MICROBIOLOGICAL AND PHYSICOCHEMICAL CHARACTERISTICS OF GROUND WATER USED AS A SOURCE OF PUBLIC SUPPLY IN JABALPUR REGION (M.P.)

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Abstract: Water found in nature is never H2O alone, hence it can be considered as separate entity and can be expressed by the chemical formula as (H2O+X) where X is measurable and controlled amount of salts(Ca, Mg, Na, chlorides, fluorides, phosphates etc.). For healthy and hygienic growth of animals especially for human beings, it is really important that the water that is being supplied to various localities where people live free from all these excess chemical constituents and microbes The physicochemical parameters of ground water of different areas of Jabalpur (M.P.)namely PH, turbidity, total dissolved solids, alkalinity and hardness, phosphate content, chloride content , nitrate content, fluoride content and sulphate content have been derived for two month period from 1st July to31st August 2012.It has been observed that there is marked difference in the values of various parameters of all the regions.

Keywords: Physicochemical Parameter, groundwater, water quality, pH, coliform.

Introduction: Water covers 70.9% of the Earth's surface, and is vital for all known forms of life. On Earth, it is found mostly in oceans and other large water bodies, with 1.6% of water below ground in aquifers and 0.001% in the air as vapour, clouds (formed of solid and liquid water particles suspended in air), and precipitation. Oceans hold 97% of surface water, glaciers and polar ice caps 2.4%, and other land surface water such as rivers, lakes and ponds 0.6%. A very small amount of the Earth's water is contained within biological bodies and manufactured products. [1, 2]

Humans require water that does not contain too many impurities. Common impurities include metal salts and oxides (including copper, iron, calcium and lead) and/or harmful bacteria, such as Vibrio. Some solutes are acceptable and even desirable for taste enhancement and to provide needed electrolytes. The single largest (by volume) freshwater resource suitable for drinking is Lake Baikal in Siberia [1, 2] Purification of water: It is a process of removing undesirable chemicals, materials, and biological contaminants from raw water. The goal is to produce water fit for a specific purpose. Most water is purified for human consumption (Drinking water) but water purification may also be designed for a variety of other purposes, including meeting the requirements of medical, pharmacology, chemical and industrial applications. In general the methods used include physical processes such as filtration and sedimentation, biological processes such as slow sand filters or activated sludge, chemical processes such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light [2, 3]. The purification process of water may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, fungi; and a range of dissolved and particulate material derived from the surfaces that water may have made contact with after falling as rain. The standards for drinking water quality are typically set by governments or by international standards. These standards will typically set minimum and maximum concentrations of contaminants for the use that is to be made of the water. [1]

The essential purpose of water analysis is to determine the fitness or potential fitness of the water for the use it is put to in house or industry. We attribute water as safe/unsafe; pure/impure; palatable/unpalatable; hard/soft; corrosive/non-corrosive; sweet/saline; as the case may be. Similarly, of sewage effluents we say putrescible/non-putrescible; strong/weak; fresh/stale; or septic. While considering the quality of water for the sake of man's health, water required for the said purpose is described as 'pure water', 'wholesome water' and 'potable' [5,7].

Methods and methodology:

Study area and sampling: Survey was conducted during the month of July and August 2012 of different parts of Jabalpur region .Location of Jabalpur in India coordinates 23.1667° N, 79.9333° E The city is surrounded by low, rocky, and barren hillocks. The main water reservoirs of Khan Dari and Pariyat are to the northeast. Water is also drawn from Narmada River by Public Health Department. Jabalpur has a humid subtropical climate, typical of North-Central (Madhya Pradesh and southern Uttar Pradesh) India The objective of sampling is to obtain a portion of material small enough in volume which can be transported easily and handled in the laboratory while still accurately representing the material being collected. The sampling program defines the portion of the whole to which test results apply. [5, 6] The variations of the whole material with respect to time, area, depth and occasionally, rate of flow must be taken into consideration to ensure representative nature of the samples. Sampling of water for chemical

differs to a great extent from the sampling for bacteriological analysis as grab sampling, composite sampling, integrated sampling [2,4] Samples of sludge and bottom deposits should be collected by means of a scoop sampler.

Physicochemical and Microbiological analysis: All the samples were analysed for the following physicochemical characteristic: ***(PH)*** the electrometric method requires a pH meter. In this method the pH meter is first calibrated against a solution of known pH and the test cell is then filled with the sample, ***(Turbidity)*** Turbidity range for the sample should be between 2.5 to>10 NTU (Nephelometric Turbidity Unit)[2,5,6]. It is measured by Turbidimetery and Nephlometery [2, 9, 10], ***Electrical Conductivity***(E.C.)µS the ability to carry electric current is due to presence of ions.it tells the concentration of total dissolved solids. [2, 5, 9, 10] reported in micromhos per centimeter (mhos/cms) i.e. (mS/m); 1mS/m = 10 mhos/cms, ***(Total Alkalinity NTU)*** It was determined by volumetric method titration with sulphuric acid [5, 10], ***Total Hardness*** (T.H.) mg/L it was determined by volumetric method with EDTA (Ethylenediaminetetraacetic acid) and Eriochrome black T as end point indicator. [2, 10] Acceptable concentration 200mg/L [5, 6], ***Chloride ions*** (mg/L) Chlorine is detected volumetrically by titrating with 0.0141N $AgNO_3$ solution [1, 2, 9] acceptable concentration 250mg/L. [2, 5, 6], ***Total Dissolved Solids(T.D.S.)*** mg/L.(TDS) present in the water sample is determined by evaporating the sample to dryness and weighing the residue left in the dish, it is essential to make the water totally free from suspended solids., ***Iron (mg/L)*** the Phenanthroline method is the standard procedure for the estimation of iron in water at the present time, except when phosphate or heavy metal interference exists [9], ***Fluoride Ions*** (mg/L) Excess concentration (more than 2mg/L) of F- ion causes Dental fluorosis (disfigurement of the teeth) and Sclerosis (harm to bony structures), ***Sulphate*** (mg/L) detected volumetrically with $BaCl_2$ titrating it with N/50 EDTA [1, 9], ***Nitrate*** (mg/L) The yellow colour produced by the reaction nitrated and phenoldisulphonic acid obeys Beer's law upto atleast 55mg/L NO_3^- at a wavelength of 410nm when a light path of 1cm is used [1, 2, 9] and ***Microbiological characteristics:*** Coliforms (MPN).The microbiological parameters analysed were total and faecal coliforms. Total and faecal coliforms were analysed by the Membrane Filter technique and also by Multiple Tube Dilution Method according to standard methods for the examination of water and wastewater [10]. Escherichia coli commonly found in the human or animal gut and which, if detected, may suggest the presence of sewage. The pad is saturated with the media (solution of peptone, lactose and sodium chloride) & excessive media is removed by tilting. All organisms which produce a dark colony with a metallic shin within 24 hours incubation are considered members of coliform group & are counted. The count is made by a low power stereo-microscope [4, 10, 12].

Result and discussion: A total of 10 samples were analysed in this period which was collected from various localities in Jabalpur and nearby regions. Of these 10 samples, GW2 and GW7 shows increased conductivity showing excessive dissolved soilds,GW1 has increased iron and is non-usable for domestic purpose , GW2, GW4, GW5, GW10 shows increased fluoride level which wasn't recommendable for drinking purpose. After treating it with doses of lime, alum and bleaching powder, its parameters dropped to acceptable concentration. Faecal coliform values were lower than the maximum permissible limit indicated in the Ecological Criteria of Water Quality (1000 colony forming unit (CFU)/100 ml of faecal coliforms) for sources of public supply. Some of parameters which vary significantly unit of parameters (mg/L):

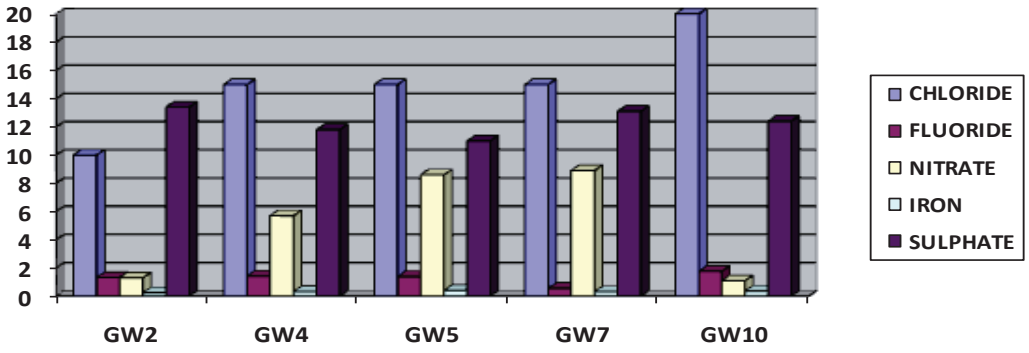

Fig: Graphical representation of some parameters.

Table 1: Microbiological & Physicochemical parameters for ground water samples in Jabalpur region

T.H. - Total hardness, T.D.S. – Total Dissolved Solids, GW- Ground Water, GP- Gram Panchayat, JBP- Jabalpur, PNG- Panagar

S. No.	Parameters	GW1 GP-JBP	GW2 GP-JBP	GW3 GP-JBP	GW4 GP-JBP	GW5 GP-JBP	GW6 GP-PNG	GW7 GP-PNG	GW8 GP-PNG	GW9 GP-JBP	GW10 GP-JBP
1.	pH	7.80	6.40	6.90	7.02	6.90	6.70	6.81	6.80	7.09	7.54
2.	Turbidity (NTU)	0.05	0.28	0.32	1.20	0.28	4.32	87	0.21	2.30	3.01
3.	Conductivity (µS)	590	747	120	88.4	751	580	997	550	101	116
4.	Total Alkalinity (NTU)	96	320	221	136	96	108	140	112	144	80
5.	T.H. (mg/L)	248	248	728	264	172	124	104	200	280	186
6.	T.D.S. (mg/L)	300	380	650	467	381	300	507	282	499	590
7.	Chloride (mg/L)	20	10	85	15	15	25	15	10	15	20
8.	Fluoride (mg/L)	1.20	1.33	1.25	1.43	1.40	0.96	0.56	0.50	1.31	1.77
9.	Sulphate (mg/L)	9.9	13.4	4.7	11.8	11	18.2	13.1	10.9	10.6	12.4
10.	Nitrate (mg/L)	31.7	1.3	5.7	5.7	8.6	6.6	8.9	7.1	1.9	1.1
11.	Iron (mg/L)	1.1	0.25	0.43	0.32	0.41	0.12	0.32	0.42	0.18	0.37
12	Coliform (MPN)	3	0	14	0	15	11	7	3	19	0

Conclusion: The differences found among samples were created by the direction of water flow (from the upper to the lower parts), which is determined by the geomorphologic features. Water quality standard vary significantly due to different environmental conditions, ecosystem. The Physicochemical parameter(pH, EC,TH,TDS, TA, Chloride, Fluoride, nitrate, sulphate, Iron) are found to be more than permissible limit in some areas The occurrence of total and faecal coliforms in some samples is an indication that contamination is beginning to reach the aquifer. For this reason, we recommended avoiding discharges of wastewater without treatment, mainly from septic tanks, which are extensively used in the area. Thus, simple techniques for treating water could save a huge number of lives each year.

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