Study of Seasonal Variation in Lake Water Quality of Byadagi Taluka

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Abstract- Groundwater is one of the major resources of the drinking water in Byadagi taluk (India.). In this study 11 sampling station were selected for the investigations on 11 chemical parameters. The work was carried out during different months of the premonsoon, monsoon and post-monsoon seasons in June 2009 to June 2010. pH values recorded were alkaline in nature. Correlation between EC, TDS, Total hardness and related results clearly indicated the degree of acceptance of results documented. Water samples were found to be rich with phosphorus. High sodium content was noticed in all the stations. Results of principal component analysis evinced that all the parameters equally and significantly contribute to groundwater quality variations. Significant variation of physico-chemical parameters of surface water were observed; various physico-chemical parameters for the water samples were within highest desirable limit (HDL) prescribed by WHO for drinking purposes for all seasons except for pH in summer, total alkalinity and Fe contents in spring, autumn and winter; total dissolved solids in winter, turbidity in all seasons.

Index Terms- Physico-chemical, Chemical parameters, Byadagi taluka and seasonal variations etc

I. INTRODUCTION

Good drinking water quality is essential for the well-being of all people which has affected the health and economic status of the populations. Groundwater is the major source of water for drinking, agricultural and industrial desires[1]. In this study, concentrations of chemical parameters such as pH, DO, BOD, COD, alkalinity, chloride, *o*-phosphate, nitrate, TDS, conductivity, TH, fluoride, ammonia and iron in groundwater samples were determined by using standard analytical methods[2]. Water is the principal need of life on earth, and is an essential component for all forms of lives, from micro-organism to man. The unplanned urbanization and industrialization [3] has resulted in over use of environment [4] in particular of water resource. A kind of crises situation has made getting clean water a serious problem. It is a known fact that when pure water is polluted its normal functioning and properties are affected. Ganges is a sacred river of India. The increased anthropogenic activities due to industrialization have contributed to decline in water quality of Ganges.

Groundwater is used for domestic and industrial water supply and irrigation all over the world. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization. Human health is threatened by most of the agricultural development activities particularly in relation to excessive application of fertilizers and unsanitary conditions. Rapid urbanization,especially in developing countries like India, has affected the availability and quality of groundwater due to its overexploitation and improper waste disposal, especially in urban areas. According to WHO organization, about 80% of all the diseases in human beings are caused by water. Once the groundwater is contaminated, its quality cannot be restored by stopping the pollutants from the source. It therefore becomes imperative to regularly monitor the quality of groundwater and to device ways and means to protect it. Water quality index is one of the most effective tools [5-8] to communicate information on the quality of water to the concerned citizens and policy makers. It, thus, becomes an important parameter for the assessment and management of groundwater. WQI is defined as a rating reflecting the composite influence of different water quality parameters. WQI is calculated from the point of view of the suitability of groundwater for human consumption. The objective of the present work is to discuss the suitability of groundwater for human consumption based on computed water quality index values.

Water is an indispensable natural resource on earth. All life including human being depends on water. We have enormous resource on the earth amounting to about 13, 481, 96000 Km3 of water. Due to its unique properties water is of multiple uses for living organisms. In India 77% of water is used in agricultural sector . Human being depends on water for almost every developmental activity. Water is used for drinking, irrigation, washing, and Industrial purposes. Although water is very abundant on this earth, yet it is very precious. Out of the total water reserves of the world, about 97% is salty water and only 3% is fresh water. Even this small fraction of fresh water is not available to us as most of it is locked up in polar ice caps and just 0.003% is readily available to us in the form of ground water and surface water. The fresh water resources now a day as consequences of population explosion coupled with industrialization, urbanization, and green revolution. In reservoirs, which are formed at the back of the relieved and accumulated structures on the running water, new organisms come into existence with the effects of different morphological structures. (Fair et al., 1971). In order to benefit from our reservoirs, lakes, ponds, dam lakes and rivers, we have to know the characteristics of these waters and the algae which are the first link of the food chain with regards to ecology and taxonomy. In comparison with natural lakes and marshes, reservoirs have the following features: (1) the water level varies irregularly, which physically destabilizes the lake shoreline, and

(2) the hydrogeological structure of dam lakes is complicated and could change easily because the water level is regulated artificially (Nakashima et al., 2007). In recent years, activities to preserve the water quality and ecosystem of reservoirs and lakes have been encouraged. For example, research on the classification of the water quality of reservoirs and lakes and the effects of its use on land have been carried out.

II. Study Area

Byadagi (Kannada: ಬ್ಯಾಡಗಿ) is a town in Haveri district in the state of Karnataka, India. Its around 18 km north west of the famous business center Ranebennur. The town is famous for the red Byadagi chilli. The surrounding areas of Byadagi produce chilli (red in color & long) which is dried in sunlight and sent to different markets. This spicy chilli is one of the common ingredients used in Udupi cuisine.Today the use of this chili is seen in abroad also.

Byadagi is located at 14.68°N 75.48°E. It has an average elevation of 601 metres (1971 feet). As of 2001 India census,[2] Byadagi had a population of 25,658. Males constitute 51% of the population and females 49%. Byadagi has an average literacy rate of 67%, higher than the national average of 59.5%; with male literacy of 74% and female literacy of 60%. 13% of the population is under 6 years of age.

III. Methodology

Groundwater samples were collected from 11 locations during pre-monsoon1,2 and post monsoon period. Each of the groundwater samples was analyzed for 11 parameters such as pH, electrical conductivity, TDS, total hardness, acidity, alkalinity, chloride, sodium. phosphorus, and potassium, using standard procedures recommended by APHA[9]. The water samples were collected from different sites in plastic bottles and transported to the laboratory in an icebox jars to avoid unpredictable changes in parameters of water samples and were compared with standard values recommended by World Health Organization[10], for drinking purposes.

IV. Results and Discussion

The values of various physic-chemical parameters in different seasons of Bydagi lake water are presented in Table.1,2 and 3 respectively. The pH of water is important because many biological activities can occur only within a narrow range. Thus, any variations beyond an acceptable range could be fatal to a particular organism.pH values recorded exhibited alkaline nature of subsurface water. Further the water was found to be more alkaline during Pre monsoon - 2 followed by Pre monsoon - 1 and Post monsoon season. Acidity and alkalinity values recorded were found to have good correlation with pH hence inferred that the results of analysis are acceptable. pH of waters varied from 8.09 to 8.80 and 8.14 to 8.86 during Pre monsoon - 1 and Pre monsoon - 2 respectively. On the other hand the pH ranging from 7.16 to 7.95 was observed during Post monsoon season. In 2002 and 2003, Zafer and Sultana 2007 reported pH range of 7.6 and 7.55 respectively for monsoon season[11].

Again the correlation between EC, TDS, Total hardness and related salts clearly indicated the degree of acceptance of results documented. The highest TDS concentration of 645 mg / l during Pre monsoon – 2 was recorded in sample collected at Mattur village, Correspondingly TDS of this sample during Pre monsoon - 1 and Post monsoon was respectively 641 mg / l and 566 mg / l . The water sample collected from subsurface water source at Kerudi village exhibited lowest concentration of TDS, the values being 393 mg / l (Pre monsoon -1), 343 mg / l (Post monsoon) and 395 mg / l (Pre monsoon -2). The highest and lowest concentrations of total hardness during Pre monsoon - 2 at Mattur and Kerudi villages were respectively 335 mg / l and 210 mg / l.

Hardness is an important parameter in decreasing the toxic effect of poisonous element. The total hardness is relatively high in some samples due to the presence of calcium, magnesium and chloride and sulphate ion. The hardness is greater than permissible limit(300 mg/l) in premonsoon-1 and 2 respectively. 1nTotal hardness in premonsoon-1, postmonsoon and premonsoon-2 ranged from 209 to 333mg/l,182 to 294mg/l and 210 to 335 mg/l respectively. Total hardness was recorded comparatively highest in premonsoon and lowest in postmonsoon is reported.[12]. Hardness more than permissible limit leads to heart diseases and kidney stone formation[13].Acidity was detected in monsoon seasons in three locations only(20,31 and 42mg/l), while in post monsoon acidity varied from 128mg/l to 222mg/l.

Nitrogen percolates easily into the groundwater through the soil along with rainwater recharge or irrigation water. As a result, the shallow aquifers are more likely than deeper ones to initially suffer from contamination problems [14–15].Within practical limitations of analysis the nitrogen content in subsurface waters during all the seasons considered for study was found to be same and it ranged from 10 mg / l to 18 mg / l.

Sulphur dioxide (SO2) and oxides of nitrogen and ozone to some extent are the primary causes of acid rain. These pollutants originate from human activities such as combustion of burnable waste, fossil fuels in thermal power plants and automobiles. These constituents interact with reactants present in the atmosphere and result into acid deposition. The natural sources of sulphur pollutants are oceans and to much smaller extent from volcanic eruptions. The man-made sources of SO2 emissions are the burning of coal and petroleum and various industrial processes (Cullis and Hischler, 1980)[16].

Alkalinity of water samples ranged from 198 to317, 182 to 222 and 200 to 319 mg/l in premonsoo-1, postmonsoon and premonsoon-2 respectively. The mild alkalinity may be due to more seepage of effluent, domestic sewage etc.

Phosphorous concentration ranging from 24 mg / l to 37 mg / l (Pre monsoon - 1), 21 to 33 mg / l (Post monsoon) and 25 to 40 mg / l (Pre monsoon - 2) were observed. Most critical single element in maintaining aquatic productivity is phosphorus, throughout is one of the most limiting factors of production in Indian reservoirs[17].

Maximum potassium concentration of 7.0 mg / l was observed at station SSB4 followed by SSB7 (6.2 mg / l) , followed by SSB3 (4.1 mg / l) , followed by SSB6 (3.9 mg / l),

followed by SSB2 (3.0 mg / l), followed by SSB8 (2.5 mg / l) ,followed by SSB5 (2.1 mg / l) , followed by SSB1 (1.3 mg / l), followed by SSB10 (1.1 mg / l) than by SSB9 (0.8 mg / l) These values corresponds to Pre monsoon - 2. accordingly the concentrations in samples during Pre monsoon - 1 were respectively 6.8 mg / l , 6.0 mg / l , 4.0 mg / l ,3.8 mg / l , 3.3 mg / l, 2.9 mg / l , 2.4 mg / l, 2.0 mg / l, 1.7 mg / l, 1.3 mg / l and 0.8 mg / l . On the other hand potassium concentration ranged from 0.7 mg / l to 6.0 mg / l during Post monsoon. Thus, the excess amount of potassium present in the water sample may lead nervous and digestive disorder [18]. Very high sodium content in the water samples at all the three stations was noticed. Again higher sodium content in water sample during Pre monsoon - 2 followed by Pre monsoon - 1 and Post monsoon were recorded. The ranges were respectively 23.1 mg / l to 173.6 mg / l , 22.0 mg / l to 165.0 mg / l and 18.5 mg / l to 103.3 mg / l . Sodium and potassium if compression to chloride is high because of the present of salt in groundwater. The chloride and fluoride are correlated with each other.

Chlorides concentration ranging from 79 mg / l to 135 mg / l (Pre monsoon - 1), 69 mg / l to 119 mg / l (Post monsoon) and 81 mg / l to 136 mg / l (Pre monsoon - 2) were observed, indicating non-pollution status of water body. These values exceeded the permissible limit proposed by WHO. It is the indicator of contamination with animal and human waste. The high concentration of chloride gives an undesirable taste to water and beverages. Taste thresholds for the chloride anion depends on the associated cation and are in the range of 200–300 mg/l for sodium, potassium, and calcium chlorides [19]. No health-based guideline value is proposed for chloride in drinking water. However, chloride concentrations in excess of about 250mg/l can give rise to detectable taste in water [19].

V. Conclusion

Analysis of Byadagi taluka lakes water in three seasons revealed that, some lake water samples are not suitable for purposes like irrigation and potable purposes.

Acknowledgements

The authors are thankful to management and staff members of S.T.J. Institute of Technology, Ranebennur, for encouragement and facilities.

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Table: 1 Variations in Characteristics of Lake water Samples in Byadgi Taluk in Pre monsoon - 1

Variations in Quality of Lake water with respect to seasons (Season : Pre Monsoon - 1) Taluk : Byadgi													
Station Code	Village	Monsoon Season	Concentrations of Parameters Stated										
			PH	EC µs	TDS mg/l	Total Hardness mg/l	Acidity mg/l	Alkalinity mg/l	Nitrogen mg/l	Phosphorous mg/l	Sodium mg/l	Potassium mg/l	Chlorides mg/l
LB1	Agasanahalli	Pre - 1	10.10	823	532	278	0	265	15	25	38.0	6.0	108
LB2	Anur	Pre - 1	8.11	819	534	284	38	199	15	25	35.0	7.2	112
LB3	Attikatti	Pre - 1	8.56	868	563	296	0	281	17	27	52.4	7.8	114
LB4	Budapanalli	Pre - 1	9.48	876	570	296	0	282	17	27	46.0	15.2	115
LB5	Chikkabasur	Pre - 1	9.20	935	601	320	0	304	17	28	53.0	8.3	126
LB6	Chikkanajji	Pre - 1	8.44	1,069	692	368	0	350	19	33	73.0	2.5	140
LB7	Galapuji	Pre - 1	8.35	647	422	219	0	208	12	20	44.0	6.3	89
LB8	Kaginehalli	Pre - 1	8.69	879	570	300	0	285	17	27	27.1	5.8	115
LB9	Kerudi	Pre - 1	9.07	648	419	223	0	212	12	20	49.3	16.3	85
LB10	Kummur	Pre - 1	9.48	630	403	214	0	203	11	19	34.5	8.3	85
LB11	Mattur	Pre - 1	8.78	1,245	810	421	0	400	23	38	80.5	51.0	164

Table : 2 Variations in Characteristics of Lake water Samples in Byadgi Taluk in Post monsoon

Variations in Quality of Lake water with respect to seasons (Season : Post Monsoon) Taluk : Byadgi													
Station Code	Village	Monsoon Season	Concentrations of Parameters Stated										
			PH	EC µs	TDS mg/l	Total Hardness mg/l	Acidity mg/l	Alkalinity mg/l	Nitrogen mg/l	Phosphorous mg/l	Sodium mg/l	Potassium mg/l	Chlorides mg/l
LB1	Agasanahalli	Post	8.50	732	474	248	0	235	14	22	45.0	8.7	96
LB2	Anur	Post	7.26	735	479	255	209	178	13	23	71.0	10.7	101
LB3	Attikatti	Post	8.48	768	500	260	0	247	14	24	134.5	48.5	101
LB4	Budapanalli	Post	7.66	782	508	267	128	187	15	24	86.0	15.9	103
LB5	Chikkabasur	Post	8.23	828	532	283	14	269	15	25	89.3	17.0	112
LB6	Chikkanajji	Post	7.55	884	572	304	150	213	15	27	95.0	16.0	116
LB7	Galapuji	Post	7.47	612	399	207	166	145	11	19	122.0	14.8	84
LB8	Kaginehalli	Post	7.77	802	520	273	105	191	15	25	82.3	14.2	105
LB9	Kerudi	Post	8.11	615	398	212	37	148	11	19	87.5	21.0	80
LB10	Kummur	Post	8.48	601	384	204	0	194	10	18	62.0	13.0	81
LB11	Mattur	Post	7.86	986	642	334	89	234	18	30	95.0	19.7	130

Table : 3 Variations in Characteristics of Lake water Samples in Byadgi Taluk in Pre monsoon - 2

Variations in Quality of Lake water with respect to seasons (Season : Pre Monsoon - 2) Taluk : Byadgi													
Station Code	Village	Monsoon Season	Concentrations of Parameters Stated										
			PH	EC µs	TDS mg/l	Total Hardness mg/l	Acidity mg/l	Alkalinity mg/l	Nitrogen mg/l	Phosphorous mg/l	Sodium mg/l	Potassium mg/l	Chlorides mg/l
LB1	Agasanahalli	Pre - 2	9.56	970	628	328	0	312	18	30	45.2	6.9	127
LB2	Anur	Pre - 2	7.68	965	629	335	124	234	18	30	41.9	8.3	132
LB3	Attikatti	Pre - 2	8.98	1,033	672	349	0	332	19	32	56.0	17.7	136
LB4	Budapanalli	Pre - 2	8.10	1,023	664	349	39	244	20	31	63.2	9.1	134
LB5	Chikkabasur	Pre - 2	8.71	1,090	701	373	0	354	20	33	65.4	9.5	147
LB6	Chikkanajji	Pre - 2	7.99	1,124	727	387	62	271	20	35	87.8	3.2	147
LB7	Galapuji	Pre - 2	7.91	763	497	258	79	181	14	24	55.1	7.5	105
LB8	Kaginehalli	Pre - 2	8.23	1,036	672	353	14	336	19	32	34.5	7.0	136
LB9	Kerudi	Pre - 2	8.59	764	494	263	0	250	14	24	61.2	18.7	100
LB10	Kummur	Pre - 2	8.98	743	474	252	0	240	13	22	43.0	10.1	100
LB11	Mattur	Pre - 2	8.31	1,404	914	475	0	451	26	43	98.2	62.3	185