Kashmir*. Ph.D thesis, University of Kashmir, Srinagar –1900 06, J&K, India.

Pandit, A. K. 1999. *Freshwater Ecosystems of the Himalaya*. Parthenon Publishing, New York, London.

Wetzel, R. G. 1983. *Limnology*. 2nd Ed. Saunders College Publishing, Philadelphia.

WHO, 1984. Guidelines for drinking water quality. World Health Organization, Geneva.

Zutshi, D. P., Subla, B. A., Khan, M. A. and Wanganeo, A. 1980. Comparative limnology of nine lakes of Jammu and Kashmir Himalaya. *Hydrobiologia*, **72** (1-2): 101 – 112.