

A Comprehensive Study of Pollution in Underground Water in Ballia City

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INTRODUCTION

The Water pollution term is present or in future. referred to the addition of an excess of material to water that is harmful to humans , animals , or desirable aquatic lives. Or otherwise causes significant departures from the normal activities or various living communities in or near bodies of water¹ . The national water commission stated that water gets polluted if it has been not of sufficiently high quality to be suitable for the highest uses people wish to make of it as in present or in future. The effect of sewage, industrial waste and agricultural drainage on plant and animal life in closed bodies of water is some time catastrophic. The accumulation of excessive plant nutrients called entrophication has occurred in lake erie, lake Washington at seattle, the lakes in the modison, Wisconsin area, and lake Zurich in Switzerland². A particular certain number of individuals will get diseases and thus capable of contaminating the water with various infections agents. In addition , hospitals dispose of water products disposed from hospitals into water ways and ground water systems also cause pollution. Unfortunately the identification of specific infections agents in a water supply needs the analysis of vast numbers of samples by time consuming and sophisticated methods generally therefore routine monitoring of water supplies employs the MPN (most probable number) method. This enrichment leads to other slow process collectively referred to as natural aging of lakes⁴ . The Chemical Treatment methods have been used in many active mines . The mine discharge has been sent to a near by treatment plant where hydrated lime has been added . This has been following by an aeration of the water. The water has been placed in a large lagoons where the sludge created by the process saltless to the bottoms and a clear overflow gets discharged in to the bottom and a clear overflow gets discharged into the natural waters large influxes of strong and have been able to over them this buffering ability of water and bring about drastic drops in pH values. The effect of chemical pollutants on health is not well understood. Even information on the identity and amount of the chemicals . That are present in incomplete , although the use of chemical products every where is on the increase. Some natural waters are known to have injurious chronic effect from prolonged use . Therefore chemical contaminants that may enter the water supply from sources such as sewage effluents, the recycling of treated wastes , or percolation of wastes in to the underground water supply should be under suspicion until proved to be harmless by experiments with laboratory animals. Several waterborne infections diseases

are directly related to polluted water. In addition the aquatic food chain acts to concentrate several toxic substances and it ascends from micro organisms through various predators and prey to fish eaten by seals, by certain birds or by people. Organochlorine and organomercury pesticides, PCBs and some radioactive pollutants are concentrated this way. Well Water contaminated by nitrates from fertilizers run of poses a hazard to health particularly for infants.

The various physico chemical techniques are used for removal of chemical, biological and radiobiological pollutants have been adsorption, electro dialysis ion exchange and reverse osmosis technique is based on the removal of salts and other substances from water by forcing the later through a semipermeable membrane under a pressure that exceeds the osmotic pressure so that flow in the reverse direction to the normal osmotic flow. In practice this involves a porous membrane whose chemical nature has been such that it has a preferential attraction for solvent while repulsion for the solute reverse osmosis has been commonly used to desalinate blackish water and also finds suitable, effective and economical method for the purification of water polluted by sewage effluent

EXPERIMENTAL

The site selected for the present dissertation is the municipal area of Ballia (S1 – Chandra Shekhar Nagar, S2 –Jagdishpur, S3 –Baria Mathia satani Sarai, S4- Japlinganj, S5- Oktenganj, S6- Civil Lines Ballia) includes a variety of people having diversity of habit habitat economic social cultural and geographical states.

In general, sampling and water measuring devices must be divided into five broad categories.

1. Water Samplers
2. Bottom Samplers
3. Biological Samplers
4. Current Measuring devices
5. Turbidity measuring devices

The most common sampler in use has been the nensen bottle. The nensen bottle has been sent down to the required depth with the volves in the open position. At the desired depth a messenger would be sent down, which strikes the trigger on the nensen bottle the trigger releases the top portion of the bottle from the wire and makes the bottle the top portion of the bottle from the wire and makes the bottle to reverse. As the bottle turns over the volves close, getting the water sample. The water samples collected by these bottles can be used for various chemical and physical analysis. In addition the particulate matter suspended in the

sample could be removed by filtration and used in a variety of chemical , biological or geological investigations. Many indicators such as ammonium purpurate , calcon etc form a complex with only calcium but not with magnesium at higher pH . As EDTAs having a higher affinity towards calcium ;the former complex is broken down and a new complex is formed. However EDTA has a property to combine with both Ca^{++} and Mg^{++} , therefore magnesium is largely precipitated as its hydroxide at sufficiently higher pH. Calcium and Magnesium form a complex of wine red colour with Eriochrome Black T at pH 10.0. The EDTA has got a stronger affinity for Ca^{++} and Mg^{++} . The former complex is broken down and a new complex of blue colour is formed . The value of Mg^{++} can be obtained by subtracting the value of calcium from the total of Ca^{++} Mg^{++} . A compound of red violet colour is formed by the reaction of dissolved hexavalent chromium with diphenylcarbazide in acid solution Total (dissolved +particulate) chromium can be obtained after digestion of sample with $\text{H}_2\text{SO}_4\text{-HNO}_3$ For determination of total dissolved chromium, the trivalent chromium can be oxidized to hexavalent by potassium permanganate. The excess KMnO_4 is then destroyed by sodium azide (NaN_3) .

For the physico chemical analysis of water various methods^{3,6,7,9,10,11,12,13} have been adopted and several methods have been suggested and discussed by some workers^{5,8,12,14 ,15,16,17} . For the determination of surface temperature , water was collected in some suitable container . Soon after collection of the sample inserted a mercury thermometer and noted the reading. The thermometer must be graduated .Depth temperatures are measured by a number of devices such as thermister, thermophone,bathy thermograph reversing thermometer. Etc, Thermister is based on the principle of developing different intensity of charges on a resistor in different temperatures . In bathythermograph a copper tubing is filled with xylene which expands or contracts and activates as a special element carrying a stylus. The stylus records on a coated glass slide , the movements of the element. Colour of the sample can be compared with the known colour standards in which one colour unit is equivalent to the colour produced by 1mg of platinum.

Odour is generally measured as “threshold odour number” which is equal to dilution ratio of the sample at which the odour is just detectable. The sample is diluted with odour free water until at least perceptible odour is detected by the tester. As the sensitivity to odour of different persons varies. A very old and convenient method is to measure the turbidity in terms of Secchi disc transparency measured in centimeters. In the laboratory turbidimeter or nephelometer is used. Silver nitrate reacts with chloride to form very slightly soluble white precipitate of Ag Cl at the end point when all the chlorides get precipitated , free silver ions with chromate to form silver chromate of reddish brown colour . pH is the negative log 10 of the hydrogen ion concentration in a solution It can be measured by colorimetric methods using various indicators or paper strips. However , the use of calorimetric methods are less convenient and Less accurate for accurate measurement of pH electrometric methods are used employing the hydrogen ion sensitive electrodes . Nitrate reacts with phenol disulfonic acid

to form a nitro derivative which in alkaline medium develops a yellow colour. The concentration of NO_3 can be determined colorimetrically using Bee's Law.

Table 1 Jan 2015

Site	Temp.	Turbidity	Colour	pH	Chloride	Nitrate	Calcium	Magnesium	Chromium
S1	31.7	2.7	5	6.5	245	18	208	145	0.014
S2	32.2	2.9	6	6.4	238	16	208	144	0.013
S3	31.1	3.0	5	6.4	242	18	208	145	0.012
S4	31.4	6.9	7	6.6	241	18	206	144	0.013
S5	32.0	7.5	8	6.2	246	18	205	144	0.011
S6	32.1	7.1	6	6.4	246	18	207	142	0.012

Table 2 Feb 2015

Site	Temp.	Turbidity	Colour	pH	Chloride	Nitrate	Calcium	Magnesium	Chromium
S1	31.8	2.5	5	6.4	240	16	211	143	0.015
S2	32.0	2.6	6	6.5	235	14	210	146	0.013
S3	32.0	2.6	5	6.3	238	16	210	147	0.013
S4	31.4	7.1	6	6.4	238	16	204	146	0.012
S5	32.1	7.2	7	6.1	242	17	207	146	0.011
S6	32.2	7.0	6	6.3	242	16	207	144	0.012

Table 3 March 2015

Site	Temp.	Turbidity	Colour	pH	Chloride	Nitrate	Calcium	Magnesium	Chromium
S1	32.0	2.3	6	6.3	25	14	212	150	0.015
S2	31.9	2.3	5	6.4	232	13	213	149	0.013
S3	32.2	2.2	4	6.3	234	14	211	150	0.013
S4	31.7	6.3	6	6.3	234	15	210	149	0.014
S5	31.8	7.0	6	6.0	238	15	210	148	0.012
S6	31.8	7.8	5	6.2	235	14	209	148	0.013

Table 4 April 2015

Site	Temp.	Turbidity	Colour	pH	Chloride	Nitrate	Calcium	Magnesium	Chromium
S1	32.2	2.1	4	6.4	228	10	214	156	0.013
S2	32.2	2.0	5	6.3	225	09	214	155	0.011
S3	32.2	2.0	4	6.3	230	10	212	155	0.012
S4	32.1	6.1	6	6.1	230	12	212	155	0.014
S5	32.0	6.8	6	6.1	234	14	212	157	0.012
S6	32.1	6.4	5	6.1	229	11	210	155	0.012

Table 5 May 2015

Site	Temp.	Turbidity	Colour	pH	Chloride	Nitrate	Calcium	Magnesium	Chromium
S1	32.3	1.9	4	6.5	225	08	216	160	0.011
S2	32.3	1.9	4	6.5	223	07	216	160	0.011
S3	32.3	1.6	4	6.5	225	10	213	160	0.011
S4	32.3	6.3	7	6.2	225	10	213	161	0.012
S5	32.6	6.5	6	6.2	230	10	213	161	0.012
S6	32.4	5.9	5	6.2	224	08	212	161	0.010

Table 6 June 2015

Site	Temp.	Turbidity	Colour	pH	Chloride	Nitrate	Calcium	Magnesium	Chromium
S1	32.4	1.5	5	6.3	220	33	212	124	0.016
S2	32.0	1.5	4	6.2	222	32	214	121	0.014
S3	32.4	1.4	4	6.4	234	32	212	115	0.013
S4	32.6	5.9	6	6.3	236	34	211	115	0.013
S5	32.8	6.8	5	6.1	228	08	212	116	0.010
S6	32.5	5.8	7	6.2	226	32	210	114	0.015

RESULTS AND DISCUSSION

(S1 – Chandra shekhar nagar , S2 – Jagdishpur , S3 – Bari Mathia Satani Sarai , S4- Japlinganj , S5 – Oktenganj , S6- Civil Lines Ballia) on the grounds of depth of water level. All the sites are free from slums, & defects , the periodic data of turbidity , colour , odour temp, pH ignitionersidue , hardness, bacterial coliform , Chloride Nitrate Calcium Magnesium .The colour of the sectors decreases from Jan to June and it suddenly rises till Sept. It declines from Oct to June , Sectors S 1 , S2, S3 have nearly the same colour value in each month respectively through out the whole year . Likewise sectors S4, S5,S6 have comparable value with slight variation. There are some irregular changes in the colour or the underground water in different sites due to metrological factors. The colour approaches to non acceptable

value . Sector S1 as the most non acceptable value in Aug Sept. while sectors S4 S5 have a similar situation in some months. The colour parameter of water is favourable for industries of wood chemicals synthetic rubber polymer petroleum products throught out the whole year but in some months it is not desiarable for the purpose of canning drying and freezing of fruits and vegetables and lather tanning in genral finishing processes Some has the water may be considered fit for soft drinks bottling. The odour of all the sites S4 to S6 has in significant value from Jan To June. The odour gathers significance from the end of June which attains the highest value during the rainy season July to October as regards the odour of underground water . A comparative study of the odour of various sectors reveals that the extent of odour freedom to various sector are S1,S2,S3,S4,S5&S6 Odour quality deteriorates as one moves from sector S4 towards S5. The odour of underground water is acceptable through out the whole year but the consumers acceptance decreases from July onwards till October. Sector S1, S2 , S3 accepts the rainy season are odour free through out the whole year but sectors S4 And S5 and odour free from Jan to June. But they have significant odour character in Jan. Some fluctuations in the odour value may be attributed to sudden change in weather and local pollution worsening of soil. The Temperature of water was almost constant through out the whole year for all the sites. Slight change in the temperature occurring site wise may be due to difference in the soil structure are some biochemical reactions taking place within the earth. The month wise variation of temperature may owns to the atmospheric temperature and radiation effects (stem correction) during its measurements with due consideration of all the limitations. It may be established that the temperature of underground water in the north part of the city excluding slum and derlects has almost a constant value free from position and period. The temperature of the ground waterif inhaled directly will suit the best for the digestion and other physiological processes. The temperature of the ground water is quite favourable and desirable for the physiological processes in plants and trees for washing bathing cooking refreezation and other industrial purpose the underground water has a proper recommended thermal state.

The pH of the water in the entire area of investigation has a peculiarity of being below 7 (seven) Thus in all the sector through out the year water remains slightly acidic. Through the acidic strength of the underground water is quite low as compared to the corresponding value of other northern and eastern districts of purvanchal Uttar Pradesh yet a regular use may cause hyper acidity and stomach truble. The acidic strength of water of sector S4 is the lowest while for s1 it is the highest except in some months. Though there is irregular variance in pH site &season wise yet it may be generalized that pH during rainy season (July-Sept) has higher value as compared to summer and winter. The water analysis of Gomti river is in support of the present investigation . The work done by Singh & Khan on Sai river and physico chemical analysis dug well water by Singh &Singh reveal that the combined use of the underground water of this area and the canal irrigated area around Jalalpur will be a healthy heiginic tonic for living beings The pH value is fit for domestic industrial and for other general

use . The underground water specially in Nov & Dec if used regularly for drinking may not suit to infants. The uptaking of the water by plants for photosynthesis will be favoured by its pH. pH of water was observed is such that it is not fit for industries of synthetic rubber plastics and polymers and petrollium products in the month of October November and December . However the value allows in other months for the manufacture of chemicals wood synthetic rubber plastics and polymers petrollium products drying freezing canning of fruits and vegetables and even for lather tanning . At lower pH values the chlorination effects i.e. the killing of microbes increases water having the pH lower than six causes excessive corrosion of plumbing system, water pipes tapes boats piers building structures water pipes utensils. Water having pH beyond 6.5-8.6 adversely affects the mucous membrane . The high value of the pH may be due to possible dissolution of free CO₂ uncommon acid rain and pollutants from forming kitchen gardening rotting of domestic wastes lounderies small scale industries and indigeneous plants. The hardness in water is not only an ordinary pollution parameters but it indicates an importance water quality mainly in terms of Mg & Ca in the form of carbonates. The maximum pereacible limit of total hardness for the purpose of drinking as recommended by WHO is 500ppm Above 500 ppm water is regarded Soft and non corrosive . The total hardness of water ranges .

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