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ASSESSMENTS OF PHYSICO CHEMICAL PARAMETERS OF GROUNDWATER SOURCES FOR DIFFERENT TAHSILOF NANDED DISTRICT, MAHARASHTRA (INDIA)

Mr. Shivraj Pandhare
Research Student

Dr. Pankaj Gupta
Dept. of Chemistry
SunRise University,
Alwar (RJ)

Abstract: Water is an essential natural resource for sustaining life and environment but over the last few decades the water quality is deteriorating due to its over exploitation. Water quality is essential parameter to be studied when the overall focus is sustainable development keeping mankind at focal point. Groundwater is the major source of drinking water in rural as well as in urban areas and over 94% of the drinking water demand is met by groundwater. The groundwater is determined of five tehsil of Nanded district of Maharashtra, where samples are under studied for Physico-chemical status of groundwater. In Physico-chemical analysis, the water quality parameters are measured like pH, temperature (T) turbidity (TUB), electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), content of calcium (Ca+2), magnesium (Mg+2), sodium (Na+), potassium (K+), chloride (Cl-), sulphate (SO4-2), total alkalinity (TA), dissolve oxygen (DO). Physico-chemical studies of eighteen groundwater samples from different tehsils of Nanded district was carried out and outcome of the results were discussed.

Key Words: *Physico-chemical analysis; ground water; Nanded district; TDS; TH.*

Introduction:

Water is formed by the union of two hydrogen atoms with one oxygen atom in an asymmetry covalent bonding (Freeze & Cherry, 1979) that gives rise to an unbalanced electrical charge and imparts a polar characteristic to the molecule. Water is essential for the existence of all life forms and it is vital for agriculture, industry, fishery and tourism etc. Increasing population, urbanisation and industrialization has led to the decreased availability of water. The distribution water in terms of quality and quantity varies from place to place and from one geological formation to another (Fetter, 1994). Freeze & Cherry (1979) noted that there are at least three factors on which groundwater occurrence depend are hydraulic properties of the geological formations, geological framework and climate. The occurrence, distribution, movement and composition of ground waters are intricately linked to the structure

and nature of the geological formations (Freeze & Cherry, 1979). Maharashtra is one of the industrialized states of India which contributes towards social and economic growth of the country. Large parts of the state fall in the rain shadow and hence face water supply and quality challenges Mishra, (2013).

Ground waters sources are the important water source in urban as well as in the rural areas of India. More than two billion people worldwide depend upon ground water. Today, with a global withdrawal rate of 600–700 km3/year, groundwater is the world's most extracted raw material (IAH, 2003). But mostly in cities households' water supply is through pipeline. Sources of groundwater have failed to escape pollution in India. Therefore, India is pertaining with issues of water crisis and pollution. Extensively changing land use patterns in most parts of the country are responsible for degradation of groundwater quality. Contamination of potable water due to changing land use patterns has become a major issue in the developing country like India. Maharashtra state is not an exceptional case in an issue with groundwater contamination problems. The state like Maharashtra has also been in the clutches of drought due to early commencement of summer conditions and unpredictable monsoon. During such situation the water supply by the corporation in the cities is not adequate and hence the only option remains is the aquifer that is the groundwater. Serious degradation of water quality in urban India has often been attributed to indiscriminate disposal of sewage and industrial effluents into surface water bodies (Srikanth, 2009). Several studies were carried out on the ground water pollution including heavy metal pollution. In the Nanded district we are attempt to determine the various physico chemical parameters from preselected area from bore-well.

Study Area: Nanded Tehsil is administrative block of Nanded District located in South Eastern Part of Deccan Volcanic Province of Marathwada region of Maharashtra state. The study area is located between latitudes 190 3' N to 190 17'N and longitude 770 10' E to 770 25' E (Fig. 1). The study area comprises with semi-arid region and tropical climate. The temperature of study area is ranging from 13 to 46 0C. The average rainfall of the study area is 900 mm, where, 88 % rain receives under the influence of South West Monsoonal winds. Godavari River flows in South West to South East direction having alluvial plain along its coast in the study area. The thickness of alluvium

varies at different places and maximum 20 m encountered in flood plain areas of rivers. The study area is principally irrigated by Godavari and its sub-tributary Asna River and also left bank canal taking off water from Siddheshwar dam of the Purna project, of Parbhani district. The North East part of the study area is the convergence point of Asna and Godavari River. The study area underlain by geological formation mainly Deccan Basalt flows of vesicular, amygdaloidal, weathered, fractured basalt etc. Black cotton soil and loamy to sandy soil are main soil types covering the study area. The present study has been carried out to assess the groundwater parameters from selected areas of Tahsil Nanded district, Nanded, in which three talukas namely Nanded, Umri, Bhoker were selected for this study to know the impact of anthropogenic and geogenic activities on the quality of groundwater.

Material and Methodology:

A-Sampling Techniques: In the present investigation, a random sampling design was considered. Random sampling design which is also known as probability sampling" has an equal chance of inclusion of every item of an object in the sample. Allen (1978) and Kotaiah and Kumaraswamy (1994), have suggested a sampling design of the bore wells in order to pursue the quality control and making forecasts to determine the extent of damage due to pollution. Hence, the random sampling technique was adopted in the present investigation in all the Taluks of Nanded District.

Sampling and preservation: The water samples were collected from those bore wells, which were being used for drinking and cooking. The bore well water samples were collected in pre-cleaned black coloured bottled 2liter capacity with necessary precautions. Water samples from bore wells (hand pumps) were collected after running them for 15-20 minutes. The temperature and pH were measured immediately using a thermometer and Systronics grip-pH meter, respectively.

All the chemicals used were of AR grade. Double distilled water was used for the preparation of reagents and solutions. Physicochemical parameter for analysis of drinking water like Temperature, Colour, Odour, pH, Electrical conductivity [EC], Total dissolved solids [TDS], Alkalinity, Hardness, Chlorides and Fluoride etc. First to know the Temperature of each sample at RT by thermometer in °C, pH by digital pH meter, electrical conductivity measured by conductivity instrument in µs/cm, TDS by disk filtration in mg/l. Titration Method used for Total alkalinity, total hardness and Ca concentration of drinking water know in mg/l. For chloride test**,** AgNO3 with K2CrO4 indicator is used. Standard 0.02N H2SO4 with methyl orange indicator is used for alkalinity measured in mg/l. Fluoride was estimated with

standard method as prescribed by Groltman et al., (1978), Trivedi and Geol (1986) and APHA (1998).

Results and Discussion:

pH: In the present investigation the ground water maximum pH value was recorded in Nanded at site-1 was recorded maximum as (8.61), followed by (7.83) at Site-2 then in Site-1 (7.71) and Site-6 (7.25) and in Site-5 (6.76) was significant at ($p<0.05$). The lowest pH values were recorded in Site-4 (6.9) and which were also observed significant at ($p<0.05$). In Umri, the Maximum pH value were recorded in Site-3 (8.61) which are observed significant at ($p<0.05$) followed by at Site-5 (8.45) and which are not found significant. Then at Site-1(8.36) were found significant at ($p<0.05$) the Site-2 (7.93) are not found significant at ($p<0.05$) the Site-4 (6.75) were found significant at ($p<0.05$). The lowest pH values were recorded at Site-6 (6.48) and which were found Non-significant at ($p<0.05$). In Bhokar, the Maximum pH value were recorded in Site-3 (8.31) Site-2 (7.1) and Site-5 (8.03) are found Non-significant at ($p<0.05$). Followed by at Site-4 (6.91) and Site-6 (7.12) are found significant at ($p<0.05$) Then the lowest pH values were recorded at Site-1 (6.76) and found significant at ($p<0.05$).

Electrical conductivity: The electrical conductivity (EC) of the ground water samples of the study area ranged from 847.33 to 2749 µS/cm. the maximum value of EC was recorded at Site-4 (2749µS/cm) in Umri and found significant at ($p<0.05$). While the lowest value was recorded at Site-6 (847.33 µS/cm) in Bhokar and found significant at ($p<0.05$). In Nanded Site-1, 2 in Umri, Site-5 &6, In Bhokar, Site-2, 4, 5 &6 and remaining sample in Nanded Site-3, 4, 5 & 6 in Umri, Site-1, 3 & 4. In Bhokar, Site-1 & 3 all the samples were found within the permissible limit.

Total Dissolved Solids (TDS): The Total Dissolved Solids (TDS) of the ground water samples of the study area was ranges from 17.66mg/lit to 2105.16 mg/lit. The maximum value of TDS was recorded in Umri at Site-4 (2105.16 mg/lit) which are found significant at ($P<0.05$) level. All the ground water samples are beyond desirable (DL) limit (50 to 2000mg/lit, BIS) but all are within permissible limit (PL). Only in Umri, Site-4 (2105.16mg/lit) beyond the permissible limit when compared with BIS.

Total Alkalinity (TA): The maximum value of Total alkalinity was recorded in Umri, at Site-2 (879 mg/lit). In Nanded, Site-1&2 in Umri, at Site-5 & 6 whereas in Bhokar, all the Site from 1to 6 are found beyond the Desirable limit (DL) these are found beyond the permissible limit (PL).

Total Hardness (TH): The maximum value of Total hardness was recorded in Umri, at Site-1 (924mg/lit) & and found significant at ($p<0.01$) level followed by in Nanded & Umri at Site-5 &2 (8.54 mg/lit) both are found significant at ($p<0.05$) level, in Bhokar, at Site-5 (148mg/lit) are found within the BIS limit and which are observed as significant at ($p<0.01$) & ($p<0.05$) level.

Chloride (Cl-): The concentration of chloride in the ground water samples of the study area recorded maximum in Bhokar at Site-1 (1314mg/lit) and found very significant at ($p<0.01$) level, followed by in Nanded at Site-2 (1174.67mg/lit) and found significant at ($p<0.05$) in Umri, at Site-1 (976.5 mg/lit), Nanded & Umri at Site-3 (975.83mg/lit) and both these value are found significant at ($p<0.05$) level.

Sulphate (SO4 -2): the concentration of sulphate in ground water was recorded maximum in Nanded & Umri at Site-3 (573.5mg/lit) and it was significant at ($p<0.05$) level, followed by In Umri, at Site-5 (496mg/lit),Site-2(446mg/lit), in Nanded at Site-4 (482mg/lit), Site-6 (422mg/lit), in Bhokar, Site-4 (421mg/lit) all these value are found significant at ($p<0.01$ & $p<0.05$) level. The lowest value are recorded in Bhokar at Site-6 (105mg/lit).

Calcium (Ca^{+2}): The Calcium was recorded maximum in Umri at Site-5 (457.16mg/lit) and it was found significant at ($P<0.05$) followed by in Nanded at Site-5 (380.16mg/lit) In Umri, at Site-1 (301.5mg/lit) and it was found significant at ($P<0.01$ &$P<0.05$) level.

Magnesium (Mg^{+2}): The concentration of magnesium in ground water maximum recorded in Nanded, at Site-3 (39.33) and found significant at ($p<0.05$) level whereas the lowest value of magnesium was recorded in Bhoker at Site-5 (14.83) and found significant at ($p<0.05$) level.

Sodium (Na^{+}): The concentration of Sodium was recorded maximum in Bhokar at Site-4 (178.5mg/lit) and found significant at ($p<0.05$) followed by again in Bhoker at Site-2 (138) & both these are found significant at ($p<0.05$) level.

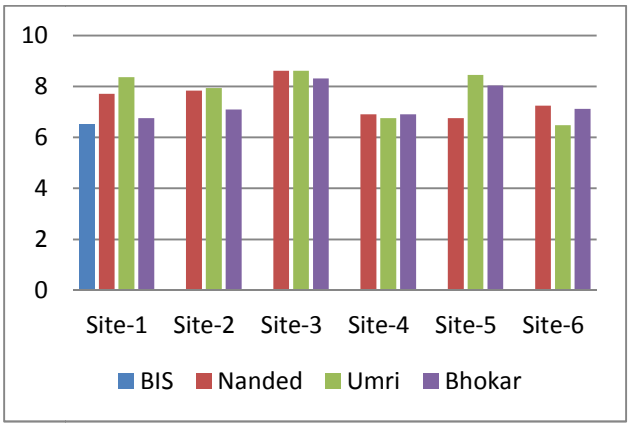
Potassium (K^{+}): In the present investigation the concentration of potassium was recorded maximum in Nanded at Site-6 (26.6mg/lit) followed by Umri, at Site- 5(19.83mg/lit) Site-2 (17.6mg/lit), Bhokar, Site-5 (18.83mg/lit), all these values are found significant at ($p<0.05$) level. The lowest value was recorded in Nanded at Site-1 (0.56mg/lit) and it was found significant at ($p<0.05$) level.

Dissolved oxygen (DO): The amount of DO was recorded in Bhoker, at Site-6 (4.38mg/lit) and it was found non-significant at ($p<0.05$) level.

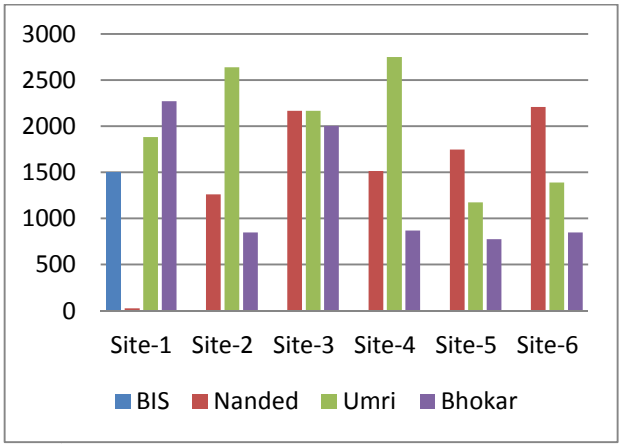
Turbidity (TUB): The lowest value was observed in Nanded at Site-4(0.06NTU) followed by Site-1 (0.32NTU), Site-3 (0.61) & Site-2(0.62NTU). In Umri, at Site-1 (0.51NTU), Site-3(0.61NTU) all these obtained value are found significant at ($p<0.05$ & $p<0.05$) level.

Fluoride (F^-): The lowest value of fluoride was recorded in Nanded and Umri at Site-3& 4 (0.03mg/lit) & Site-2 &3 (0.04mg/lit & 0.03mg/lit) all these value are found significant at ($p<0.01$ & $p<0.05$) level.

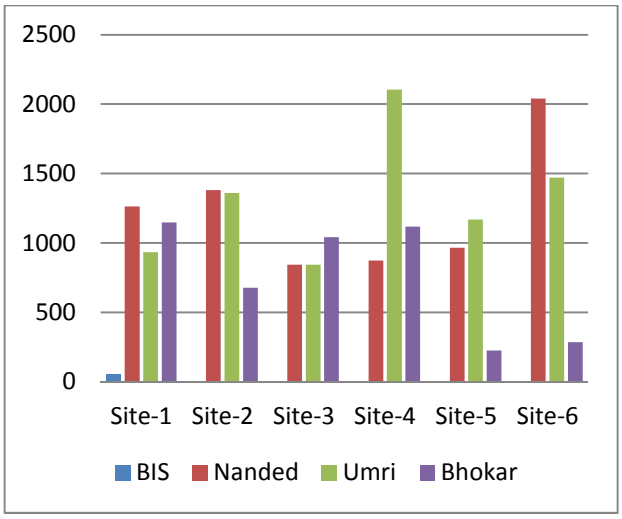
Nitrate (NO): In the present investigation the concentration of nitrate was found maximum in Umri at Site-4 (45.66mg/lit) and are found very significant at ($p<0.01$) level.



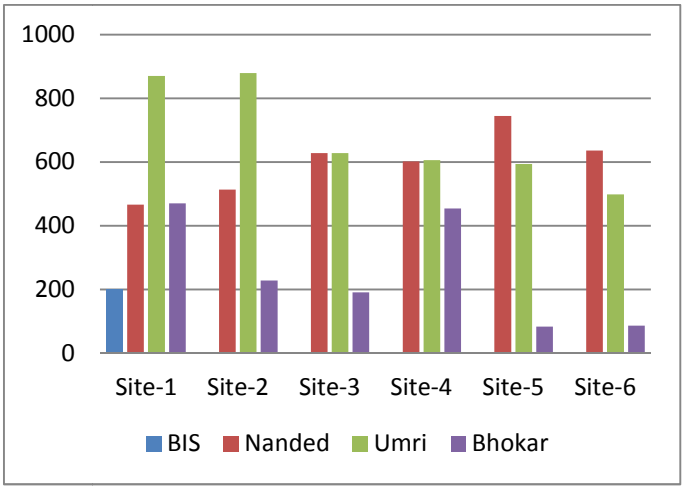
Graph no.1
Variation of pH. In ground water samples collected from Nanded, Umri & Bhoker



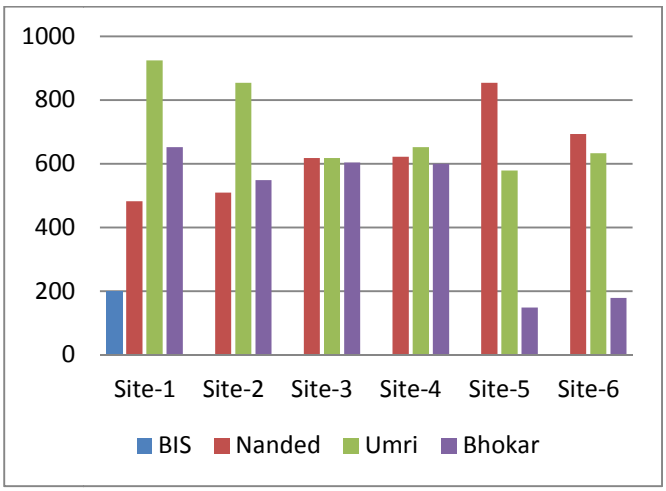
Graph no.2
Variation of EC in ground water samples collected from Nanded, Umri & Bhoker



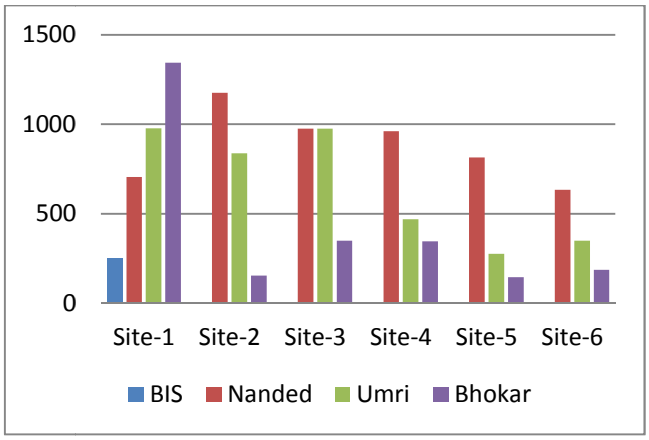
Graph no.3
Variation of TDS in ground water samples collected from Nanded, Umri & Bhoker



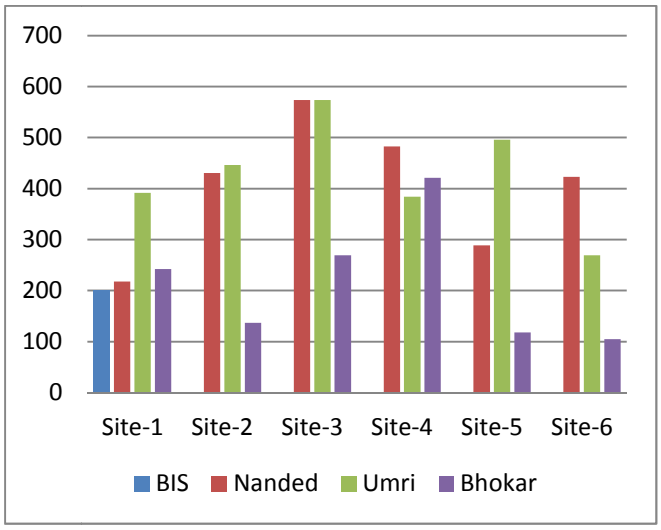
Graph no.4
Variation of Alkalinity in ground water samples collected from Nanded, Umri & Bhoker



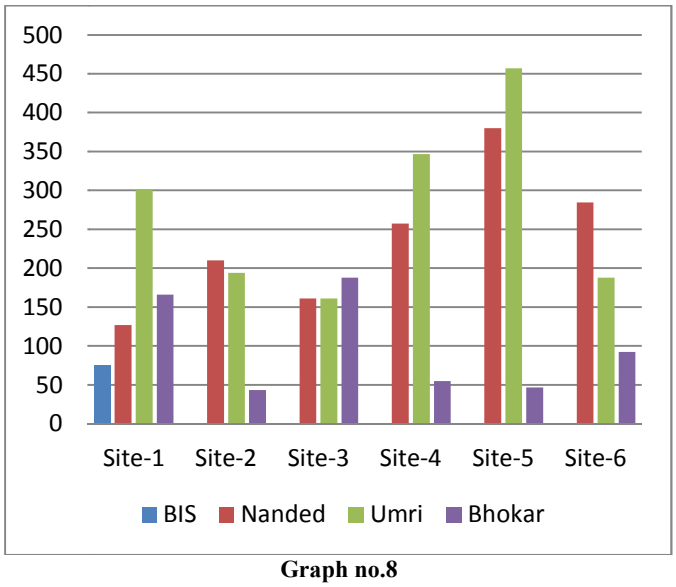
Graph no.5
Variation of Total hardness in ground water samples collected from Nanded, Umri & Bhoker



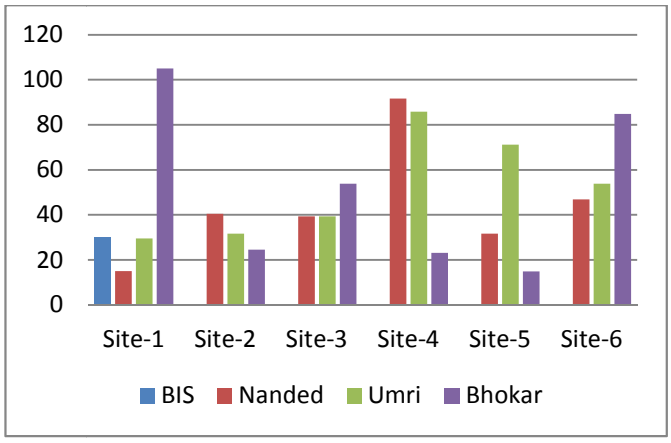
Graph no.6
Variation of Chloride in ground water samples collected from Nanded, Umri & Bhoker



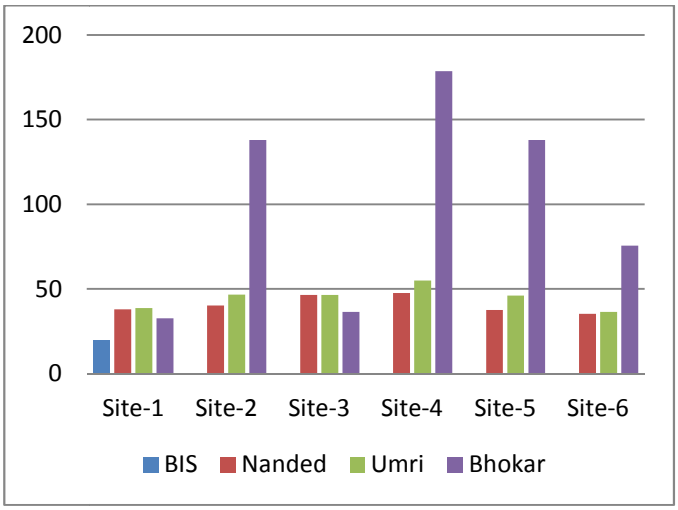
Graph no.7
Variation of Sulphate in ground water samples collected from Nanded, Umri & Bhoker



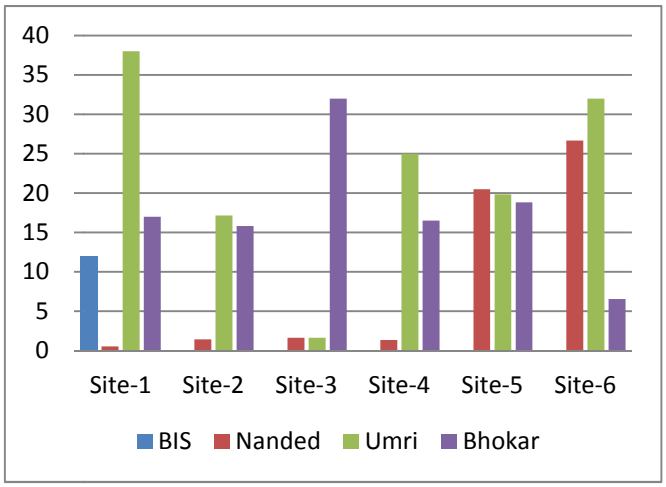
Graph no.8
Variation of Calcium in ground water samples collected from Nanded, Umri & Bhoker



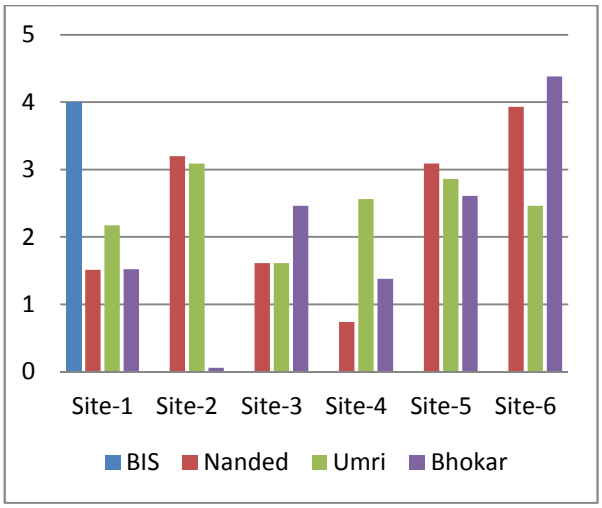
Graph no.9
Variation of Magnesium in ground water samples collected from Nanded, Umri & Bhoker



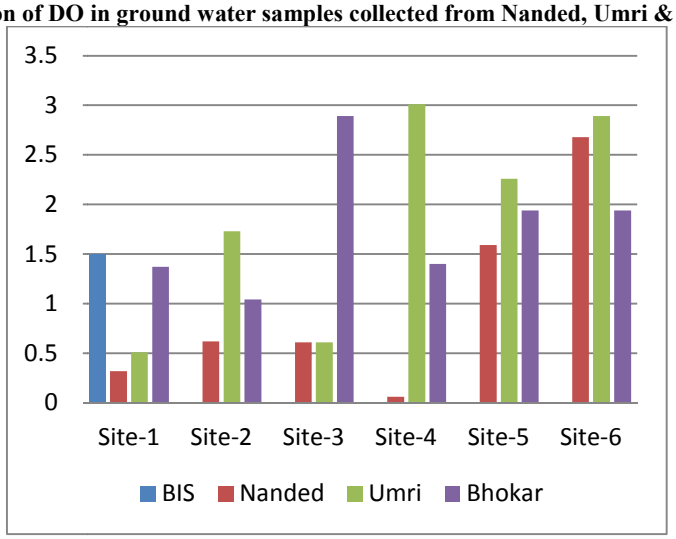
Graph no.10
Variation of Sodium in ground water samples collected from Nanded, Umri & Bhoker



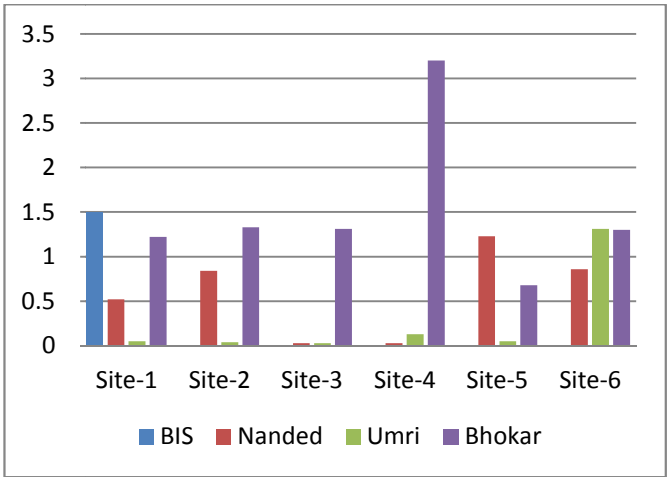
Graph no.11
Variation of Potassium in ground water samples collected from Nanded, Umri & Bhoker



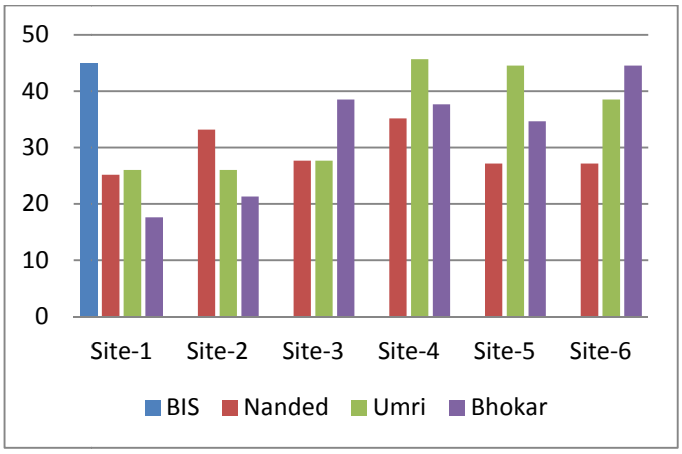
Graph no.12
Variation of DO in ground water samples collected from Nanded, Umri & Bhoker



Graph no.13
Variation of Turbidity in ground water samples collected from Nanded, Umri & Bhoker



Graph no.14
Variation of Fluoride in ground water samples collected from Nanded, Umri & Bhoker



Graph no.15
Variation of Nitrate in ground water samples collected from Nanded, Umri & Bhoker

Discussion:

The pH was observed in all the sites in Nanded district varies from 6.6 to 9.05 Similar observations were represented by Narayana and Suresh (1989), Gill, *et al.,* 1993), Mehta and Trivedi (1993), Mittal, *et al.,* (1994). Ballukraya and Ravi (1999) had proved the variation of the conductivity of the water due to residential times and the geographical features of the sampling locations. The variation of Total Dissolved Solids (TDS) of the ground water samples of the study area was ranges from 17.66mg/lit to 2105.16 mg/lit. This may be due to an increased run off of bicarbonate and carbonate. Similar result was observed by Jahangir *et al.,* (2000) from at Keenjhar Dhimdhime and Ambhore (2004) from Siddheshwar dam, Parbhani district reported similar results.

The variation of alkalinity due to the dissolution of mineral substance and atmosphere the most common constituents of alkalinity are carbonates (CO3--), bicarbonates (HCO3-) and hydroxide (OH-). Similar findings have been recorded by Muley and Patil, (2006); Korai *et al.,* (2008); Salve and Hiware, (2006); Bhatt *et al.,* (1999) has mentioned lower range of total alkalinity during different seasons. The higher alkalinity of a ground water is owing to the presence of bicarbonates trace amount of carbonate Zuddas & Podda, (2005) and hydroxide salts Manivasakam, (1985). The high percentage of chloride is due to the use of mineral acids for chemical processing in industries Vaishanve & Shrivastava (2007). Chlorides are leached from various rocks into soil and water by weathering (WHO, 1996). The high concentration of sulphate is due to oxidation of metal sulphides, which is discharged by various industries. Many researcher have been reported the high concentration of chloride. Reddy *et al*., (2009), Telkhade *et al*., (2008) and Shanthi *et al*., (2006) observed high value in monsoon. Calcium

initiated in alkaline in nature, calcium content is very corporate in groundwater, because they are available in most of the rocks, profusely and also due to its higher solubility (Channabasava, *et al.,* 2017). Magnesium content in groundwater of Nagpur city (Maharashtra) was studied and it was detected that it ranges from 218 to 270 mg/1. (Shelke *et al.,* 2002), Magnesium content in groundwater of Amravati District (Maharashtra) varied between 24-66 mg/I (Haseeb, 1984). Sodium and potassium are exceeding the permissible limit in the range of 170 to 550 mg/L and 20 to 135 mg/L respectively (Raja and Venkatesan, 2010). Thus, the excess amount of potassium present in the water sample may lead nervous and digestive disorder (Tiwari, 2001). (Pandey *et al.,*1999) studied Do from river Ramjan (Klshanganj) in relation to its impact on biological components. The 6 mg/L to 9 mg/L range of DO is supported for potability and aquaculture.

The turbidity in excess of 5 NTU or 5JTU may be noticeable and consequently objectionable to the consumers Protocol for turbidity (2008). Highly turbid water reduces light penetration therefore affecting levels of photosynthesis, warming is increased due to absorption of sunlight, and it is generally aesthetically unpleasing. At high concentrations fluoride is toxic to humans and animals and can cause bone diseases, mottling of teeth can occur (WHO, 1984a). Skeletal fluorosis is a bone disease caused by excessive consumption of fluoride. Groundwater can also be contaminated by sewage and other wastes rich in nitrates (Trivedi and Goel, 1986). In areas of high nitrogen fertilizer application it may reach very high concentrations. (Lakshmanan *et al.,* 1986); (Adak and Purohit, 2001) reported that nitrate values of groundwater of Mandiakudar (Orissa) were found to be fluctuating between 15.20 and 58.70 mg/1. (Das *et al.,* 2003) assessed the nitrate content in groundwater of Guwahati

Conclusion:

Analyzed results of groundwater samples compare with desirable limit of BIS the value are more than desirable limit but within the permissible limit. The average values of EC, TDS, Hardness, Alkalinity, Chloride, and Nitrates are high in granitic aquifers as compare to basaltic aquifers in maximum samples and the average values of Fluoride and Sulphate are high. The preliminary study indicates that, fluoride content above the safe limit (1 mg/l) in most of the villages of the study area within short distance. Rainwater harvesting is also one of the technique to minimize the fluoride concentration in drinking water. Use of alternate water sources of basaltic and granitic aquifer which does not contain fluoride, nitrate above safe limit. Awareness programme should be conducted in fluoride affected area.

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