

## Physico-chemical Characteristics of Ground water in and around Sambhal, Moradabad (Uttar Pradesh)

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### ABSTRACT

Water samples from ten underground water sites of public places in and around Sambhal Tehsil of Moradabad district were collected and analyzed for different physico-chemical characteristics of water following standard methods and procedures of sampling and estimation. The water is noticed to be very hard, alkaline, full of chemical and biological pollutants. The water bears alarming concentrations of iron and solids. The ground water of study area was found to be polluted at all the sites with reference to almost all the parameters studied. The present study suggests that people exposed to this water are prone to health hazards of polluted water and ground water quality management is urgently needed for the study area.

**Keywords:** Physico-chemical, Ground water, Pollution, Hardness, Fluoride, Solids.

### INTRODUCTION

Though water is renewable resource, improper management and reckless use of water systems are causing serious threats to the availability and quality of water<sup>1-3</sup>. It is the duty of scientists to test the available water in any locality in and around any residential area. As a part of society, it is a must. Attention on water pollution and its management has become the need of the hour because of far reaching impact on human health<sup>4,5</sup>.

Moradabad is a 'B' class city of western Uttar Pradesh. It is situated at the bank of Ram Ganga river and its altitude from the sea level is about 670 feet. It is extended from Himalaya in north to Chambal river in south. It is at 28° 20', 29° 15' N and 78° 4', 79° E. Sambhal is head quarter of Tehsil previously a part of Moradabad district now of Sambhal district itself. The total area of Sambhal Tehsil is 45 Km<sup>2</sup> with total population of more than 3 lacs. It is famous for mentha production and seeng work. Silver foil making is also prominent.

### MATERIAL AND METHODS

Underground water samples of ten India Mark II (IM2) hand pumps at different public places at Sambhal tehsil of

Moradabad, Uttar Pradesh were collected and analyzed quantitatively for different water quality physico-chemical parameters following standard methodology of sampling and estimation<sup>6</sup>. Three samples of each site were collected, analyzed and arithmetic mean of three values is reported here. A blank was also run for all volumetric titrations. All chemicals of anal R grade were used. The specifications of used instruments are Century CP 901 pH meter, RI Conductivity meter and Hach 2100(version 6.4) spectrophotometer. The estimated parameters are Temperature, pH, Conductivity, Total Solids, Total Dissolved Solids, Turbidity, Total Hardness, Calcium, Magnesium, Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Fluoride, Iron, Chloride, Silica as SiO<sub>2</sub>, Alkalinity and Acidity. A brief description of sampling sites is given in Table 1.

### RESULT AND DISCUSSION

Site-wise estimated values of different physico-chemical parameters with their presented W.H.O.<sup>7</sup> standards are listed in Table 2. A critical analysis of data and its comparison with drinking water standards revealed following facts regarding the

ground water quality at Sambhal, Moradabad.

Ground water is found to be alkaline with higher values of pH and very high values of alkalinity. The observed range of conductivity and dissolved solids are 0.760-1.532  $\mu\text{S}/\text{cm}$  and 395-905 mg/lit. The estimated range of hardness is 472-720 mg/lit and the water is very hard and unfit for usage. Higher concentration of magnesium is indicative of hardness of water due to salts of magnesium through water is enriched with calcium and magnesium as essential micronutrient.

The amount of dissolved oxygen is irrelevant for ground water, however, water samples are found to be deficient of oxygen. The estimated range of biological oxygen demand and chemical oxygen demand are 14-32 mg/lit and 24-62 mg/lit respectively. The values suggest high concentration of organic pollutants and presence of high amount of chemical pollutants as well in ground water of study area.

The observed range of fluoride and iron in water of study area are 0.61-1.20 mg/lit

and 0.68-1.50 mg/lit. Hence water of study area is enriched with fluoride and bears an alarming concentration of iron. Low concentration of silica is desirable in water, which is not observed at all sites.

### CONCLUSION

On the basis of discussion, it may be concluded that underground water at Sambhal tehsil of Moradabad is highly alkaline, very hard, highly polluted with organic and also highly polluted with reference to all physico-chemical parameters studied. Hardness of water is mainly due to salts of magnesium. The water is enriched with calcium and magnesium as essential micro-nutrient. The ground water is also enriched with fluoride. The water of study area bears an alarming concentration of iron. The people exposed to water study area are prone to health hazards of polluted water and quality management is needed in the study area.

**Table 1: Details of sampling sites**

S.No.	Site No. & Name	Location of site	Apparent water quality	Usage
1	I, Veterinary Hospital	6.0 km East from tehsil	Pale yellow on standing, odourless	Drinking & Bathing
2	II, Sambhal Block	0.5 km South to site no.I	Colourless, odourless	Drinking & Bathing
3	III, Roadways	5.0 km South-West from tehsil	Colourless, odourless	Drinking & Bathing
4	IV, Samudayik Swasthya Kendra	4.5 km East from tehsil	Colourless, odourless	Drinking & Bathing
5	V, District Court	5.0 km North-East from tehsil	Pale yellow on standing, odourless	Drinking & Bathing
6	VI, Shankar College Square	4.0 km North to site no. III	Colourless, odourless	Drinking & Bathing
7	VII, Government Hospital	2.0 km North to site no.VI	Colourless, odourless	Drinking & Bathing
8	VIII, Nagar Palika Parishad	3.5 km South-East from tehsil	Colourless, odourless	Drinking & Bathing
9	IX, Sambhal Tehsil	8.0 km North-East to site no. III	Colourless, odourless	Drinking & Bathing
10	X, Railway Station	8.0 km South-East to site no.IX	Pale yellow on standing, odourless	Drinking & Bathing

**Table 2: Site-wise estimated values of different physico-chemical parameters with their WHO standards**

S.No	Sampling Sites	Site no. I	Site no. II	Site no. III	Site no. IV	Site no. V	Site no. VI	Site no. VII	Site no. VIII	Site no. IX	Site no. X	WHO Standard
1	Temperature(°C)	22.3	24.8	25.8	24.0	20.0	25.8	25.0	25.0	23.2	25.0	-
2	pH	8.16	8.20	7.95	7.97	8.03	7.83	7.97	7.76	7.91	8.09	8.0
3	Conductivity(µS/cm)	1.455	1.532	1.051	0.970	1.312	0.879	0.991	0.760	0.961	1.311	0.300
4	Total Solids (mg/lit)	1100	1250	1050	870	1210	710	815	650	705	1085	500
5	Total Dissolved Solids(mg/lit)	819	875	795	610	871	418	517	395	585	905	500
6	Turbidity (mg/lit)	4.55	5.40	4.85	3.24	3.20	2.80	2.71	3.20	2.90	4.43	5
7	Total Hardness (mg/lit)	508	560	656	576	492	720	584	620	684	472	100
8	Calcium (mg/lit)	136	184	204	196	192	216	272	260	276	248	100
9	Magnesium (mg/lit)	372	376	452	380	300	504	312	360	408	224	30
10	Dissolved Oxygen (mg/lit)	2.11	2.0	2.25	2.45	2.22	3.0	2.50	3.0	2.30	2.15	5
11	Biological Oxygen Demand (mg/lit)	31	28	29	26	32	18	17	14	16	27	6
12	Chemical Oxygen Demand (mg/lit)	52	61	49	31	48	26	34	24	30	49	10
13	Fluoride (mg/lit)	1.20	1.14	1.0	0.81	1.10	0.81	0.73	0.61	0.79	1.14	1.0
14	Iron (mg/lit)	1.19	1.02	0.95	0.71	0.81	0.68	0.71	1.11	1.01	1.50	0.1
15	Chloride (mg/lit)	53.98	89.97	101.96	148.95	82.97	125.96	48.98	138.95	114.96	35.98	200
16	Silica as SiO <sub>2</sub> (mg/lit)	34.67	30.17	29.16	24.12	32.50	28.14	27.85	20.50	22.40	32.15	-
17	Alkalinity (mg/lit)	240	176	260	168	256	268	284	232	284	248	100
18	Acidity (mg/lit)	30	34	90	66	68	104	42	120	68	84	-

**REFERENCES**

1. Dawle JK. Intl J Chem Sci. 2010;8(1):97-202.
2. Kumar N and Sinha DK. Indian J Env Prot.2009;29(11):997-1001.
3. Manonmani N. Inte J Chem Sci. 2010;8(1):537-552.
4. Shahnawaz MD, Singh KM and Shekhar H. Indian J Env Prot. 29 (11):945-952.
5. Sinha DK and Saxena R. J Environ Science and Engg. 2006;48(3):57-164.
6. APHA, Standard Methods for Examination of Water and Waste Water, 19<sup>th</sup> Ed., AWWA, WPCF, Washington D.C, 1995 .
7. WHO. International Standards for Drinking Water, Health organization, Geneva, 1971.