ESTIMATION OF NITRATE, NITRITE, ARSENIC AND OTHER PHYSIC-CHEMICAL PROPERTIES OF WATER.

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ABSTRACT: Contamination of drinking water by nitrates, nitrites and arsenic is an evolving public health concern since nitrate can undergo endogenous reduction to nitrite and nitrosation of nitrites can form N-nitroso compounds which are potent carcinogens. Nitrites can lead among infants to the disease called methemoglobinemia (blue baby syndrome). There is a strong relationship between nitrate concentration and recurrent diarrhoea and also other illness. The objective of this study is investigation and determination of nitrate, nitrite, arsenic and other physic-chemical parameters of Bagalkot district. 46 samples of water were analysed for pH, total hardness, chloride, fluoride, iron, total alkalinity, nitrate, nitrite, arsenic and sulphates. It was found that water samples had within the permissible limits of WHO.

Key words: Nitrate, Nitrite, Arsenic, methemoglobinemia etc.

INTRODUCTION

As the whole human population needs drinking water for sustaining life the provision of a safe supply is a high priority issue for safeguarding the health and well being of humans. The production of adequate and safe drinking water is the most important factor contributing to a decrease in mortality and morbidity in developing countries. The World Health Organisation (WHO) reported that nearly half of the population in these countries suffers from health problems associated with lack of drinking water or the presence of microbiologically contaminated water [1]. Water is a very good solvent, hence it dissolves some toxic and hazardous substances producing water pollution problem posing many public parameters of interest for water quality assessment and nitrates out of them. An increase of nitrates in water is often associated with farming fertilizer, pesticide or poor sanitary activities [2-7]. The use of nitrate contaminated drinking water to prepare infant formula is a well known risk factor for infant methemoglobinemia. Affected infants develop a peculiar blue-grey skin colour and may become irritable or lethargic depending on the severity of their condition. The condition can progress rapidly to cause coma and death if it is not recognised and treated appropriately [8]. There is a positive association between nitrates in drinking water and n-Hodgkin lymphoma and colorectal cancer[9]. In 1986 WHO fixed the limit of the contents of nitrates and nitrites in drinking water, taking guidance from which Indian standards were developed. High nitrate may cause methemoglobinemia, gastric cancer and birth defects [10]. Other health effects on humans that are potentially influenced by elevated levels of nitrate in drinking water include tetragonic toxicity and hypertrophy of the thyroid [11]. Nitrate in high concentration has been observed in ground water of Churu of Rajasthan [12]. In an effort to prevent the disease ICMR has recommended the concentration of 2 mg/L nitrate in water to be used for infant feeding, while more than 100 mg/L was not recommended for human consumption. Moreover, the increased nitrate level in drinking water may adversely affect the central nervous system [13].Twenty three incidents of ground water arsenic contamination have been reported so far in different parts of the world. The largest population at risk is in Bangladesh [14]. Groundwater arsenic contamination and associated skin lesions have also been reported from Nepal [15], state of Bihar etc [16].

The research work is being persuaded to analyse ground water quality and to find out chemical and biochemical remediation of problematic ions. In this context the work published here provides insight into the problems faced by the people of Bagalkot district, Karnataka India.

MATERIAL AND METHODS

Groundwater samples collected from the bore wells, hand pumps, lakes of 46 sampling stations were analysed (Table.1). Samples were collected in clean Teflon bottles of 1 litre capacity. Highly pure chemicals and double distilled water was used for preparing solutions for analysis. Physical parameters like, pH, TDS were measured using digital meters immediately after sampling. The total hardness, alkalinity, nitrate, nitrite were analysed in the laboratory using standard methods [17]. The flow injection hydride generation atomic absorption spectrophotometer (FI-HG-AAS) method was used for arsenic analysis [18].

RESULT AND DISCUSSIONS

Table.1 presents an overview of groundwater parameters. In the studied localities were free from colour, odour, turbidity and bacteria. The PH values of groundwater were ranged from 5 to 8.5 and most of the water samples are acidic in nature. The lower value of pH may be due to the dilution of alkaline substances or atmospheric CO_2. The dust particles are rich in calcium carbonate/bicarbonate which are the major buffering agents for acidity generated by SO_4^{2-} and NO_3^- in Bagalkot district. It is the indicator of hydrology and aesthetic quality of water. During study, the hardness was ranged from 105 to 1680mg/L.

WHO recommended safe permissible limit for hardness i.e, 500mg/L. Water hardness in most ground water is naturally occurring from weathering of limestone, sedimentary rock and calcium bearing minerals. Hardness can also occur locally in groundwater from excessive application of lime to the soil in agricultural areas. Very hard water results in urinary concentrations, disease of kidney or bladder or stomach disorder. Chloride is the indicator of contamination with animal and human waste. The chloride contents varied from 0.1 to 1150mg/L indicates pollution status of water body. Increase in chloride concentration may be due to the entry of allochthonous material into catchment area. The rain contributes in increasing the chloride content in water has also been reported [19, 20]. Fluoride content ranges from 0.3 to 10.00mg/L. The study indicates that most of the water samples (about 23%) contain fluoride above 1mg/L, the highest desirable level set by WHO and ICMR. Studies in this area revealed that fluoride is more than the permissible limit i.e, 0.3 to 10mg/L as reported in our previous work [21,22]. Sulphate is the indicator of hydrology and solution of fertilizer into water.

During the study, sulphate ranged from 15 to 210mg/L. Iron content of water samples ranged from 0.1 to 0.3mg/L. The values of alkalinity ranged from 135 to 1250 mg/L. It provides guidance in applying doses ofchemicals in water and waste water processes particularly in coagulations, softening and operational control of anaerobic digestion. Nitrate and nitrites of water samples collected lie in the range from0.3 to 58 mg/L and 0.2 to 25 mg/L respectively. About 18% of samples collected have high values of nitrate and exceeds the permissible limit proposed by BIS and WHO (45mg/L). Due to its solubility and anionic form nitrate is very mobile can easily leach into the water table [23]. Nitrates and nitrites are indicators of remote and recent faecal pollution respectively. The results of investigations of Yang et al [24], showed that there is a significant positive association between drinking water nitrate exposure and gastric cancer mortality. According to Gupta et al [25], a review of literature indicated an association among high nitrate ingestion methamoglobinemia and pathologic changes in bronchi and lung parenchyma. Generally the nitrate contamination in our water samples reaches high levels as a result of agricultural run off, refuse, dump run off or contamination with human or animal waste [3, 25]. Significant positive relationship with rainfall amount was also important. Bagalkot district is faced with a serious problem of potable water supply. The arsenic and bacteria were not detected in the studied water samples. The sanitation is even worst in villages, which lack public water distribution system. There is a need to evaluate these waters and develop strategies to reduce and prevent their contamination

Table.1: Overview of Groundwater Parameters

Sr.no	pH	Total hardness	Cl	F	Fe	SO$_4$	Total alkalinity	NO$_3$	NO$_2$	As	B.T	T.B
1	6.5	210	Nil	0.5	Nil	50	650	50	0.2	Nil	black	Nil
2	5.0	390	Nil	2.5	Nil	150	700	5.0	0.2	Nil	Nil	Nil
3	6.8	450	125	1	Nil	150	1050	5.0	0.15	Nil	Nil	Nil
4	7.5	775	75	1.8	Nil	150	650	58	4.5	Nil	Nil	Nil
5	5.0	450	125	0.5	Nil	nil	750	0.5	0.2	Nil	Nil	Nil
6	7.5	420	0.2	0.5	0.3	150	nil	45	1.2	Nil	Nil	Nil
7	5.0	360	50	3.5	Nil	200	405	25	4.8	Nil	Nil	Nil
8	8.4	1080	Nil	Nil	Nil	I80	300	10	0.8	Nil	Nil	Nil
9	5.0	750	60	0.5	Nil	180	300	25	0.6	Nil	Nil	Nil
10	5.0	525	190	0.5	Nil	180	450	50	0.3	Nil	Nil	Nil
11	5.0	600	Nil	Nil	0.3	100	450	10	0.3	Nil	Nil	Nil
12	5.5	300	80	2.5	Nil	100	80	50	10	Nil	Nil	Nil
13	6.8	1110	250	10	Nil	150	950	10	0.5	Nil	Nil	Nil
14	5.0	525	330	Nil	0.3	150	180	10	0.5	Nil	Nil	Nil
15	6.5	1020	Nil	0.5	Nil	200	225	45	2.2	Nil	Nil	Nil
16	7.5	450	150	0.8	Nil	200	225	52	3.5	Nil	Nil	Nil
17	6	540	75	0.92	Nil	100	1050	35	5	Nil	Nil	Nil
18	7.3	600	75	0.5	Nil	50	750	54	2.8	Nil	Nil	Nil
19	5	1050	Nil	0.5	Nil	150	750	0.3	Nil	Nil	Nil	Nil
20	5.5	570	90	8.5	Nil	25	750	5	0.8	Nil	Nil	Nil
21	6.5	375	130	0.5	Nil	100	450	51	0.2	Nil	Nil	Nil
22	5.8	375	130	1.5	Nil	100	450	54	0.2	Nil	Nil	Nil
23	6.5	980	75	0.5	Nil	150	450	25	Nil	Nil	Nil	Nil
24	5.5	180	100	0.5	Nil	200	135	4.5	2.8	Nil	Nil	Nil
25	7.8	105	60	2.2	Nil	15	450	25	8.0	Nil	Nil	Nil
26	7.5	450	75	1.2	Nil	55	300	25	25	Nil	Nil	Nil
27	7.4	450	75	0.7	Nil	50	300	45	25	Nil	Nil	Nil
28	5.5	375	31	0.65	Nil	100	450	12	10	Nil	Nil	Nil
29	5.5	1680	40	0.5	0.3	200	300	5	1.0	Nil	Nil	Nil
30	5.8	1050	90	0.3	Nil	200	950	6.5	1.2	Nil	Nil	Nil
31	5.8	1050	900	0.3	Nil	50	150	10	0.5	Nil	Nil	Nil
32	8.5	1350	75	0.5	0.3	100	750	10	1.2	Nil	Nil	Nil
33	5.5	1200	52	0.6	100	Nil	675	15	0.5	Nil	Nil	Nil
34	8.5	1050	115	0.5	Nil	210	675	51	0.5	Nil	Nil	Nil
35	6.5	405	53	0.2	Nil	150	750	12	0.3	Nil	Nil	Nil
36	7.5	525	75	0.4	Nil	150	650	15	0.8	Nil	Nil	Nil
37	7.5	690	105	1.0	Nil	50	700	10	2	Nil	Nil	Nil
38	8.5	625	80	5	Nil	150	600	5	1.0	Nil	Nil	Nil
39	8.5	450	150	0.5	Nil	50	750	25	0.5	Nil	Nil	Nil
40	8.4	525	250	2.0	Nil	85	56	0.8	Nil	Nil	Nil	Nil
41	5.2	330	60	0.5	0.3	100	1250	35	2.5	Nil	Nil	Nil
42	8.3	390	20	4.5	0.1	200	300	35	10	Nil	Nil	Nil
43	8.0	645	0.1	0.5	Nil	150	300	35	8	Nil	Nil	Nil
44	6.5	325	75	2.5	0.22	100	450	25	2	Nil	Nil	Nil
45	6.5	525	70	0.5	Nil	50	450	45	1.5	Nil	Nil	Nil
46	7.5	300	50	0.5	Nil	150	150	10	0.8	Nil	Nil	Nil

WHO Standards:

B.T. Black colour 24hrs   Turbidity: 525

Note: P= Permissible Limit   E=Excessive Limit

	P	E
pH	7-8.5	6.5-9.2
Total hardness	300	600
Cl-	200	600
F-	—	1.5
Fe	0.3	1.0
Total alkalinity	200	-
NO2-	45	N
SO4-	200	400

CONCLUSION

The total hardness of ground water of Bagalkot district area fall in the hard category. Nitrate and nitrite in the study area indicates the sign of deterioration which calls for at least primary treatment of ground water before being used for drinking. The ground water quality improves with the increase in depth and distance of the bore well or lake from the pollution source.

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