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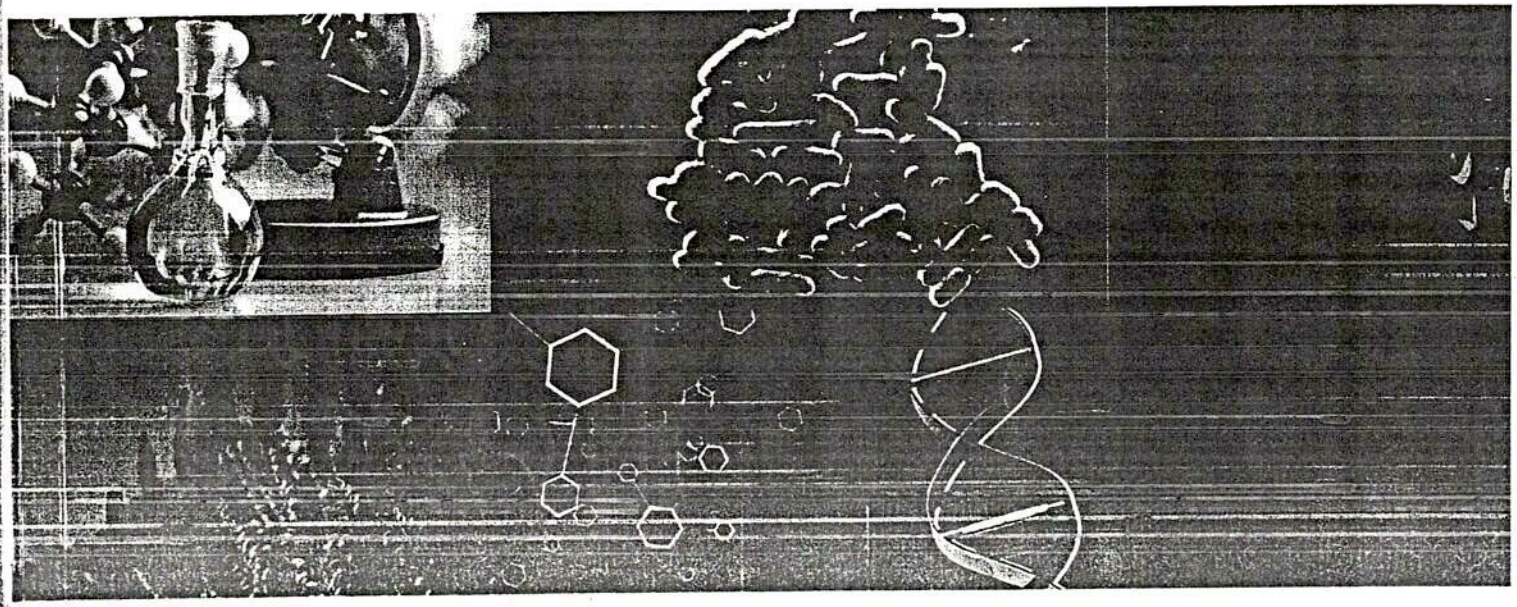

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GROUND WATER PROFILE IN KHANAPUR TEHSIL OF SANGLI DISTRICT, (M.S.) (India)

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ABSTRACT :

The study of physicochemical investigation of Ground water quality in khanapur tehsil was done. The twelve Ground water samples used for drinking and domestic purpose from different fields of khanapur tehsil were collected. Each of which was representative of five to six sub samples collected from neighbourng five to six village corners of the site and one from the approximate center. The laboratory test of the samples were performed for various parameters such as turbidity, total alkalinity, total solids, temperature, suspended solids, pH, odour, total Hardness (TH), electrical conductivity, total dissolved solids(TDS),dissolved oxygen (DO), colour, COD, and BOD, chloride, phosphates, calcium, fluorides, iron, magnesium, nitrates, nitrites, potassium, silicates, sodium, and sulphates. The standard methods recommended by APHA, WHO are employed for the analysis. The obtained values are compared with the standard limits. The results showed that the physico-chemical parameters are within the maximum permissible limit of WHO with some slight variations in some parameters except TDS which are above the permissible limit. Hence, Ground water is safe at border line and to make it suitable for drinking, domestic and irrigation purposes. The amount of TDS must be brought within permissible limit by using modern techniques for its purification. Direct consumption of untreated Ground water is potentially hazardous, and risk increases as drainage discharge increases which also causes changes in the physiological and structural aspects of the users.

Key words : Total Alkalinity, Total Dissolved Solids (TDS), Fluorides, Ground water, Turbidity.

INTRODUCTION :

Quality of groundwater is equally important to its quantity owing to the suitability of water for various purposes. Water quality analysis is an important issue in groundwater studies. Variation of groundwater quality in an area is a function of Physical and chemical parameter which are greatly influenced by geological formations and anthropogenic activities. Among the various sources of water, groundwater is said to be the safest water for drinking and domestic purpose.A tube well is a type of water well in which a long 100-200 mm (4 to 8 inches) wide stainless steel tube or pipe is bored into an underground aquifer. The lower end is fitted with a strainer and a pump at the top lifts water for irrigation on the depth of water table. A small reservoir of water is made at the outlet of the tube well. This reservoir is used for different usage of water by the local population.

Groundwater is our most valuable natural resource from the ground. It is essential to all basic human needs, including food, drinking water, sanitation, health, energy and shelter. Its proper management is the most pressing challenge to all of us. Without water, we have no society no economy, no culture, and no life although water is a global issue. The problems and solutions are often highly localized. Our natural environment supplies clean drinking water. Biodiversity supplements the ability of the environment to do this. The convention on biological diversity promotes the restoration and maintenance of biologically diverse ecosystems as a way of improving access to clean drinking water and as a means to eradicate poverty by using the services that healthy water sheds and fresh water ecosystems provide naturally. Human needs and environmental needs are often uneven against each other in a false dichotomy protecting the interests of one side often harms the interests of the other. But in the case of drinking water human and environmental interests are clearly aligned. Holistic water management is essential if the world is to achieve sustainable development. The provision of potable Water to the rural and urban population is necessary to prevent health hazards. Ground water is ultimate and most suitable fresh water resource for human consumption in both urban as well as rural areas. There are several states in India where more than

90% population is dependent on Ground water for drinking, domestic, irrigation and other purposes[12]. Ground water is also frequently used as the alternative source for agricultural and industrial sector. However there are various ways as ground water is contaminated such as by excess use of fertilizer in farming[2], sewage from effluent bearing water bodies[1]. Most of the industries discharge their effluent without proper treatment into nearby open pits or pass them through unlined channels, resulting in the contamination of ground Water[6]. The incidence of tube well water pollution is highest in urban areas where large volumes of waste are concentrated and discharged into relatively small areas[14]. The hydro-geochemical conditions are also responsible for causing significant variations in ground water quality[8]. The paper makes an attempt to carry out qualitative analysis of some major physico-chemical parameters of ground water in the study area.

STUDY AREA :

Khanapur is a tehsil place and is located in rural and hilly area of Sangli district in Maharashtra. It is rapidly growing city on account of trade, industrial and agricultural practices located at 17.2642404' N. latitude and 74.7082145 E longitudes consisting of 64 villages. The majority of population lives in rural area and most of the peoples in these villages are economically dependent on agricultural practices. The majority of the farmer cultivates various crops according to the economical point of view by using excess various chemical fertilizers and organo pesticides in their field which affects agricultural profile and also ground water profile, which is very harmful to the proper vegetation of the crops under cultivation and quality of ground water used for drinking and domestic purpose. Most of the peoples are illiterate with potable water science. Peoples from in and around khanapur tehsil are no exception to this. The map of khanapur tehsil is presented by Fig.1.

MATERIALS AND METHODS:

Sample Collection : The sampling locations consist of urban as well rural area. The twelve ground water representative samples used for drinking purpose from different villages of khanapur tehsil were collected in the afternoon hours between 12.00 to 2.30 pm, in polythene bottle in the month of February 2015. Each of which was representative of five/six sub samples collected from neighboring four/five village corners of the site and one from the approximate centre of the group. Polythene containers of two liter capacity which were pre-treated with dilute nitric acid, dried and rinsed three times with the sample water which was used for collecting water samples. The temperature of water sample was recorded on the spot by using $1/10^{th}$ mercury thermometer. The samples were taken to the laboratory and preserved in the refrigerator. To identify and locate the samples easily, all samples carried self-adhesive labels. These were affixed on the sample bottles instead of the cover to prevent loss or misplacing causing sample mix-up. The information on the sample label includes location, date, time and temperature. The physico-chemical analysis was done as per the standard methods[3, 21]. Samples were collected in plastic container to avoid unpredictable changes in characteristic as per standard procedure[3].

RESULT AND DISCUSSION :

The sample coding for sixty four villages in khanapur tehsil of Sangli district are given in Table.1. Data of physico-chemical characteristics of the water samples collected from twelve representative villages among the sixty four villages are as shown in Table. 2.

Physical Properties : The physico-chemical investigation of Ground water from Krishna river in Khanapur tehsil of sangli district is done which was found to be within the standard values prescribed by WHO [21].

1. BOD: Biological oxygen demand is an important parameter to assess the pollution of water where the contamination occurs due to disposal of domestic and industrial effluents. The low and high values for BOD were 6.5 mg/L and 9.3 mg/L in Samples A and H respectively.

2. COD : Chemical oxygen demand estimates the carbonaceous fraction of organic matter. Values for COD were 77.58 mg/L and 114.58 mg /L respectively for the sample E and I.

3. Color : When pollutants like sewage, drainage, industrial waste mixed with the ground water It reveals the color of pollutants which is the indicative of degree of the pollution caused by human material, drainage, plant weeds, metallic substances and protozoa's. The samples in the study during investigation were found predominantly colorless.

4. Dissolved Oxygen : Dissolved oxygen is is susceptible to environmental changes ranged from 3.8 mg/L for the sample A and highest 6.8 mg/L to the sample H.

5. Electrical Conductivity : There are several factors that determine the degree to which tube well water will carry an electrical current. This includes the concentration, mobility of ions, oxidation state and temperature of the tube well water. It was observed that samples G had 651 and the samples C had 783 umho/cms which were below the permissible limit.

6. Total hardness : The presence of multivalent metal ions (calcium and magnesium) which comes from the minerals dissolved in the water is known to cause hardness in water bodies. Hardness of water is dependent upon the ability of these ions to react with soap to form a precipitate or soap scum. The reaction of iron and manganese in fresh water may contribute to the hardness of such water. The highest total hardness for the sampleH was 28.67 mg/L and the lowest for the sample G was 22.16 mg/L in the overall sampling places.

7. Odour : There was essentially no particular odour of specific nature was recorded

8. pH : It indicates the acidity or alkalinity of a substance from 1.0 to 14. Acidity increases as the pH gets lower. Aquatic organism differs as the range of pH in which they live. pH of most of the samples was mild alkaline to a high recording of 8.6 for the sample I and lowest 7.4 for the samples H with corresponding high alkalinity of 169.07and 116.73 mg/L respectively. Low pH value may be due to incoming Water[12]. Hence, the alkaline pH of the most of the samples is explained by the fact that inadequate rain in the region, bringing in no enough water for dilution of alkaline substances resulting in keeping the pH on its higher level possible. However, in tube well water p^H usually ranges from 6.5 to 8.5 and it is bio-tolerable. The pH of most of the samples of the study carried is within the permissible range recommended[21] by WHO (2003).

9. Suspended Solids : Suspended minerals are a measure of the amount of sediment moving in water. Solids present within water bodies are highly dependent on the flow of water which usually increases during and immediately after rain events. As the sediment settles out of the water it gradually becomes clear, but in most cases, the aquatic habitats are often destroyed. It was observed that sample G are known to have this suspended solid inside them with the highest value of 100 mg/L while sample E having the lowest value of 96.7 mg/L. All the values were observed to be at border line but within the permissible limit.

10. Temperature : Temperature is one of the important environmental parameter in fresh water eco-system which affects the ability of water to hold oxygen, the rate of photosynthesis by aquatic plants and the metabolic rate of aquatic organisms. Cause of temperature includes Weather removal of shading stream, bank vegetation, impoundment, discharge of water into to the stream. The variation of trend in temperature noted in the present study, and it was found to be minimum for sample A (25.7oC) and maximum for sample B (28.2oC) which commensurate with the desired limit.[19]

11. Total Dissolved Solids : Total dissolved solids is an important parameter to ascertain the vulnerability of salt content in dissolved state. Total dissolved solids ranges from 438.40to 541.26 mg/L. which shows most of the samples are at the border line of the permissible limit.

12. Total Alkalinity : Alkalinity of natural water is generally due to presence of bicarbonates formed in reactions in the soil through which the water percolates and sometimes may also be due to carbonates and hydroxides. It is a measure of the capacity of the water to neutralize acids and it reflects so- called

buffer capacity. Correspondingly, the highest alkalinity was 169.07 mg/L observed for the sample I However, the lowest alkalinity noted was 116.73 mg/L for the sample H.

13. Turbity : Turbidity is described as the measure of amount of particulate matter suspended in Water. When ground water appears to be cloudy or opaque in nature is said to be highly turbid which can cause increased water temperature because suspended particles absorb more heat and also reduce the amount of light penetrating the Water. The samples L had lowest turbidity value of 16.8 NTU and a highest of 22.8 NTU for the sampleC. The values of the suspended solids ranged from 96.7 mg/L to 100 mg/L for the sample E andG respectively. The dissolved solids varied from 438.40mg/L for the sample F and 541.26 mg/L for the sample K. The water found turbid or muddy in color is due to varieties of materials which are being discharged by domestic and industrial use[11] Suspended matter, in general reduces the diversity of life in aquatic systems. Total solids were recorded 533.55 mg/L as maximum in sample G and minimum 474.28 mg/L in sample D. The observations are in agreement with similar one made by Shastri[16] and Gupta[4] et.al.

14. Chemical Nutrients : Presence of nutrients and oxygen in tube well water is essential for the sustained proliferation of organisms. However, nutrient enrichment leads to undesirable change in the structure and function of ecosystems[17]. Nutrients stimulate growth of aquatic plants which in turn decay and consume oxygen and emanate hydrogen sulphide. This accumulation exerts high biological demand on the ecosystem. In addition with accumulation of nutrients the organic biomass increases leading to pollution[7]. The quantity of nutrients present in the water samples varies. Calcium forms the most abundant cation in fresh tube well water. It contributes hardness to water. It has been a basic parameter for detecting pollution of tube well water by sewage plant before development of bacteriological produces cathartic effect in human beings[18].

Calcium ranged from a low value of 19.6 mg/L in sample G to a high value of 27.6 mg/L in sample C. Chloride ranged from 54.9 mg/L to 58.9 mg/L in sample L and sample I respectively. The level of fluoride did not unduly vary and the lowest was recorded as 0.38 mg/L in sample A and the highest in sample L with a value of 0.94 mg/L. Iron was high in sample C with a value of 2.1 mg/L, while low with 0.8 mg/L in sample H. Magnesium had high value in sample D with 3.5mg/L and 3.0 mg/L as low value in sample H. The values of nitrates varied only slightly and were high in sample B,D&H with a value of 9.7 mg/L and low in sample C as 8.8 mg/L. Phosphate was high in sample F with a value of 1.7 mg/L, while it was 1.0 mg/L in sample K as lowest. Potassium was 1.8mg/L and 0.8 mg;/L as high and low in sample A and sample C. Silicate varied from 16.0 mg/L in sample A and 20.1 mg/L in sample B . Sodium was high in sampleH with a value of 4.0 mg/L, and low in sample D with a value of 2.8 mg/L. Sulphate ranged from 8.7 mg/L to 10.2 mg/L in sample F and L respectively. Most of the fresh water derives their sodium, potassium, calcium, chloride, sulphate and other nutrients from soils and rocks. Phosphate is considered amongst the primary limiting nutrients in ponds and lakes[15]. Phosphate was generally low with a peak in summer season. The higher concentration of it could be from the run-off from the agricultural fields[9]. The main source of the formation of nitrate is the decomposition and biodegradation of organic matters. High nitrates would indicate high pollution load. Intrusion of sewage into the natural tube well water increases levels of nitrate. Nitrate level in the sample is below permissible limits making them suitable for humans and live stock consumption[11].

CONCLUSION :

Among the twelve sampling places of villages in kadegaon tehsil, all the samples for most of the parameters were found to have their values within the standard values prescribed by WHO and NAFDAC except total dissolved solids are found at extreme border line which needs to be reduced by using modern technique.

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Figure. 1. Map of Khanapur Tehsil of Sangli District in Maharashtra (India)

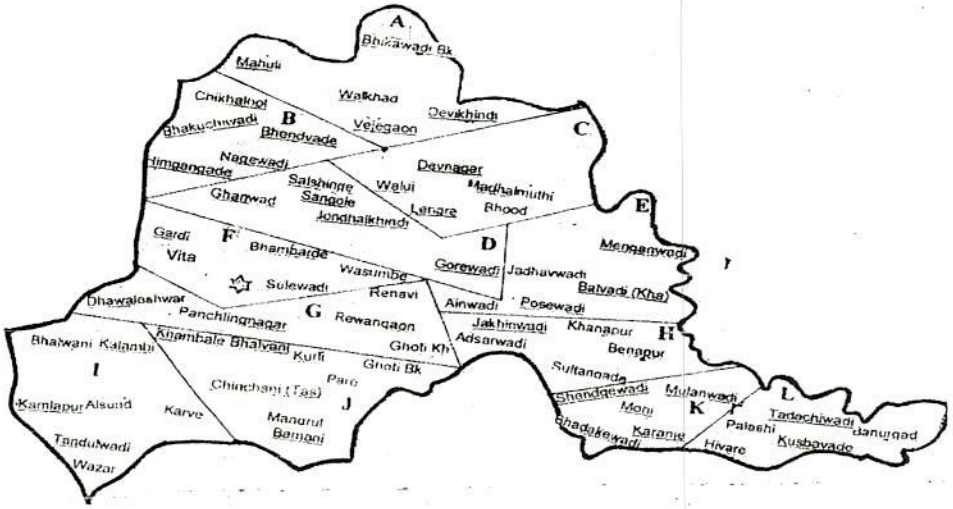

TABLE : 1 the sample coding for cluster of five neighboring villages under study area in Khanapur tehsil of Sangli district.

Sr.	Sampling PlaceCluster of Villages	Sample Code	Sr.	Sampling Place Cluster of Villages	Sample Code	Sr.	Sampling Place Cluster of Villages	Sample Code
1	Bhikawadi Bk		21	Menganwadi		41	Bhalwani	
2	Mahuli		22	Jadhavwadi		42	Kalambi	
3	walkhad	A	23	Balvadi(kha)	E	43	Kamlapur	I
4	vejegaon		24	Ainwadi		44	Aisund	
5	Devikhindi		25	Posewadi		45	Karve	
						46	Tandulwadi,	
						47	Wazar	
6	Chikhalhol		26	Gardi		48	Khambale(bh)	
7	Bhakuchiwadi		27	Bhambarde		49	Kurli	
8	Bhendvade	B	28	Wasumbe	F	50	Ghoti (Bk)	J
9	Nagewadi		29	Sulewadi		51	Pare	
10	Hingangade		30	Vita		52	Chinchani(Tas)	
						53	Mangrul	
						54	Bamani	
11	Devengar		31	Dhawaleshwar		55	Shendgewadi	
12	waluj		32	Panchilnagar		56	Mulanwadi	
13	Madhalmuthi	C	33	Renavi	G	57	Mohi	K
14	Lengre		34	Rewangaon		58	Bhadakwadi	
15	Bhood		35	Ghoti (kh)		59	Karanje	
16	Salshinge		36	Adsarwadi		60	Tadachiwadi	
17	Sangole		37	Jakhinwadi		61	Palashi	
18	Ghanwade	D	38	Khanapur	H	62	Banurgad	L
19	Jondhalkhindi		39	Benapur		63	Hivare	
20	Gorewadi		40	Sultangade		64	Kusbavade	

TABLE : 2. Physico-Chemical parameters and the Nutrients of the Samples A to L

Sr	Parameters	The Sample Codes of the villages at the bank of Krishna River in Kadegaon Tahasil											
A	(mg/L)	A	B	C	D	E	F	G	H	I	J	K	L
1	BOD	6.5	6.7	7	6.6	7.1	9	8.5	9.3	8	8.2	6.3	8.1
2	COD	112.78	102.74	89.18	83.68	77.58	108.58	113.52	99.78	114.58	97.9	99.17	87.04
3	Color	clear	clear	clear	clear	clear	clear	clear	clear	clear	clear	clear	Clear
4	DO	3.8	4	5	5.3	4.3	5.8	6.5	6.8	6.3	5.2	6.7	6.1
5	Dissolved solids	499.74	448.34	503.34	438.99	456.43	438.4	529.51	537.37	528.18	509	541.26	517 34
6	Ele. Con.	692	672	783	653	710	670	651	763	676	777	657	780
7	Total Hardness	22.63	23.54	23.12	35.06	23.19	24.25	22.16	28.67	27.25	28.34	25.64	26.63
8	Odour	No	No	No	No	No	No	No	No	No	No	No	No
9	P^H	8.2	8.1	8.3	8.4	8.7	8.4	8	7.4	8.6	7.9	7.8	8.2
10	Suspended	99.5	98.2	98.8	99.2	96.7	97.7	100	97.2	98.6	96.8	99.8	99.3
11	Temp o^0C	25.7	28.2	27.9	27	25.9	26.1	26.5	26.9	26.6	26	26.2	26.3
12	Total Solids	519.39	476.32	539.77	474.28	500.35	523.82	533.55	532.41	565.13	526.12	525.38	513 99
13	Total Alkalinity	1698.63	163.72	161.29	165.82	168.72	157.12	120.75	116.73	159.07	161.12	116.73	167
14	Turbidity(NTU)	21.3	19.8	22.8	23.7	22.3	20.7	20.3	19	17.7	17.3	22.8	16.8
B	**Nutrients (mg/L)**												
15	Calcium	20.1	21	27.6	28.5	22.7	24	19.6	26.6	25.9	24.7	27.4	21.5
16	Chlorides	57.7	56.2	58.1	55.4	56.8	58.3	55.6	57.1	58.9	56.8	57.1	54.9
17	Fluorides	0.38	0.69	0.51	0.83	0.47	0.81	0.65	0.62	0.57	0.83	0.74	0.94
18	Iron	1.1	1.4	2.1	1.6	1.8	2.2	1	0.8	2	0.9	1.8	1.2
19	Magnesium	3.1	3.3	2.6	3.5	3.1	2.8	2.3	3	3.3	3	2.4	3.4
20	Nitrate	9.4	9.7	8.8	9.7	9.2	9.1	9.3	9.7	9.4	9.1	9.6	8.6
21	Nitrite	0.9	0.7	0.9	0.8	0.6	0.7	0.8	0.6	0.9	0.8	0.6	0.7
22	Phosphates	1.5	1.8	1.6	1.4	1.1	1.7	1.6	1.3	1.1	1.6	1	1.5
23	Potassium	1.8	1.6	0.8	1.1	1.7	1	1.5	0.9	1.7	1.1	0.8	1.2
24	Silicates	16	20.1	17.9	19	16.8	19.6	18.5	17.6	16.2	20	15.9	18.1
25	Sodium	3.6	3.8	3.3	2.8	3.9	3.1	3.7	4	3.5	3.1	3.4	4
26	Sulphates	9.4	9.8	10.1	9.3	9.7	8.7	9.5	9.2	10	9.9	9.1	10.2