

Assessment of Physico-Chemical Characteristics of Drinking Water Sources in Winter at Manikpur, Chitrakoot (UP)

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Abstract: *Manikpur is a subdivision of Chitrakoot District. There is no proper sewer system in the town and effluents in winter are allowed to flow over the roads and streets, as the result endangering the ground water quality. To determine the extent of ground water pollution assessment of physico-chemical characteristics of drinking water sources was done during winter. Eight sites named as Site-I-Patel Nagar, Site-II-Jawahar Nagar, Site-III-Shastri Nagar, Site-IV-Subhash Nagar, Site-V-Gandhi Nagar, Site-VI-Arya Nagar, Site-VII-Mahaveer Nagar & Site-VIII-Shiv Nagar were chosen for the purpose. The parameters which were determined are Colour, Taste, Odour, Temperature, pH, Conductivity, Turbidity and contents Total solids, Suspended solids, Settable solids, DO, BOD, COD, TKN, BHC. The water samples were also analyzed for the determination of contents like Calcium, Magnesium, Chloride, Sulphate, Carbonate, Nitrate, Sodium, Potassium and free CO₂. The level of those parameters and contents were evaluated; exceeded all the eight sites on comparing with desirable limits as prescribed by WHO and results were lowest at Site-7- Mahaveer Nagar and highest at Site-1- Patel Nagar in the winter.*

1. Introduction

The term pollution derived from the Latin word pollure and means to soil¹ or to defile. The term pollution, contamination, nuisance and degradation often are used simultaneously to describe faulty conditions of surface waters. Pollution has been defined as an unavoidable change in physico-chemical and biological characteristics of our air, land and water that may or will hostilely affect human life or that of other describe species or industrial process or deteriorate our natural resources.

Pollution of water is responsible for² a very large number of mortalities and incapacitations in the world. Polluted state of water resources has led to a steady decline in fisheries and has also affected the irrigation land. Water no longer remains a free good. Availability of clean water is going to become the greatest constraint for the development of tomorrow.

Man has tried to cope with this scenario and has rapidly advanced its efforts to counteract this malady. In past few decades³ natural and polluted waters have been studied in detail all over the world and considerable data is now available on most kind of pollutants and their effect on ecosystem as well as on organisms.

Sources of pollution can be divided into two groups natural and cultural. The sources can be further classified as either point or non point. Point sources enter the pollution transport routes at discrete identifiable locations and usually can be measured directly or otherwise quantified and their impact can be evaluated directly. Pollution from non point sources can be related to weathering of minerals, erosion of virgin lands and forests including residues of natural vegetation or artificial or semi artificial sources. The last can be directly related to human activity such as fertilizer applications or use of agricultural chemicals for controlling weeds or insect erosion of soil materials from

agricultural farming areas and animal feed lots, construction sites, transportation of dust and litter on impervious urban surfaces⁴.

Ground water is usually traced back to four main origins. Industrial domestic agricultural, environmental pollution, each family is being divided up into continuous and accidental types.

2. Experimental and Discussion in the month of December

In this month temperature was found maximum 14.60 °C at site-IV (Subhash Nagar) and minimum 10.00 °C at site-VII (Mahaveer Nagar). It is very important to know that temperature is an important factor to influence the biological reaction in water. Higher values of temperature augment the chemical reaction and reduce solubility of gasses and dissolved oxygen.

At the eight sites pH followed the order Site-I> Site-III> Site-II> Site-IV> Site-V> Site-VIII> Site-VI> Site-VII. It ranged between 7.25-7.50. It was found maximum at site-I (Patel Nagar) and minimum at site-VII (Mahaveer Nagar). In this month quantum of filth is quite high in the site-VII-Mahaveer Nagar. Hand pumps are installed by the side of gutters where animal and vegetable waste is scattered all along the sides of these gutters. Peels of vegetable, fruits and morsels of edibles make the soil alkaline resulting increase the measured pH value.

Conductivity is a measurement of the dissolved solids in us/cm. No permissible limit has been decided for this. In this month Conductivity ranged between 635.00-644.00 us/cm. Lowest value was recorded at site-VII-Mahaveer Nagar and highest at site-I-Patel Nagar. Obviously dissolved solids are in high concentration at site-VII (Patel Nagar). At the eight sites it followed the order site-I> site-V> site-III > site-VIII> site-VI> site-II> site-VII.

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Turbidity varied from 8.10-11.28 NTU. Highest value of turbidity was recorded at site-I (Patel Nagar) and lowest at site-VII –Mahaveer Nagar. It followed the order site-I>site-V>site-III >site-VIII>site-VI>site-II>site-VII.. Turbidity was under the permissible limit for drinking water at the sites I,II,III , IV&VII.

Calcium content at the eight sites followed the order site-I>site-V>site-III >site-VIII>site-VI>site-II>site-VII. It fluctuated between 92.15-100.56 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). It was under the permissible limit for drinking water (200mg/l, ISI, 1991) but exceeded the desirable limit (75mg/l, ISI, 1991) at all the eight sites.

Magnesium content followed the order as site-I>site-VI>site-V>site-II>site-III>site-IV>site-VIII>site-VII. It ranged between 59.60-63.56 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). It was above the permissible limit for drinking water (30 mg/l, ISI, 1991) at all the eight sites.

The concentration of total solids ranged between 640.20-699.00 mg/l. The highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). At the eight sites it followed the order site-I>site-VI>site-V>site-II>site-VIII>site-III>site-IV>site-VII. Total solids contents were above the desirable limit 500 mg/l at all six sites. Actually in many parts of the world; water with dissolved solids concentration ranging from 2000-4000 mg/l is also used and no psychological effect were reported.

Suspended solids varied from 18-22 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). It followed the order site-I >site-VI>site-V>site-VIII>site-III>site-IV>site-II>site-VII.

Settleable solids varied from 5.94-.8.56 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). It followed the order site-I>site-III>site-IV>site-VI>site-V>site-VIII>site-II>site-VII.

The chloride content followed the order site-I>site-VI>site-III>site-V>site-II>site-IV>site-VIII>site-VII. It normally increases as the mineral content increases. It is found in the form of Na, K and La salts. It shows the degree of pollution of animal origin. In this month it varied from 340-355 mg/l. The lowest value was recorded at site-VII (Mahaveer Nagar) and highest at site-I (Patel Nagar). At all sites chloride content surpassed the limit for drinking water (250mg/l, ISI, 1991) but was found under the permissible limit for drinking water (1000mg/l, ISI, 1991).

A scientist Stiever (1967) has reported that the sulphate reduces to H₂S very quickly under high organic pollution and depleted oxygen conditions. It followed the order site-I>site-VI>site-III>site-V>site-IV>site-VIII>site-II>site-VII. In this month sulphate content ranged between 155.00-172.00 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). In this month it was found within the permissible limit (400 mg/l, ISI, 1991) at all eight sites.

Carbonate at the six sites followed the order site-I>site-III>site-VI>site-V> site-II>site-IV>site-VIII>site-VII. It varied from 4.90-5.60 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar).

Bicarbonate followed the order site-I>site-III>site-VI>site-V>site-II>site-IV>site-VIII>site-VII. It varied from 566-609 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar).

Free CO₂ followed the order site-I>site-III>site-VI>site-V>site-II>site-IV>site-VIII>site-VII. It ranged between 9.36-13.48 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). Water at all sites is corrosive in nature as CO₂ always exceeds the limit (6mg/l, Kudesia, 1991). The high CO₂ level here is an indication of pollutants in water and not much harmful for aquatic life. The higher value of free CO₂ might be due to increased rate of decomposition of organic matter by microbes in bottom resulting in the fast production of free Carbon di oxide.

In this month Nitrate ranged between 13.10-18.5 0mg/l. It followed the order site-I>site-III>site-VI>site-V>site-II>site-IV>site-VIII>site-VII. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). Site-I, Patel Nagar is situated near the open ground which is suitable for agriculture. Its highest value at aforesaid site was due to the influx of nitrogenous fertilizers through agricultural lands.

Nitrite ranged between 1.50-4.32 mg/l. It followed the order site-I>site-III>site-VI>site-V>site-II>site-IV>site-VIII>site-VII. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). At the site I, II & VII nitrite content was found under the provisional guidelines for drinking water 3mg/l.

Sodium controls the acidic basic equilibrium. It is mostly associated with the chloride and bicarbonate ions. Sodium content ranged between 334-350 mg/l. It followed the order site-I>site-II>site-VI>site-V>site-III>site-IV>site-VIII>site-VII. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). No permissible limit has been prescribed of sodium for drinking water.

The concentration of potassium is insignificant in most drinking waters. It ranged between 7.5-8.45mg/l. The order followed by all eight site was site-I>site-III>site-VI>site-V>site-II>site-IV>site-VIII>site-VII. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar).

Dissolved Oxygen followed the order site-I>site-III>site-VI>site-V>site-II>site-IV>site-VIII>site-VII. It varied from 4.25-6.60 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). DO at the sites II and VII was found below the minimum desirable limit 6 mg/l for drinking water.

BOD in this month ranged between 6..80-7.98 mg/l. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII (Mahaveer Nagar). It followed the

ordersite-I>site-III>site-VI>site-V>site-II>site-IV>site-VIII>site-VII. BOD at all sites exceeded the maximum permissible limit of 2mg/lit for drinking water.

Chemical oxygen demand in this month followed the order site-I>site-III>site-VI>site-V>site-II>site-IV>site-VIII>site-VII. In this month It ranged between 70.35-75.7 mg/lit. Highest value was recorded at site- I (Patel Nagar) and lowest at site- VII (Mahaveer Nagar).

Total Kjheldal Nitrogen followed the ordersite-I>site-III>site-VI>site-V>site-II>site-IV>site-VIII>site-VII. It varied from 8.52-16.32 mg/lit. Highest value was recorded at site-I (Patel Nagar) and lowest at site-VII(Mahaveer Nagar). It is lowest at site-VII because it is least dirty and maintaining some hygiene and sanitation conditions are good.

In this month water was found to be colourless at sites I, IV, VII,VIII and light yellow at sites II, III,V,VI.

Taste of water in this month was good at sites I, IV,V,VII and not good at sites II, III, VI VIII.

Odour in this month was not objectionable at sites I, IV,V,VII. and objectionable at sites II, III, VI,VIII.

Similarly various parameters and contents were determined and discussed in the month of February also.

3. Conclusion

Mahaveer Nagar (site- VII) is found with desirable limit of various Physico-Chemical parameters and contents of water. Worst affected is Patel Nagar (site-I) due to the bad community habits, rivulets and gutters delivering fifthly and boggy water, the said site is thickly inhabited by people of lower middle class; who have installed hand pumps in their houses for meeting their needs of drinkable water and water for cleaning .

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