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GROUND WATER QUALITY STUDIES OF BIDAR URBAN WITH SPECIAL EMPHASIS TO SPRING WATER

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***Abstract*—This electronic document is a "live" template. The various components of your paper [title, text, heads, etc.] are already defined on the style sheet, as illustrated by the portions given in this document.**

***Index Terms*—Component, formatting, style, styling, insert.**

I. INTRODUCTION

Water is the most precious gift of nature, the most crucial for sustaining life and is required in almost all the activities of man - for drinking, municipal use, for irrigation, to meet the growing food needs for industries, power generation, navigation and recreation. Moreover, the rainfall is mostly confined to the monsoon season and is unevenly distributed both in space and time even during this season. As a result, the country is affected by frequent droughts. Nearly one third of the country is drought prone. In the very near future, water will be a scarce resource and therefore, needs to be harnessed in the most scientific and efficient manner. The surface water is subjected to various threats like discharge of effluents from different industries in the vicinity, encroachment of surface water sources like pond, river, stream etc. Groundwater is the major source of drinking water in both urban and rural India. The demand for water has increased over the years and this has led to water scarcity in many parts of the world. Exploitation of groundwater reservoir is a viable source of drinking water and for domestic use (or even for small scale industries) is safer and economical than surface water, as groundwater is not only found almost everywhere but also generally uncontaminated. As a result groundwater investigation has assumed top priority in recent years. Groundwater is often thought of as an underground river or lake. Groundwater is usually held in nonporous soils or rock materials. The area where water fills these spaces is called the saturated zone; the top of this zone is called the water table. The water table may be shallow (only a foot below the ground surface) or it may be deep (hundreds of feet down) and may rise or fall depending on many factors. Heavy rains or melting snow may cause the water table to rise while an extended period of drought may cause the water table to fall. Groundwater is stored in, and moves slowly through, layers of soils.

II. LITERATURE REVIEW

"Phytoplankton Diversity as Indicator of Water Quality for Fish Cultivation".- Arunova, Pradhan, Pranami bhaumik, Suman Das reported that the Waste water fed fisheries are a common feature in different parts of the world. Yet not all work as efficiently as those operating at East Calcutta Wetland for more than 70 years now. The objective of their study is to unravel the reason for the markedly greater efficiency of the Bheris in fish production compared to other water bodies like rain water ponds or sewage fed fish ponds elsewhere. The study indicates that plankton growth could be an important factor responsible for greater fish production in the Bheris. The architecture of the Bheri itself acts as a facilitator in the process. It is proposed that planktons can act as biomarker for water quality assessment in fish production. (7)

"Water Quality Assessment of the Owena Multi-Purpose Dam, Ondo State, Southwestern Nigeria" – Oyhakilome,Gloria Irenosen, Aiyesaumi Ademola, made survey and the Composite water samples taken from Owena Multi-purpose Dam in six sampling campaigns covering the wet and dry seasons were analyzed for physico-chemical and microbial characteristics using standard methods for the examination of water and wastewater jointly published by the American Public Health Association, American Water Works Association and Water Pollution Control Federation. Results showed significant ($p < 0.05$) seasonal variations in most measured parameters with few showing significant spatial variation. The characteristics of the water from the dam lake revealed an acceptable quality for most measured parameters with low chemical pollutants burden when compared with drinking water standards and water quality for aquaculture. However, high values of turbidity, color, iron, manganese and microbial load were recorded compared with drinking water standards, which call for proper treatment of the water before distribution for public consumption.[2]

"The variability of phosphorus fractions in sediments of a shallow restored Antoninek Reservoir (Poznań, Poland)". – Ranata Dondajewska, made survey & the Spatial and temporal variability of phosphorus (P) fractions content in bottom sediments of a shallow preliminary reservoir was studied in Antoninek, situated in Poznań. Fractions were analyzed at least once in a season (more often in spring and summer) between August 2004 and November 2005 according to the fractioning protocol proposed by Psenner et al. (1988). Circa 10 cm thick sediment layers were collected

from three study sites, situated along the main axis of the reservoir. The contribution of NH 4Cl-P and BD-P, i.e. the most accessible fractions biologically was similar at all stations (usually below 10%). The share of other fractions increased according to the sequence NaOH-RP < NaOH-NRP < HCl-P < Res-P. Only at station 1 the amount of phosphorus related to organic matter was lower than with aluminum. The domination of Res-P fraction indicated that the main part of phosphorus in sediment is biologically unavailable; therefore the intensity of phosphorus loading from sediments shall be low. However, high organic matter content, noted in sediments of Antoninek Reservoir, determined great amount of NaOH-NRP fraction. Both parameters remained under the influence of mats of macroalgae, growing intensively in the reservoir during vegetation season. The role of sediments as a source of phosphorus for water column enlarged, due to increased organic matter decomposition, especially in periods of high water temperature in this shallow reservoir.[5]

"Physico-Chemical Studies on Chimdi Lake of Sunsari District during its Restoration Stage." - R.Surana, B.R.Subba & K.P. Limbu reported that the Chimdi Lake is ecologically a valuable site but due to the exploitation, almost all parts of the Lake changed into a terrestrial habitat. The issues of lake conservation have been brought into light recently and the work for rehabilitation; protection and conservation have been initiated by local peoples. Water quality plays an important role in determining the biodiversity of any water body. Various physico-chemical parameters such as atmospheric temperature, water temperature, transparency, total solids, total dissolved solids, total suspended solids, humidity, pH, dissolved oxygen, free carbon dioxide, total alkalinity, acidity, total hardness, calcium hardness, calcium, magnesium and chloride were estimated on monthly basis from March 2004 to February 2005. Physico- chemical values revealed that the lake is a suitable site for the habitat of aquatic lives.[4]

"Modeling Diffusive Flux of Non Point Source Pollutants in Lake Victoria: A Comparison Study of Fick's Law and the Fokker-Planck Law." – N.Banada, F.Ayaa, I Nhapi, U.G.Wali, R.J.Kimwaga & D.A.Mashauri reported that the Mathematical models have the potential to conceptually quantify, link and simulate the interactive processes of nature. In this study 68 samples were collected at Gaba landing site in Uganda during a rainy season and were analyzed for nutrients, namely, Ammonia, Nitrite, Nitrate, and Phosphate. In addition, portable meters were used to measure Total Dissolved Solids (TDS) and Dissolved Oxygen (DO) instantaneously at point of sample collection. Within the lake, sam-ples were taken at for horizontal transects of 10 metres (m) interval over a distance of 50 m from the shore where surface runoff was released. At each 10 m sampling point, three samples were drawn at vertical distances of 0.5 m, 1.0 m and 1.5 m from water surface using a hand pump with graduated delivery pipe. This paper presents the results obtained from the application of two alternative expressions, fick's law and Fokker-Planck law to gain insight into the pollutants diffusive flux patterns within the lake. We conclude that in general the Fokker-Planck model should be given preference, in model-ling Ammonia and Phosphate flux profiles while Fickian model should be deployed in modelling DO, TDS, Nitrites and Nitrates. [1]

"Physico-Chemical Environment of Coastal Areas in the Vicinity of Lbod And Tidal Link Drain in Sindh, Pakistan after Cyclone 2a." - Salam Khalid, inamullah Bhatti, Shaukat Hayat Khan & Abdul khalique Ansari. Made study & their paper presents the results of preliminary assessment of water quality along the coastal areas in the vicinity of Left Bank Outfall Drainage (LBOD) and Tidal Link Drain (TLD) in Sindh province after the cyclone 2A occurred in 1999. The water samples were collected from various RDs of Tidal Link Drain and lakes during September 2001 to April 2002 and were analysed for salinity, nitrite, phosphate, ammonia, silicate and suspended material in water. The results of the study showed considerable variations in water quality depending upon the location along the coast in the vicinity of LBOD and RDs. The salinity ranged between 4.39–65.25 ppt in Tidal Link Drain samples whereas 2.4–38.05 ppt in samples collected from lakes. The values of suspended material at various RDs of Tidal Link Drain ranged between 56.6–2134 ppm and at the lakes between 68–297 ppm. The data of continuous monitoring at RD–93 showed the range of PO4(8.6–25.2 µg/l), SiO3(554.96–1462 µg/l), NO2(0.557.2–25.2 µg/l) and NH3(9.38–23.62 µg/l). The concentration of nutrients in water samples collected from different RDs was found in the range of PO4(10.85 to 11.47 µg/l), SiO3(1624 to 2635.08 µg/l), NO2(20.38 to 44.8 µg/l) and NH3(24.08 to 26.6 µg/l). Sindh coastal areas which situated at the north-western boundary the Arabian Sea are highly vulnerable to flood damages due to flash floods during SW monsoon or impact of sea level rise and storm surges coupled with cyclones passing through Arabian Sea along Pakistan coast. It is hoped that the obtained data in this study would act as a database for future investigations and monitoring of LBOD and Tidal Link Drain coastal waters. [3]

"Physico-Chemical Characteristics of Kunigal Lake in Tumkur District, Karnataka, India" - T.Parameshwara Naik, K.V.Ajeyan, & G.H. Lokesh made study & In Their study the investigation was carried out in Kunigal Lake, it belongs to Kunigal Taluk of Tumkur district. Twenty four physical and chemical parameters of water sample were analyzed, which show fluctuation throughout the sampling periods (two years 2007-2009). Higher amount of alkalinity, pH, total dissolved solids, poor dissolved oxygen and high turbidity show that water of Kunigal is unfit for potability.[8]

"Estimation of the Water Quality of Wetlands in Manipuri District (U.P.) India" – Amita Sarkar & Bhavna Upadhyay made study and Their study was carried out to evaluate the physico-chemical parameters of wetlands, located at Manipuri district viz- Site-I(Markandeshwar), Site-II (Bhamwat Canal), Site-III (Saman), Site IV(Sauj) and Site-V(Kirithua).The physicochemical parameters play a vital role in the wetland ecosystems. Physiochemical studies of

wetlands of Manipuri were conducted six times in an year, during April 2011 to Feb 2012 to estimate the water quality of wetlands and alternate monthly comparisons were made. In this paper we discuss Zinc, Cobalt, Nickel, Alkalinity, Sulphates, Calcium, SiO3, NH3 and Hg .A significant variation in these parameters was observed throughout the study period Investigation due to pollutant inflow and change in the season and environment. Saman and Sauj (Site-III and IV) are IBAs(Important bird areas) under Important Bird Areas Programs of BNHS and Bird Life International. [9]

MATERIALS AND METHODS

3.1 Study Area :

Bidar district is one of the 30 districts of Karnataka state in southern India (Figure 3(a)).. The Bidar district is the northern most part of the Karnataka state with geographical area of 5460 sq.km. It lies between 17°35' and 18°29' North latitude and 76°41' to 77°39' East longitude. It is bounded by Nizamabad and Medak districts of Andhra Pradesh state on the eastern side, Latur and Osmanabad districts of Maharastra state on the western side, Nanded district of Maharastra state on the northern side and Gulbarga district on southern side. The district is situated in northern Karnataka between Bidar has a semi-arid climate (Figure 3(b)). The Bidar district is constituted by five talukas i.e. Aurad, Basavakalyan, Bhalki, Bidar and Humnabad with Bidar being the head quarters of the district. Major parts of the district is covered by Godavari basin, drained by its two major tributaries the Manjara and the Karanja rivers. The Manjara river is perennial river flows over a distance of 155 km in the central parts of the district and flows eastern direction with a meandering course. The Karanja river flows in northern-western direction for 74km with karanja reservoir being major water source. The river Mullamari takes its origin near Matala village of Basavakalyan taluk flows from west to east length of 38 sq.km and then flows into Gulbarga district and joins the river Kagna. The Kagna river is one of the main tributary of Bhima river. Besides, there are several streams, which are of ephemeral in nature. The drainage pattern in the district varies from sub-dendritic to dendritic and some streams have a sub parallel drainage to the main river. The two important types of soils noticed in the district are black soils and lateritic soils. Black soils are derived from Deccan traps. These are deep black in colour and their texture varies from loam to clay. Lime concentration in this soil is high resulting in poor infiltration capacities. Their infiltration characteristics are poor to moderate. These types of soils cover mainly in areas lying below 610 m contour and along the valley portions. Lateritic soil is confined to the central portion of the district. Lateritic soils are pale to bright red in colour and clay to clayey loam in nature. This soil has moderate to good infiltration characteristics. These types of soils cover mainly in areas lying above 610 m contour. Figure 3(c)) ?

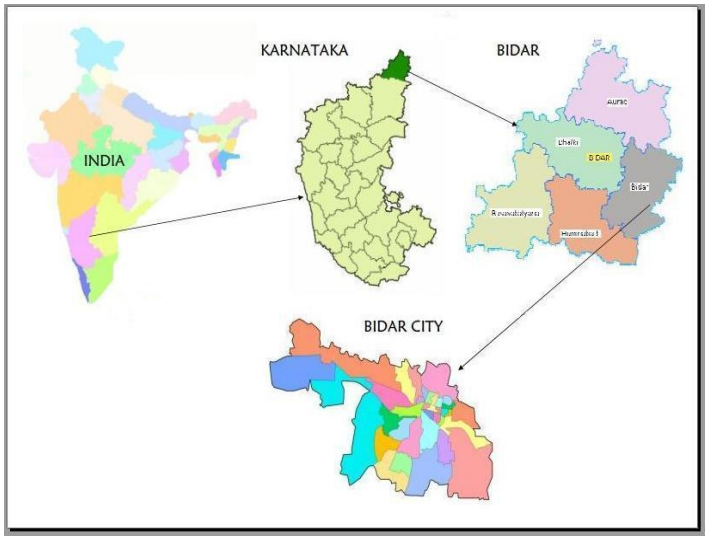


Figure 3.1: Showing the Location of Bidar City

Table 3.1: Analytical Methods and Equipments used in the study [12]

Sl No.	Parameters	Methods	Equipments
1	pH	Electrometric	pH Meter
2	Temperature ^0C	Thermometric	Thermometer
3	Total Dissolved Solids- TDS	Electrical conductivity method	EC/TDS Analyzer
4	Total Hardness – TH	Titration by EDTA	-
5	Calcium – Ca	Titration by EDTA	-
6	Magnesium – Mg	Titration by EDTA	-
7	Sodium – Na	Flame emission	Flame photometer
8	Potassium – K	Flame emission	Flame photometer
9	Dissolved Oxygen – DO	Titration by N/40 $Na_2S_2O_37H_2O$	Winkler method
10	Biochemical Oxygen Demand – BOD	0.025N $Na_2S_2O_37H_2O$	5 day incubation at 20^0 C & titration of initial & final DO

11	Chllride – C1	Titration by silver nitrate	-
12	Sulphate – SO_4	Turbidimetric method	Photoelectric colorimeter
13	Alkalinity – $CaCO_3$	Titration by 0.02N H_2SO_4	-
14	Nitrates – NO_3	Spectrometer method	Spectrophotometer

3.2 Sampling Techniques and Preservation

Sampling is the first of a series of steps leading to the generation of water quality data and is an exceedingly important one. Care must always be taken to ensure obtaining a sample that is truly representative. Further the integrity of the sample is not representative of the system sampled or if the sample has changed in chemical composition between sampling and analysis, all care taken to provide an accurate analysis will be lost.

The precautions are as follows:

1. The water has been collected in bottles, especially of white color, having well fitted stoppers or screw caps.
2. Bottles having holding capacity of about one liter of water are necessary for the chemical analysis.
3. Bottle has been thoroughly cleaned, filled thrice with water and emptied before collecting the sample.
4. After collecting the sample, the stopper of the bottle have been well secured and the bottles containing samples of water have been labeled stating the date and time of collection.

3.3 SAMPLING

The samples were collected from Aug 2 2015 to Oct. 28 2015 covering rainy and winter seasons. The grab samples are collected covering with a frequency of 10 times after a gap of every 10 days. Two liters of water samples are collected from each sampling point and immediately transported to the laboratory for analysis. All the samples were tested in the laboratory to determine physico-chemical parameters such as Total Dissolved Solids (TDS), Chloride, Alkalinity, Dissolved Oxygen(D.O.), pH, Total Hardness(TH), Calcium(Ca^{+2}), Magnesium(Mg^{+2}), Nitrate(NO_3^-), Sulphate(SO_4^-), The methods adopted for the determination of the above parameters are as shown in table 3.1

3.4 Software used

MINITAB 15 for statistical calculations

3.5 Correlation and Regression analysis

Co-variation of two independent magnitudes is known as correlation. If two variables x and y are related in such a way that increase or decrease in one of them corresponds to increase or decrease in the other, we say that the variables are positively correlated. Also if increase or decrease in one of them corresponds to decrease or increase in the other, the variables are said to be negatively correlated. The numerical measure of correlation between two variables x and y is known as coefficient of correlation. Regression is an estimation of one independent variable in terms of the other. If x and y are correlated, the best fitting straight line in the least square sense gives reasonably a good relation between x and y. The best fitting straight line of the form y = ax+b (x being the independent variable) is called the regression line of y on x and x = ay+b (y being the independent variable) is called the regression line of x on y.

The formula correlation co-efficient (r)

$$r = \frac{N\sum(X_iY_i) - (\sum X_i).(\sum Y_i)}{\sqrt{[N\sum X_i^2 - (\sum X_i)^2][N\sum Y_i^2 - (\sum Y_i)^2]}}$$

3.6 Factor Analysis

Factor analysis is a very powerful technique which provides information on the meaningful parameters which describe the whole data set rendering data reduction with minimum loss of information (Singh K. P. et. al,). FA is a quantification of the significance of variables that explain the observed grouping and patterns of the inherit properties of the individual objects (Kowalkowski T. et. al,). FA allows the explaining of related parameters by only one factor (Singh K. P. et. al, Kowalkowski T. et. al, Boyacioglu. H. et. al,). FA exposes the important factor responsible for variation in ground water quality and eventually leads to sources identification of ground water pollution. In this study, FA was applied to extract the most significant factors and to reduce the contribution of less significant variables to simplify even more of the data structure coming from factor analysis. The factors obtained were further subjected to varimax rotation according to well established rules to maximize differences between the variables and facilitate easy interpretation of the data. The rotating axis defined by factor analysis generates varimax factor (Factor1, Factor2….) which can further reduce the contribution of variable with minor significance. [39]

3.7 Water Quality Standards [17]**.**

The evolution of standards for quality control of public water supplies has to take in account the limitations imposed by local factors in several regions of the country. Drinking water of acceptable quality must be free from pathogenic organisms and chemical compounds having acute or long term adverse effects on human health.

The idea of water quality management is to ensure that water supplied is free from pathogenic organisms, clear potable and free from undesirable taste and odour of reasonable temperature, neither corrosive nor scale forming and free from mineral which could produce undesirable physiological effects. In many places these desirable properties cannot be achieved completely, hence the alternative approach is to improve the quality to bring it to the desirable level.

Standard Parameters (as per IS 10500 1991) [19]

Chloride (Cl) (mg/L):

Range	Class

0-200	Permissible
200-600	Maximum permissible
600-1000	Exceeding level

Sulphate (SO4) (mg /L) :

Range	Class
0-150	Permissible
150-400	Maximum permissible
>400	Exceeding level

Nitrate (NO3) (mg\L) :

Range	Class
0 – 30	Permissible
30 – 50	Maximum permissible
50 – 100	Exceeding level

Alkalinity (CaCo3) (mg\L) :

Range	Class
0 – 200	Permissible
200-600	Maximum permissible
>600	Exceeding level

pH :

Range	Class
7.0 – 8.0	Normal
8.0-8.5	Slightly alkaline
>8.5	Alkaline

TDS (mg\L) :

Range	Class
500 – 1500	Maximum permissible
1500 – 2000	Slightly saline
>2000	Saline

Total Hardness (TH) (mg\L) :

Range	Class
0 – 75	Soft
75 – 150	Moderately soft
150 – 300	Hard
300 – 1000	Very Hard

Calcium Hardness (Ca) (mg\L):

Range	Class
0 – 75	Permissible
75 – 200	Maximum permissible
>200	Exceeding Level

Magnesium Harness (Mg) (mg\L):

Range	Class
0 – 75	Permissible
75-100	Maximum permissible
100-150	Exceeding Level

RESULTS AND DISCUSSIONS

4.1 Gurudwara and Narsimha jhara:

For sampling purpose we have selected 3 points such as spring water open well water and bore well water around the periphery. We have analyzed 10 samples from each sampling points. This description of sampling is given in table number 4.1
& the diagrammatic sketch is presented in figure no. 4.1

Table 4.1 Location of sampling points for Gurudwara and Narsimha jhara water:

Sl. No.	Location	Sample Code
1	Gurudwara spring water	GSW
2	Gurudwara open well water	GOW
3	Gurudwara bore well water	GBW
4	Narsimha jhara spring water	NSW
5	Narsimha jhara open well water	NOW
6	Narsimha jhara bore well water	NBW

4.2. Characteristics of Gurudwara spring water

Water samples collected from Gurudwara spring water and they are analyzed for the Following parameters and the results of the GSW are tabulated in the table 4.2 and the diagram showing the variation of different parameters are represented in figure 4.2 to 4.13.

4.2.1 pH (Hydrogen Ion Concentration):
The determination of the pH facilitates the broad and quick evaluation of the acidic/alkaline nature of water. The pH in study area ranges from 6.07 to 7.1. The mean value of pH is 6.66 and the standard deviation value is 0.414 coefficient of variation value is 0.0622. The bar diagram showing the pH variations in the days is as shown in Fig 4.4

4.2.2 Alkalinity:
The Alkalinity concentration in the lake water varying from a minimum value of 83.2 mg\L to a maximum value 99.3 mg\L, the mean value is 93.27 mg\L and the and the standard deviation value is 5.908 . And the coefficient of variation value is 0.063And bar diagram showing the concentration variations are shown in Fig 4.5

4.2.3 Dissolved Oxygen:

The dissolved oxygen concentration in the Lake water varying from minimum value of 6.8 mg\L to a maximum value of 7.89 mg\L, the mean value is 7.236 mg\L and the standard deviation value is 0.344. And the coefficient of variation value is 0.0475 and bar diagram showing the concentration variations are shown in Fig 4.6

4.2.4 Total Dissolved Solids:
The total dissolved solids in water under the study area has been found that it varies from minimum value of 110.5 mg/L and maximum values of 135 mg/L. The mean value is 119.75 mg/L and the standard deviation is 7.383. And the coefficient of variation value is 0.0616 the bar diagram showing the pH variations in the days is as shown in Fig 4.8.

4.2.5 Total Hardness:
The total hardness of the lake water ranges from a minimum value of 133 mg/L and the maximum value of 151.8 mg/L, the mean value being143.82 mg/L and the standard deviation is 6.237. And the coefficient of variation value is 0.043 the bar diagram showing the pH variations in the days is as shown in Fig.4.9.

4.2.6 Calcium Hardness:
The Calcium Hardness of the lake water ranges from a minimum value of 24mg/L, the maximum value of 40.3 mg/L, The mean value being 32.3 and standard deviation value is 4.59. And the coefficient of variation value is 0.142 and the bar diagram showing the concentration are as shown in Fig.4.10

4.2.7 Magnesium Hardness:
The Magnesium Hardness of the lake water ranges from a minimum value of13.5 mg/L, the maximum value of 29.3 mg/L, The mean value being 19.61 and standard deviation value is 4.31. And the coefficient of variation value is 0.219 and the bar diagram showing the concentration are as shown in Fig.4.11

4.2.8 Nitrate:
The Nitrate concentration in the lake water varying from a minimum value of 4.5 mg\L to a maximum value 7.1 mg\L, the mean value is 5.93 mg\L and the and the standard deviation value is 0.783. And the coefficient of variation value is 0.132 and bar diagram showing the concentration variations are shown in Fig 4.12

4.2.9 Chloride:
The Chloride concentration in the lake water varying from a minimum value of 89.9 mg\L to a maximum value of 138.5 mg\L, the mean value is 109.49 mg\L and the and the standard deviation value is 16.90. And the coefficient of variation value is 0.154 and bar diagram showing the concentration variations are shown in Fig 4.13

Table 4.2: Characteristics of Lake Water at Gurudwara spring water.

No of samples	pH	Alkalinity	DO	TDS	TH	Ca	Mg	NO_3	SO_4	Cl
1	6.73	98.5	6.92	115	136	24	13.5	5.6	4.1	89.9
2	6.95	98.9	7.50	126	145	30.4	29.3	5.2	4.2	109.6
3	6.08	98.5	6.80	113	150.8	28.8	23.5	6.1	4.5	93.4
4	6.92	99.3	7.00	118	151.8	33.6	18.9	4.5	4.1	91.5
5	6.85	95.2	7.89	120	149.2	34.2	19.8	5.9	4.2	105.7
6	7.00	91.3	7.12	119	143.7	36.8	15.6	6.5	4.4	101.5
7	6.09	93.7	7.52	126	141.7	29.8	18.2	6.8	4.5	114.6
8	6.07	83.2	7.26	115	133	30.4	19.4	5.4	4.7	115.8
9	7.10	85.5	6.93	110.5	140	34.7	19.8	7.1	4.6	134.4
10	6.85	88.6	7.42	135	147	40.3	18.1	6.2	4.9	138.5
Max	7.1	99.3	7.896	135	151.8	40.3	29.3	7.1	4.9	138.5
Min	6.07	83.2	6.8	110.5	133	24	13.5	4.5	4.1	89.5
Mean	6.664	93.27	7.236	119.75	143.82	32.3	19.61	5.93	4.42	109.49
SD	0.41463	5.90801	0.344034	7.3833	6.23766	4.5937	4.31186	0.78323	0.26998	16.9067
%CV	0.0622	0.0633	0.0475	0.0616	0.0433	0.1421	0.2198	0.132	0.0632	0.1544
Sum	66.44	932.7	72.36	1197.5	1438.2	323	196.1	59.3	44.2	1094.9

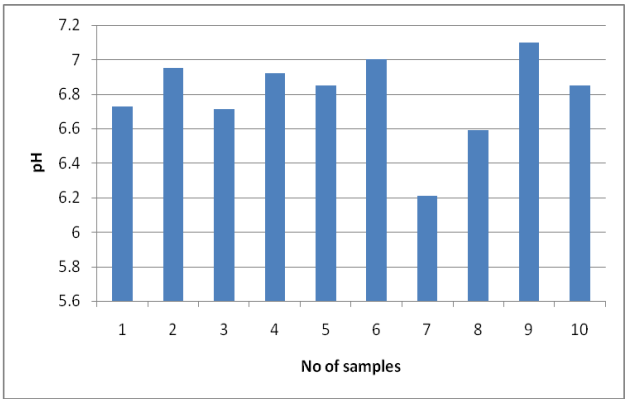


Fig.4.2 Showing the variations of pH at all the days.

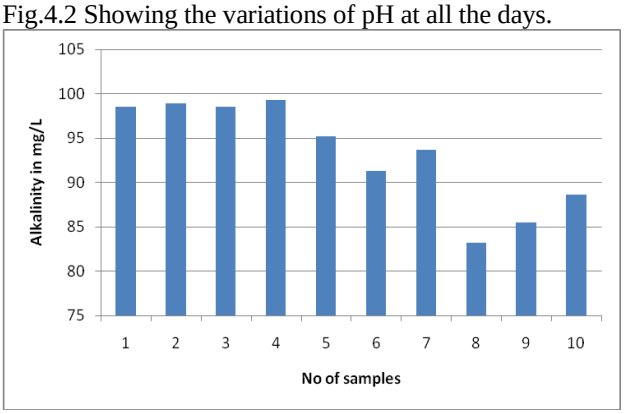


Fig.4.3 Showing the variations of Alkalinity at all the days.

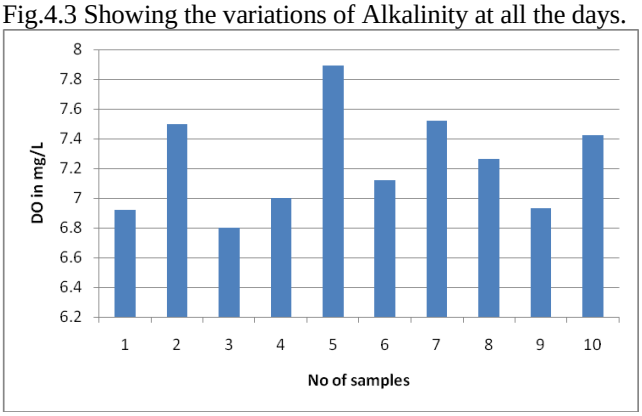


Fig.4.4 Showing the variations of DO at all the days

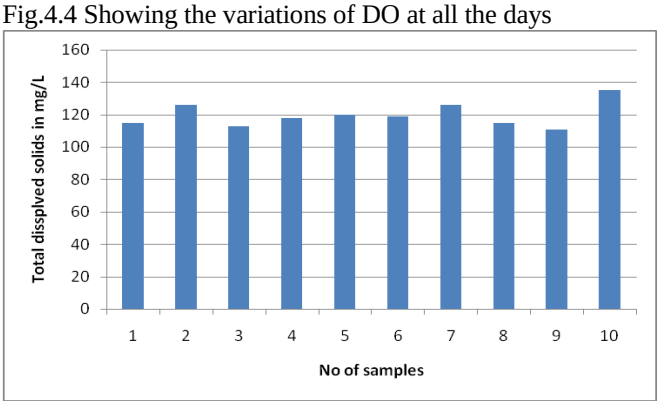


Fig.4.5 Showing the variations of TDS at all the days.

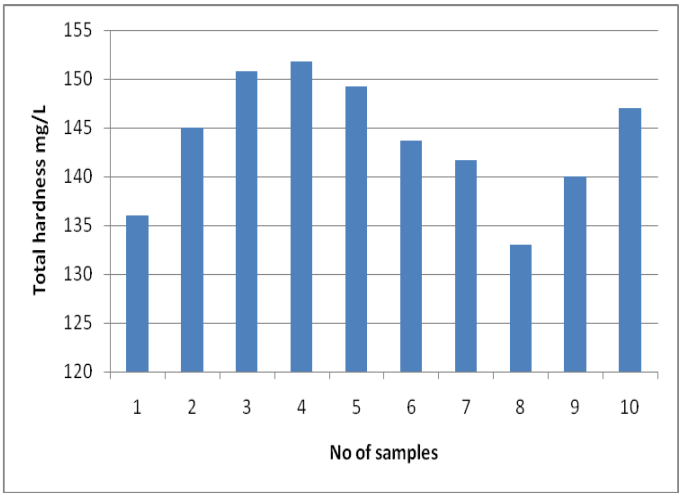


Fig.4.6 Showing the variations of TH at all the days.

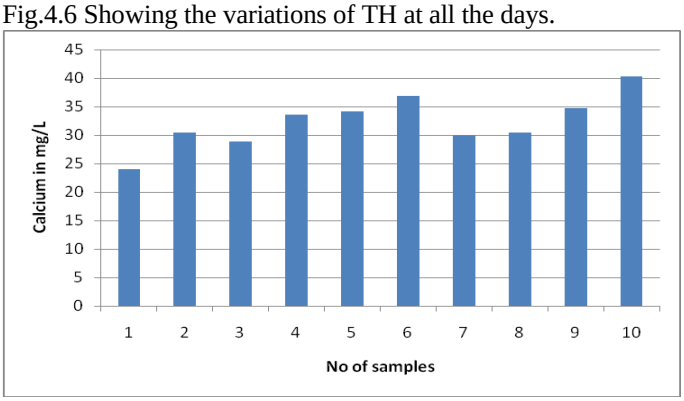


Fig.4.7 Showing the variations of Ca at all the days.

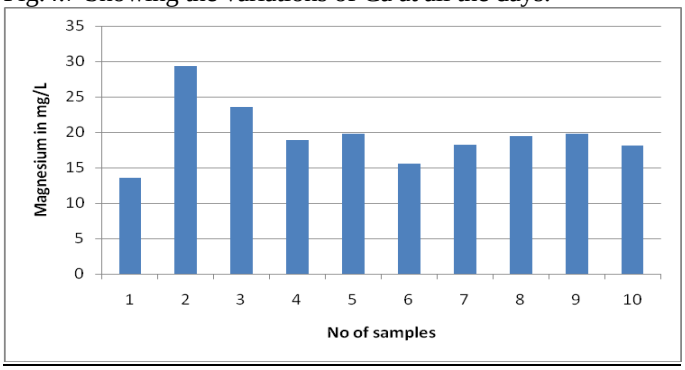


Fig.4.8 Showing the variations of Mg at all the days.

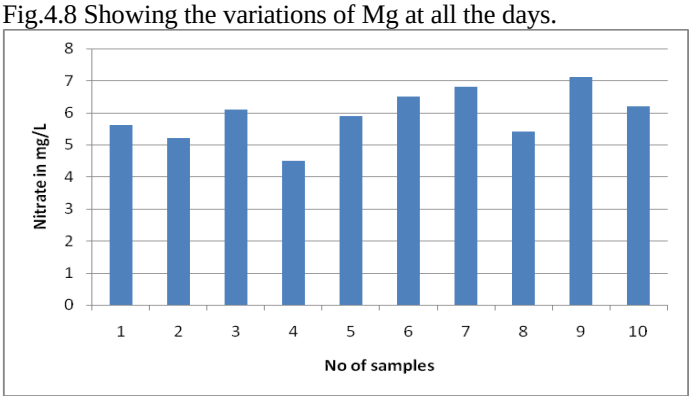


Fig.4.9 Showing the variations of NO3 at all the days.

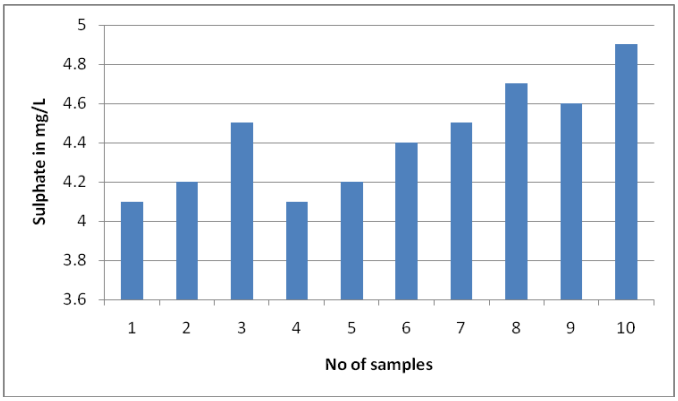


Fig.4.10 Showing the variations of So4 at all the days.

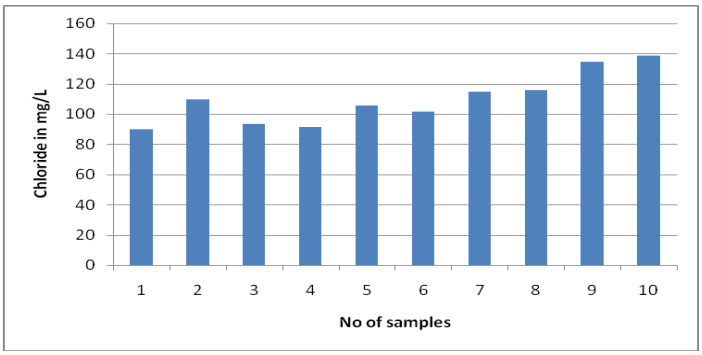


Fig.4.11 Showing the variations of Cl at all the days.

Correlation Analysis of Gurudwara spring water

Correlation co-efficient (r) between any two parameters, X and Y is calculated for parameters such as pH, TDS, TH, Ca, Mg, C1, SO_4, DO, NO_3, of the GSW.

The degree of line association between any two of the water quality parameters as measured by the simple correlation coefficient (r) is presented in Table 4.3 as 11x11 correlation matrix.

The positive correlation is found between Total dissolved Solids & Magnesium hardness as shown in Table 4.3 were observed and for the same regression equations were formed and regression lines are drawn as shown in Figure 4.12.

Table 4.3 Correlation Co-efficient of different parameters of Gurudwara spring water

Parameter	pH	TDS	TH	Ca	Mg	DO	No3	So4	Cl	Alkalinity
pH	1	-	-	-	-	-	-	-	-	-
TDS	0.228	1	-	-	-	-	-	-	-	-
TH	0.481	0.456	1	-	-	-	-	-	-	-
Ca	-0.041	0.122	0.338	1	-	-	-	-	-	-
Mg	0.043	**0.689**	0.118	0.284	1	-	-	-	-	-
DO	-0.046	-0.016	-0.192	0.246	-0.229	1	-	-	-	-
No3	-0.337	0.245	-0.264	0.454	-0.044	0.008	1	-	-	-
So4	0.154	0.403	-0.215	0.6	0.083	0.291	0.614	1	-	-
Cl	0.073	0.045	0.554	-0.441	0.236	-0.054	-0.466	-0.808	1	-
Alkalinity	-0.285	-0.351	0.136	-0.302	-0.132	-0.357	0.496	0.021	-0.224	1

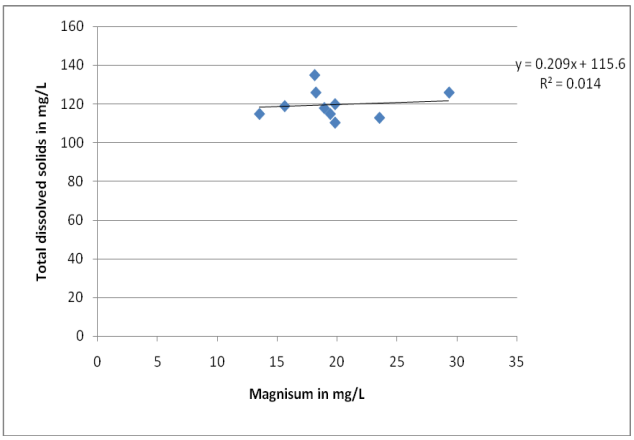


Fig. 4.12 Regression Line for TDS v/s Mg in mg\L at GSW.

4.4 Characteristics of Gurudwara open well water

Water samples collected from Gurudwara open well and they are analyzed for the Following parameters and the results of the GOW sample are tabulated in the table 4.4 and the diagram showing the variation of different parameters are represented in figure 4.27 to 4.39.

4.4.1 pH (Hydrogen Ion Concentration):
The determination of the pH facilitates the broad and quick evaluation of the acidic/alkaline nature of water. The pH in study area ranges from 6.04 to 7.2. The mean value of pH is 6.804 and the standard deviation value is 0.311 coefficient of variation value is 0.0458. The bar diagram showing the pH variations in the days is as shown in Fig 4.29

4.4.2 Alkalinity:
The Alkalinity concentration in the lake water varying from a minimum value of 69.2 mg\L to a maximum value 89.4 mg\L, the mean value is 74.99 mg\L and the and the standard deviation value is 7.040 . And the coefficient of variation value is 0.093 and bar diagram showing the concentration variations are shown in Fig 30

4.4.3 Dissolved Oxygen:
The dissolved oxygen concentration in the Lake water varying from minimum value of 6.04 mg\L to a maximum value of 8.8 mg\L, the mean value is 7.23 mg\L and the standard deviation value is 0.979. And the coefficient of variation value is 0.135 and the bar diagram showing the concentration variations are shown in Fig 4.31

4.4.4 Total Dissolved Solids:
The total dissolved solids in water under the study area has been found that it varies from minimum value of 118 mg/L and maximum values of 137 mg/L. The mean value is 127.14 mg/L and the standard deviation is 6.303. And the coefficient of variation value is 0.049. The bar diagram showing the pH variations in the days is as shown in Fig 4.33

4.4.5. Total Hardness:
The total hardness of the lake water ranges from a minimum value of 125 mg/L and the maximum value of 151 mg/L, the mean value being 138.05 mg/L and the standard deviation is 7.66. And the coefficient of variation value is 0.055. The bar diagram showing the pH variations in the days is as shown in Fig.4.34

4.4.6. Calcium Hardness:
The calcium Hardness of the lake water ranges from a minimum value of 35.05 mg/L, the maximum value of 58.3 mg/L, The mean value being 42.33 and standard deviation value is 7.484. And the coefficient of variation value is 0.176 and the bar diagram showing the concentration are as shown in Fig.4.35

4.4.7. Magnesium Hardness:
The Magnesium Hardness of the lake water ranges from a minimum value of 17.05 mg/L, the maximum value of 26.5 mg/L, The mean value being 20.68 and standard deviation value is 2.83. And the coefficient of variation value is 0.139 and the bar diagram showing the concentration are as shown in Fig.4.36

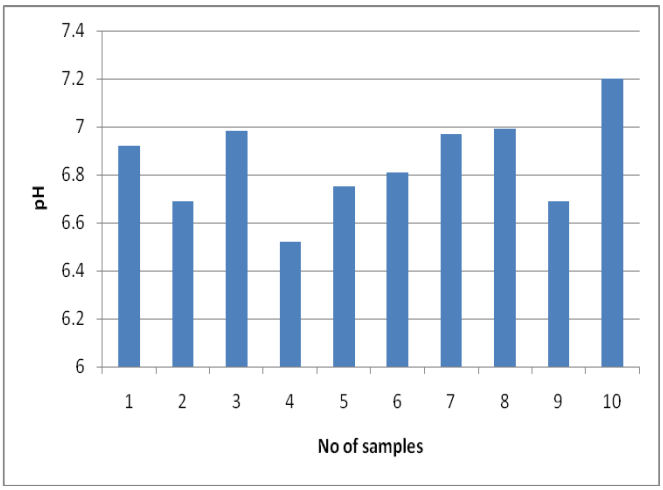
4.4.8 Nitrate:
The Nitrate concentration in the lake water varying from a minimum value of 3.5 mg\L to a maximum value 8.1 mg\L, the mean value is 5.82 mg\L and the and the standard deviation value is 1.518. And the coefficient of variation value is 0.261 and bar diagram showing the concentration variations are shown in Fig 4.37

4.4.9 Sulphate:
The Sulphate concentration in the lake water varying from a minimum value of 5.1 mg\L to a maximum value 7.9 mg\L, the mean value is 6.51 mg\L and the and the standard deviation value is 0.84. And the coefficient of variation value is 0.130 And bar diagram showing the concentration variations are shown in Fig 4.38

4.4.10 Chloride:
The Chloride concentration in the lake water varying from a minimum value of 87.4 mg\L to a maximum value of 143.5 mg\L, the mean value is 124.72 mg\L and the and the standard deviation value is 17.81. And the coefficient of variation value is 0.142 and bar diagram showing the concentration variations are shown in Fig 4.39

Table 4.4: Characteristics of Gurudwara openwell water

No of samples	pH	Alkalinity	DO	TDS	TH	Ca	Mg	No3	So4	Cl
1	6.92	85.9	8.45	122	138	35.05	17.05	3.5	5.1	132.5
2	6.69	69.2	7.8	118	151	58.3	23.5	5.8	5.8	124.5
3	6.98	71.5	7.85	118.8	142	49.6	20.9	4.5	5.9	143.5
4	6.04	70.5	8.8	128	138	46.9	20.6	3.9	6.1	137.8
5	6.75	69.8	7.14	129	135	43.9	21.3	6.5	6.3	126.3
6	6.81	75.6	6.04	125	137	40.1	21.3	7.1	6.5	98.6
7	6.97	73.2	7.12	128.6	141	40.9	26.5	6.9	6.9	87.4
8	6.99	74.6	6.12	137	128	35.9	17.5	5.1	7.1	132.5
9	6.69	70.2	6.15	130	125	36.5	18.3	8.1	7.5	128.5
10	7.2	89.4	6.87	135	145.5	36.2	19.9	6.8	7.9	135.6
Max	7.2	89.4	8.8	137	151	58.3	26.5	8.1	7.9	143.5
Min	6.04	69.2	6.04	118	125	35.05	17.05	3.5	5.1	87.4
Mean	6.804	74.99	7.234	127.14	138.05	42.335	20.685	5.82	6.51	124.72
SD	0.31199	7.0407	0.9790	6.3034	7.6683	7.4845	2.83255	1.51863	0.84912	17.811
%CV	0.0458	0.0938	0.1353	0.0495	0.0555	0.1767	0.1369	0.2609	0.1304	0.1428
Sum	68.04	749.9	72.34	1271.4	1380.5	423.35	206.85	58.2	65.1	1247.2



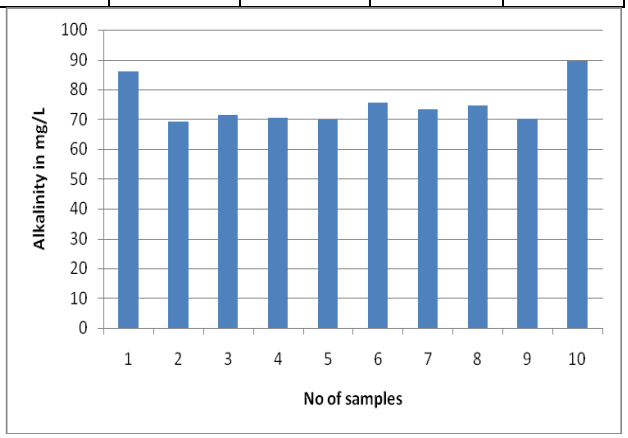


Fig.4.13 Showing the variations of pH at all the days.

Fig.4.14 Showing the variations of Alkalinity at all the days.

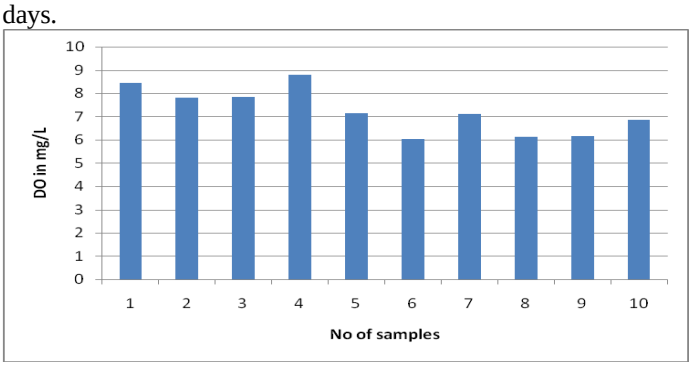


Fig.4.15 Showing the variations of DO at all the days.

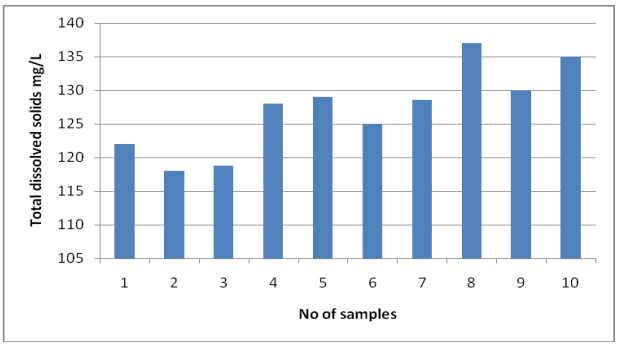


Fig.4.16 Showing the variations of TDS at all the days.

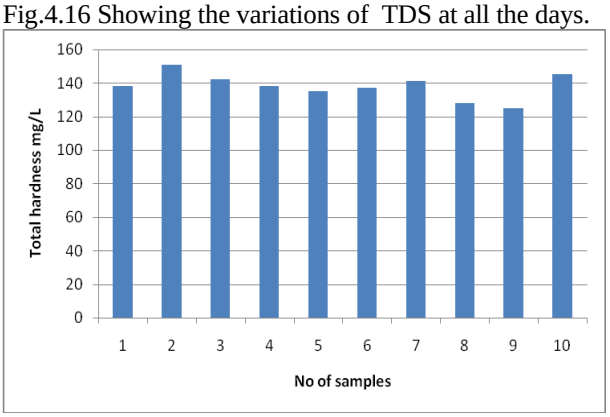


Fig.4.17 Showing the variations of TH at all the days.

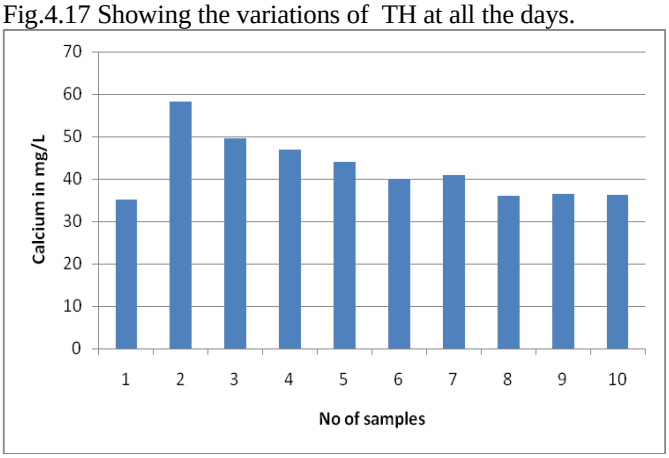


Fig.4.18 Showing the variations of Ca at all the days.

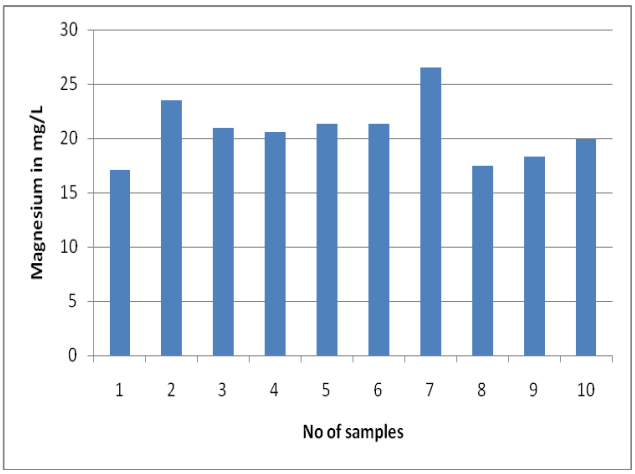


Fig.4.19 Showing the variations of Mg at all the days.

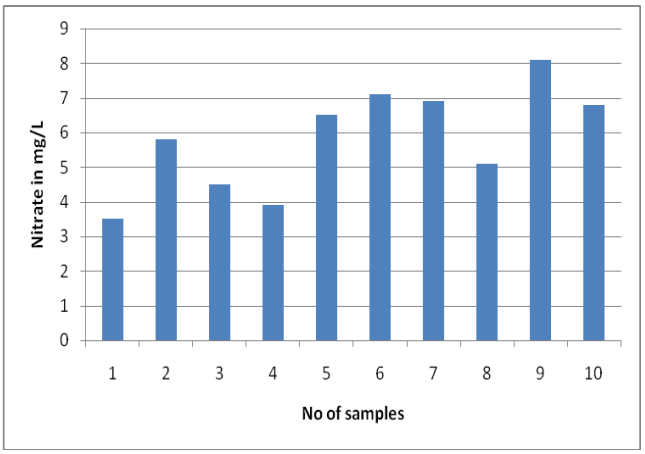


Fig.4.20 Showing the variations of NO3 at all the days.

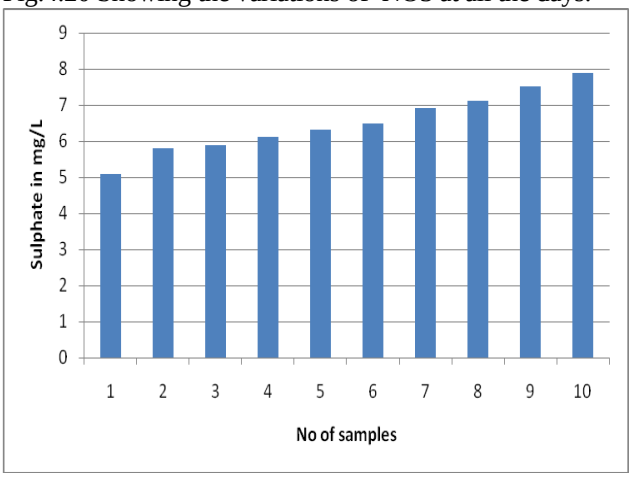


Fig.4.21 Showing the variations of SO4 at all the days.

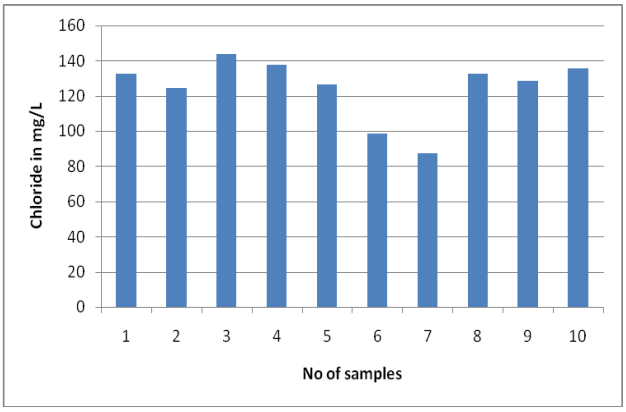


Fig.4.22 Showing the variations of Cl at all the days.

4.5 Correlation Analysis at Gurudwara open well water

Correlation co-efficient (r) between any two parameters, X and Y is calculated for parameters such as pH, TDS, TH, Ca, Mg, C1, SO_4, DO, NO_3, of the GOW.

The degree of line association between any two of the water quality parameters as measured by the simple correlation coefficient (r) is presented in Table 4.5 as 11x11 correlation matrix.

The highest positive correlation is found between Nitrate & Total dissolved solids, Nitrate & Dissolved Oxygen . shown in Table 4.5 were observed and for the same regression equations were formed and regression line are drawn as shown in Fig. 4.40 and Fig. 4.49.

Table 4.5: Correlation Co-efficient of different parameters of Gurudwara open well water

Parameter	pH	TDS	TH	Ca	Mg	DO	No3	So4	Cl	Alkalinity
pH	1	-	-	-	-	-	-	-	-	-
TDS	0.115	1	-	-	-	-	-	-	-	-
TH	-0.389	-0.678	1	-	-	-	-	-	-	-
Ca	-0.042	-0.280	0.560	1	-	-	-	-	-	-
Mg	-0.458	**-0.539**	0.495	0.458	1	-	-	-	-	-
DO	0.261	0.333	-0.194	-0.194	0.306	1	-	-	-	-
No3	0.313	**0.794**	-0.460	-0.460	-0.008	**0.728**	1	-	-	-
So4	-0.137	-0.006	0.093	0.093	-0.662	0.382	-0.521	1	-	-
Cl	0.552	0.261	-0.596	-0.596	-0.380	0.019	-0.137	0.151	1	-
Alkalinity	0.074	0.494	-0.152	-0.152	0.411	-0.121	0.351	0.655	-0.226	1

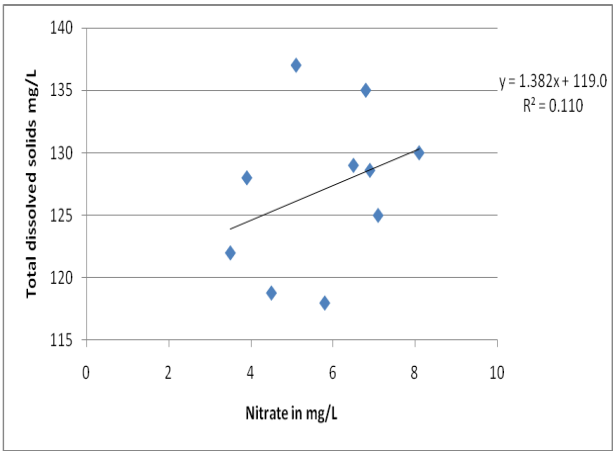


Fig. 4.23 Regression Line for No3 v/s TDS in mg\L at GOW.

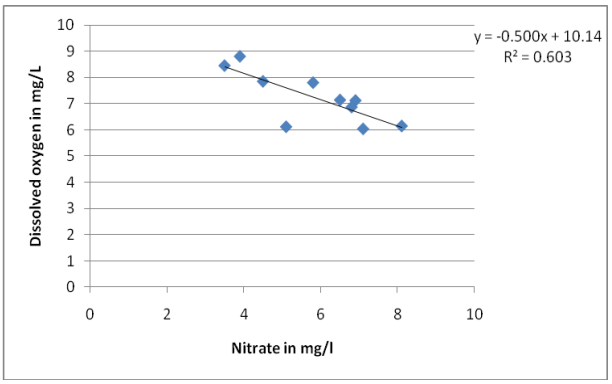


Fig. 4.24 Regression Line for No3 v/s DO in mg\L at GOW.

4.6 Characteristics of Gurudwara bore well water

Water samples collected from Gurudwara bore well water and they are analyzed for the Following parameters and the results of the GBW sample are tabulated in the table 4.6 and the diagram showing the variation of different parameters are represented in figure 4.50 to 4.62.

4.6.1. pH (Hydrogen Ion Concentration):
The determination of the pH facilitates the broad and quick evaluation of the acidic/alkaline nature of water. The pH in study area ranges from 7.12 to 7.63 . The mean value of pH is 7.41 and the standard deviation value is 0.18 coefficient of variation value is 0.025. The bar diagram showing the pH variations in the days is as shown in Fig 4.52

4.6.2. Alkalinity:
The Alkalinity concentration in the lake water varying from a minimum value of 72.3 mg\L to a maximum value 91.5 mg\L, the mean value is 82.78 mg\L and the and the standard deviation value is 7.78 . And the coefficient of variation value is 0.094 And bar diagram showing the concentration variations are shown in Fig 4.53

4.6.3. Dissolved Oxygen :
The dissolved oxygen concentration in the Lake water varying from minimum value of 5.18 mg\L to a maximum value of 7 mg\L, the mean value is 6.11 mg\L and the standard deviation value is 0.566. And the coefficient of variation value is 0.092 And bar diagram showing the concentration variations are shown in Fig 4.54

4.6.4 Total Dissolved Solids:
The total dissolved solids in water under the study area has been found that it varies from minimum value of 118 mg/L and maximum values of 145 mg/L. The mean value is 132.32 mg/L and the standard deviation is 7.688. And the coefficient of variation value is 0.058 The bar diagram showing the pH variations in the days is as shown in Fig 4.56.

4.6.5. Total Hardness:
The total hardness of the lake water ranges from a minimum value of 124.4 mg/L and the maximum value of 142 mg/L, the mean value being 135.5 mg/L and the standard deviation is 6.17. And the coefficient of variation value is 0.045 The bar diagram showing the pH variations in the days is as shown in Fig.4.57

4.6.6 Calcium Hardness:
The Calcium Hardness content in the various days varies from 29.5 mg/L as minimum and maximum being 39.3 mg/L. The mean value being 33.51 mg/L and its standard deviation from the mean value is 3.03. And the coefficient of variation value is 0.0906 And the bar diagram showing the concentration variation are in Fig.4.58

4.6.7 .Magnesium Hardness:
The Magnesium Hardness of the lake water ranges from a minimum value of 15.1 mg/L, the maximum value of 23.4 mg/L, The mean value being 19.23 and standard deviation value is 2.26. And the coefficient of variation value is 0.117 And the bar diagram showing the concentration are as shown in Fig.4.59

4.6.8. Nitrate:
The Nitrate concentration in the lake water varying from a minimum value of 4.8 mg\L to a maximum value 8.1 mg\L, the mean value is 6.24 mg\L and the and the standard deviation value is 0.931. And the coefficient of variation value is 0.149 And bar diagram showing the concentration variations are shown in Fig 4.60

4.6.9 Sulphate:

The Sulphate concentration in the lake water varying from a minimum value of 7.2 mg\L to a maximum value 9.4 mg\L, the mean value is 8.41 mg\L and the and the standard deviation value is 0.703. And the coefficient of variation value is 0.083 And bar diagram showing the concentration variations are shown in Fig 4.61

4.6.10 Chloride :

The Chloride concentration in the lake water varying from a minimum value of 129.6 mg\L to a maximum value of 148.6 mg\L, the mean value is 138.59 mg\L and the and the standard deviation value is 5.391. And the coefficient of variation value is 0.038 And bar diagram showing the concentration variations are shown in Fig 4.62

Table 4.6: Characteristics of Gurudwara bore well water

No of samples	pH	Alkalinity	DO	TDS	TH	Ca	Mg	No3	So4	Cl
1	7.12	72.4	6.98	128.6	127	37.2	17.4	4.8	7.2	143.5
2	7.43	73.3	7	118	124.4	32.8	18.3	5.6	7.8	135.5
3	7.63	78.7	5.99	140	131	33.1	19.2	8.1	9.1	136.5
4	7.18	72.3	6.12	145	135	39.3	23.4	5.9	8.5	129.6
5	7.58	88.1	5.89	125.8	142	33.6	20.3	6.5	7.8	134
6	7.45	85.3	5.18	138	139	34.7	18	5.8	8.9	136.5
7	7.53	87.6	5.48	135	137	29.8	21.4	5.7	9.4	141.2
8	7.58	91.5	6.12	132	140.6	29.5	19.6	6.5	7.9	148.6
9	7.16	90.4	6.55	129	137	31.5	15.1	6.2	8.6	138.7
10	7.54	88.2	6.18	131.8	142	33.6	19.6	7.3	8.9	141.8
Max	7.63	91.5	7	145	142	39.3	23.4	8.1	9.4	148.6
Min	7.12	72.3	5.18	118	124.4	29.5	15.1	4.8	7.2	129.6
Mean	7.41	82.78	6.116	132.32	135.5	33.51	19.23	6.24	8.41	138.59
SD	0.18708	7.785	0.56670	7.6884	6.1754	3.03917	2.26816	0.93119	0.70309	5.39144
%CV	0.0252	0.094	0.0926	0.0581	0.0455	0.0906	0.1179	0.14292	0.0836	0.0389
Sum	7.41	827.8	61.16	1323.2	1355	335.1	192.3	62.4	84.1	1385.9

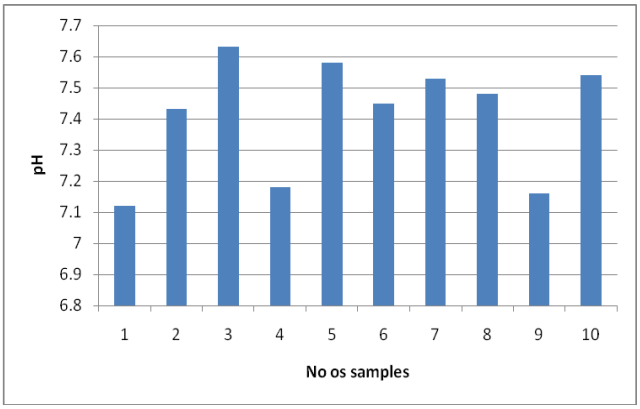


Fig.4.25 Showing the variations of pH at all the days.

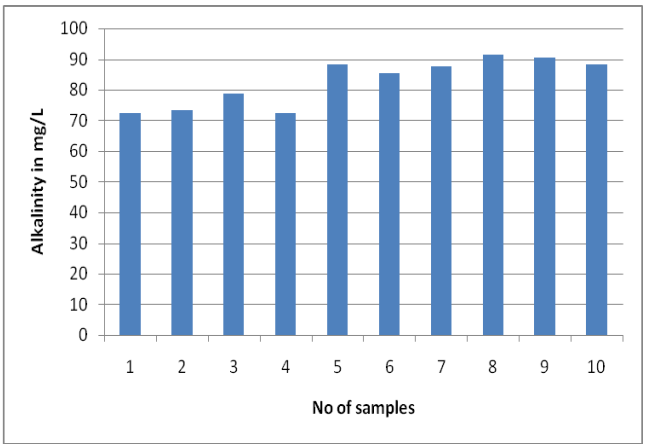


Fig.4.26 Showing the variations of Alkalinity at all the days.

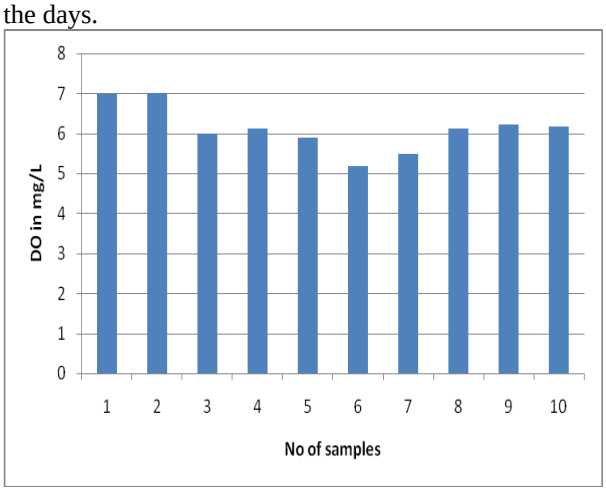


Fig.4.27 Showing the variations of DO at all the days

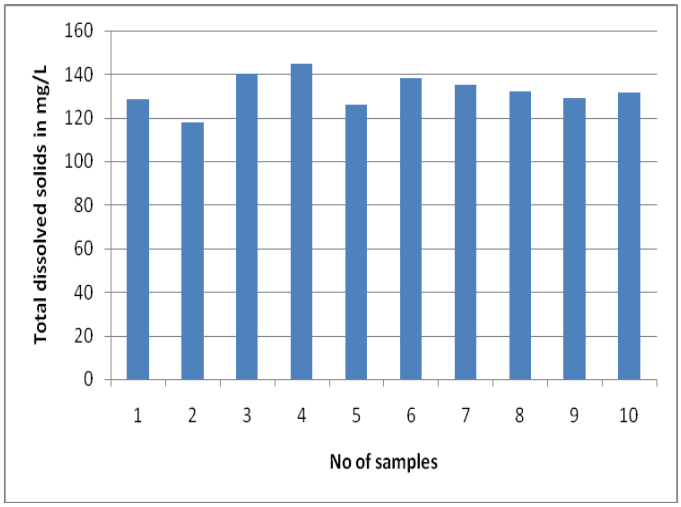


Fig.4.28 Showing the variations of TDS at all the days.

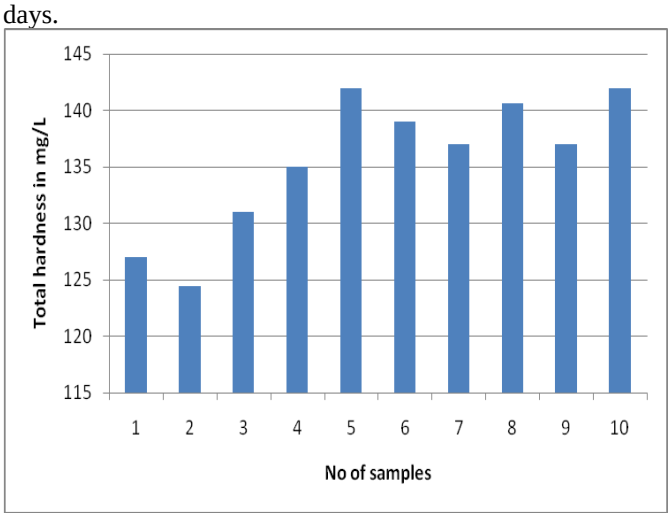


Fig.4.29 Showing the variations of TH at all the days.

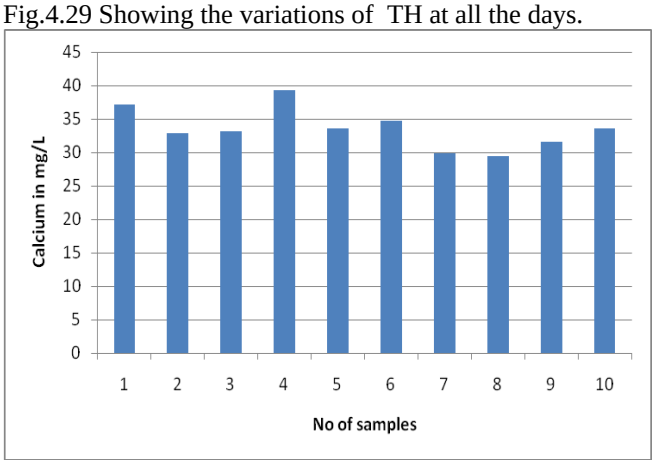


Fig.4.30 Showing the variations of Ca at all the days.

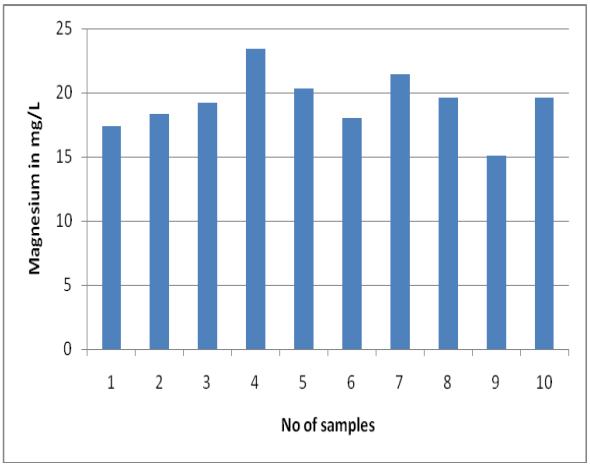


Fig.4.31 Showing the variations of Mg at all the days.

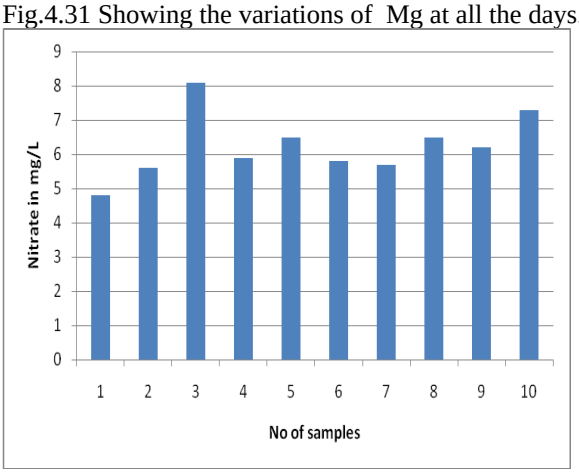


Fig.4.32 Showing the variations of NO3 at all the days.

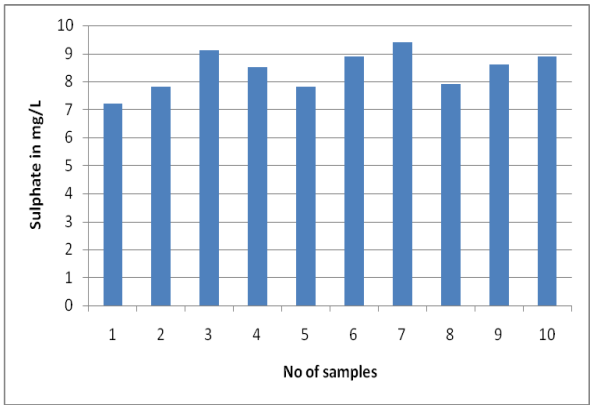


Fig.4.33 Showing the variations of SO4 at all the days.

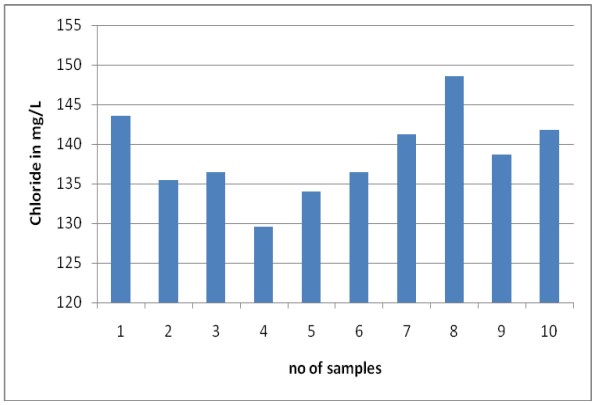


Fig.4.34 Showing the variations of Cl at all the days.

4.7 Correlation Analysis at Gurudwara Bore Well water

Correlation co-efficient (r) between any two parameters, X and Y is calculated for parameters such as pH, TDS, TH, Ca, Mg, C1, SO_4, DO, HCO_3, NO_3, of the GBW.

The degree of line association between any two of the water quality parameters as measured by the simple correlation coefficient (r) is presented in Table 4.7 as 11x11 correlation matrix.

The highest positive correlation is found between Chlorine & Total hardness (Cl & TH) shown in Table 4.7 were observed and for the same regression equations were formed and regression line are drawn as shown in Fig.4.63andFig.4.75. **Table 4.7: Correlation Co-efficient of different parameters of Gurudwara bore well water**

Parameter	pH	TDS	TH	Ca	Mg	DO	No3	So4	Cl	Alkalinity
pH	1	-	-	-	-	-	-	-	-	-
TDS	0.348	1	-	-	-	-	-	-	-	-
TH	-0.519	0.337	1	-	-	-	-	-	-	-
Ca	0.274	0.497	0.222	1	-	-	-	-	-	-
Mg	-0.452	-0.579	-0.689	0.235	1	-	-	-	-	-
DO	0.651	0.285	0.360	-0.273	0.108	1	-	-	-	-
No3	0.410	0.583	0.359	-0.272	0.226	-0.717	1	-	-	-
So4	0.073	-0.226	0.151	-0.566	-0.325	0.121	-0.036	1	-	-
Cl	0.406	-0.052	**0.829**	-0.727	-0.182	-0.562	0.343	0.345	1	-
Alkalinity	0.121	0.500	-0.390	0.183	0.342	-0.146	-0.048	0.304	0.066	1

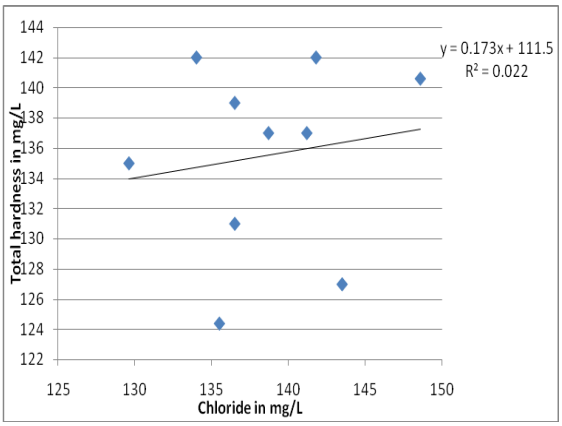


Fig. 4.35 Regression Line for Cl v/s TH in mg\L at GBW.

4.8 Characteristics of Narsimha jhara spring water

Water samples collected from Narsimha jhara spring water and they are analyzed for the Following parameters and the results of the NSW sample are tabulated in the table 4.8 and the diagram showing the variation of different parameters are represented in figure 4.76 to 4.88.

4.8.1 pH (Hydrogen Ion Concentration):
The determination of the pH facilitates the broad and quick evaluation of the acidic/alkaline nature of water. The pH in study area ranges from 7.65 to 7.96. The mean value of pH is 7.80 and the standard deviation value is 0.09 coefficient of variation value is 0.011. The bar diagram showing the pH variations in the days is as shown in Fig 4.78

4.8.2. Alkalinity:
The Alkalinity concentration in the lake water varying from a minimum value of 85.27 mg\L to a maximum value 106.2mg\L, the mean value is 96.16 mg\L and the and the standard deviation value is 6.50 . And the coefficient of variation value is 0.067 And bar diagram showing the concentration variations are shown in Fig 4.79

4.8.3. Dissolved Oxygen:
The dissolved oxygen concentration in the Lake water varying from minimum value of 6.81 mg\L to a maximum value of 8.37 mg\L, the mean value is 7.77 mg\L and the standard deviation value is 0.57. And the coefficient of variation value is 0.073 and bar diagram showing the concentration variations are shown in Fig 4.80

4.8.4. Total Dissolved Solids:
The total dissolved solids in water under the study area has been found that it varies from minimum value of 290 mg/L and maximum values of 304 mg/L. The mean value is 297.83 mg/L and the standard deviation is 4.46. And the coefficient of variation value is 0.014 the bar diagram showing the TDS variations in the days is as shown in Fig 4.82

4.8.5. Total Hardness:
The total hardness of the lake water ranges from a minimum value of 135.34 mg/L and the maximum value of 168.57 mg/L, the mean value being152.63 mg/L and the standard deviation is 10.33. And the coefficient of variation value is 0.067 The bar diagram showing the TH variations in the days is as shown in Fig.4.83

4.8.6. Calcium Hardness:
The Calcium Hardness content in the various days varies from 101.51mg/L as minimum and maximum being 126.42 mg/L. The mean value being 114.47 mg/L and its standard deviation from the mean value is 7.74. And the coefficient of variation value is 0.067 And the bar diagram showing the concentration variation are in Fig.4.84

4.8.7 Magnesium Hardness:
The Magnesium Hardness of the lake water ranges from a minimum value of 33.84 mg/L, the maximum value of 42.14 mg/L, The mean value being 38.15 and standard

deviation value is 4.25. And the coefficient of variation value is 0.067 And the bar diagram showing the concentration are as shown in Fig.4.85

4.8.8 Nitrate:
The Nitrate concentration in the lake water varying from a minimum value of 0.72 mg\L to a maximum value 0.91 mg\L, the mean value is 0.80 mg\L and the and the standard deviation value is 0.05. And the coefficient of variation value is 0.062 And bar diagram showing the concentration variations are shown in Fig 4.86

4.8.10 Chloride :
The Chloride concentration in the lake water varying from a minimum value of 188.93 mg\L to a maximum value of 209.15 mg\L, the mean value is 197.24 mg\L and the and the standard deviation value is 5.86. And

4.8.9. Sulphate:
The Sulphate concentration in the lake water varying from a minimum value of 2.77 mg\L to a maximum value 3.65 mg\L, the mean value is 3.37 mg\L and the and the standard deviation value is 0.28. And the coefficient of variation value is 0.083 And bar diagram showing the concentration variations are shown in Fig 4.87

the coefficient of variation value is 0.029 And bar diagram showing the concentration variations are shown in Fig. 4.88

Table 4.8: Characteristics of Narsimha jhara spring water

No of samples	pH	Alkalinity	DO	TDS	TH	Ca	Mg	No3	So4	Cl
1	7.1	89.4	6.75	493.6	292.5	115.6	87.5	10.5	30.15	100.6
2	7.18	108.3	6.12	336.5	316.4	109.4	98.7	10.5	41.5	140.1
3	7.16	98.3	5.18	428.5	284.8	117.25	69.25	10.6	45.6	150.4
4	7.15	96.4	5.89	410.5	260.5	96.4	67.7	5.6	54.2	134.4
5	7.19	102.7	4.89	363.5	289.7	97.2	89.8	6.5	57.36	162.3
6	7.11	109.1	6.75	298.5	252.6	85.4	58.1	6.8	45.8	130.5
7	7.13	110.4	7.1	260.5	224.5	85.8	64.3	7.1	61.6	110.5
8	7.2	112.3	7.5	193.8	264.2	87.8	64.1	10.5	59.4	90.8
9	7.14	124.6	6.89	198.1	276.9	86.6	65.7	11.1	58.4	99.4
10	7.6	104.9	6.74	210.4	265.4	92.4	68.1	11.6	45.4	101.5
Max	7.6	124.6	7.5	493.6	316.4	117.25	98.7	11.6	61.6	162.3
Min	7.1	89.4	4.89	193.8	224.5	85.4	58.1	5.6	30.15	90.8
Mean	7.196	105.64	6.381	319.39	272.75	97.385	73.325	9.08	49.941	122.05
SD	0.1456	9.762308	0.84354	104.9135	25.29028	12.39471	13.53303	2.27732	9.942542	24.67321
%CV	0.0202	0.0924	0.1321	0.3284	0.0927	0.1272	0.1845	0.2508	0.199	0.2021
Sum	71.96	1056.4	63.81	3193.9	2727.5	973.85	733.25	90.8	499.41	1220.5

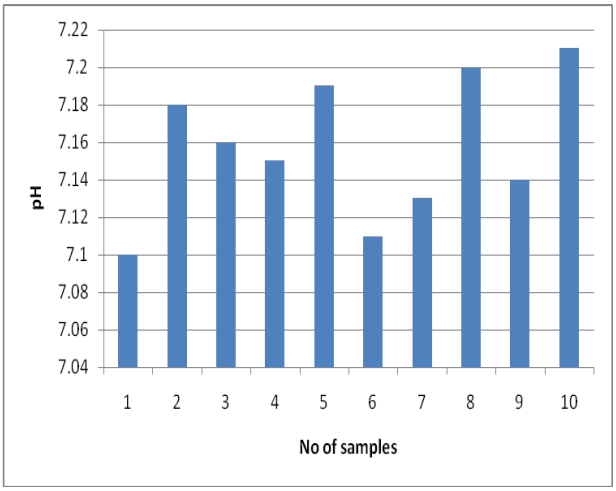


Fig.4.36 Showing the variations of pH at all the days.

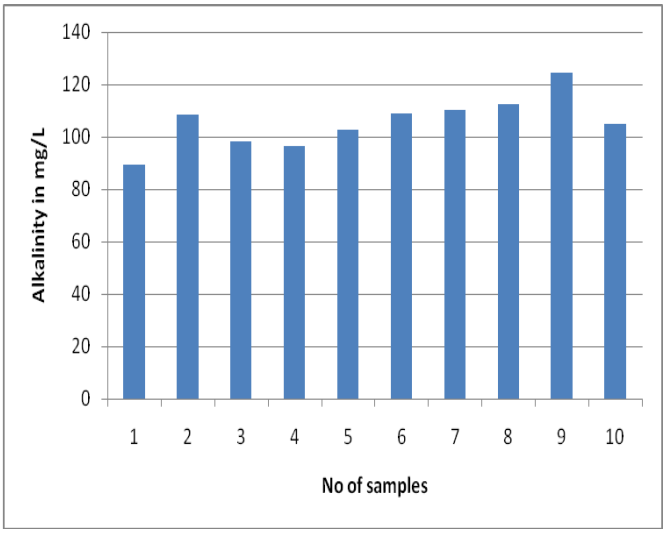


Fig.4.37 Showing the variations of Alkalinity at all the days.

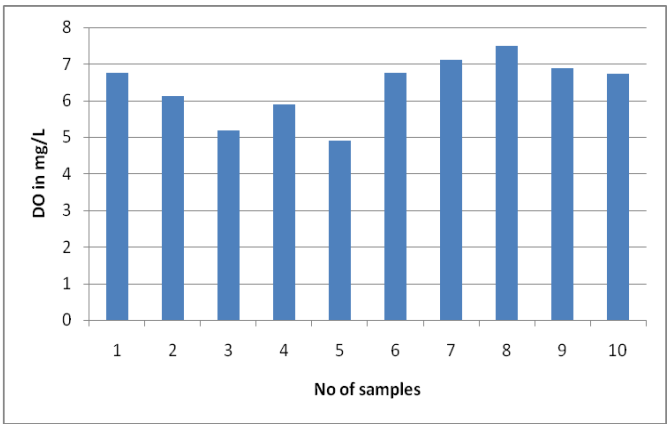


Fig.4.38 Showing the variations of DO at all the days.

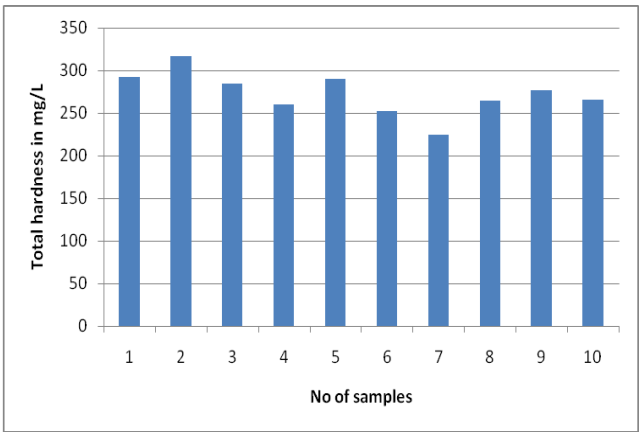


Fig.4.40 Showing the variations of TH at all the days.

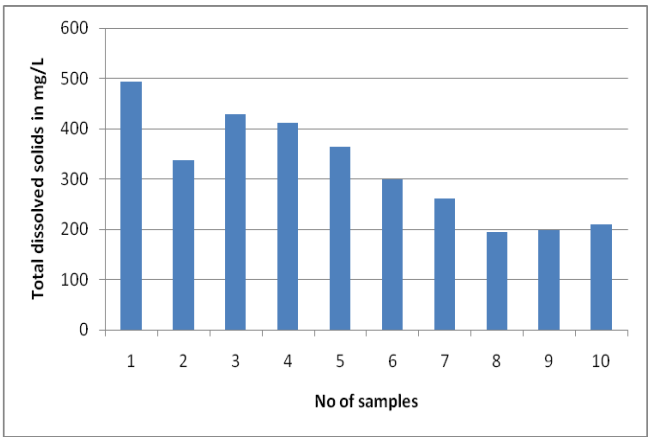


Fig.4.39 Showing the variations of TDS at all the days.

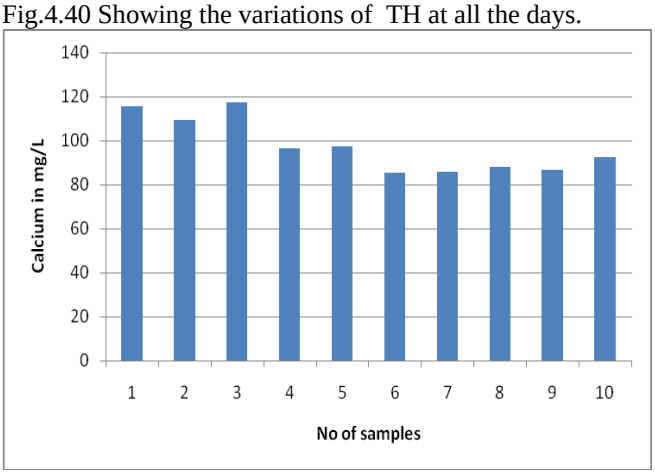


Fig.4.41 Showing the variations of Ca at all the days.

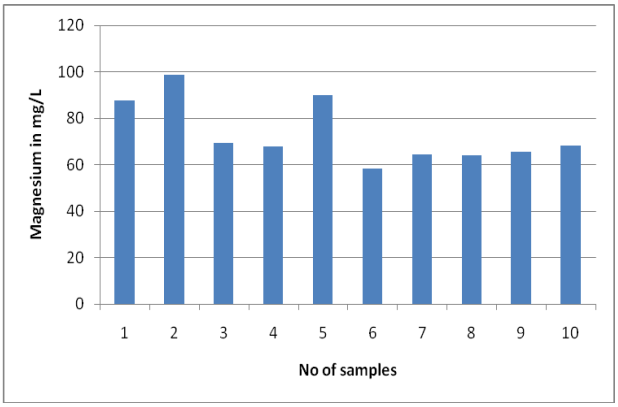


Fig.4.42 Showing the variations of Mg at all the days.

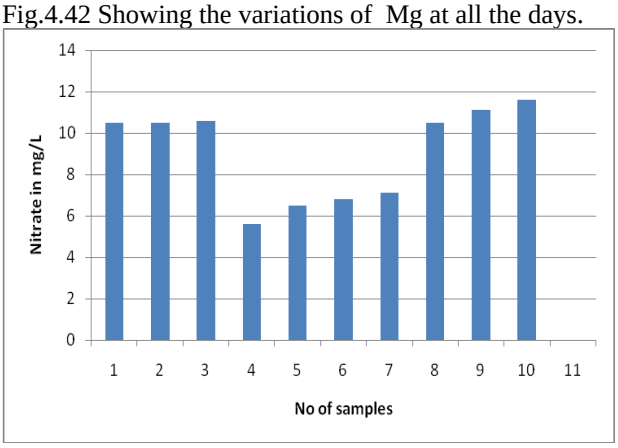


Fig.4.43 Showing the variations of NO3 at all the days.

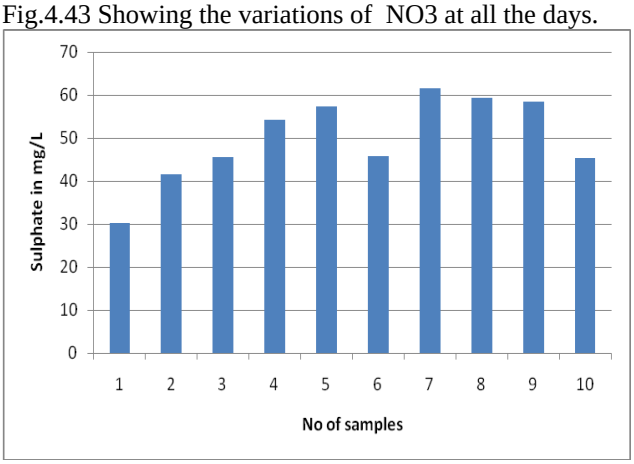


Fig.4.44 Showing the variations of SO4 at all the days.

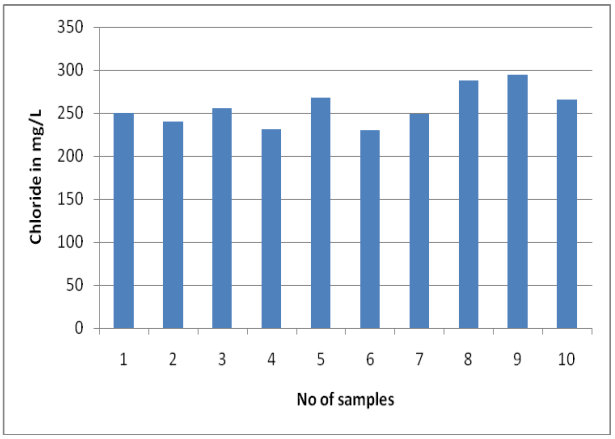


Fig.4.45 Showing the variations of Cl at all the days.

4.9 Correlation Analysis at Narsimha jhara spring water

Correlation co-efficient (r) between any two parameters, X and Y is calculated for parameters such as pH, TDS, TH, Ca, Mg, C1, SO_4, DO, HCO_3, NO_3, of the NSW.

The degree of line association between any two of the water quality parameters as measured by the simple correlation coefficient (r) is presented in Table 4.9 as 11x11 correlation matrix.

The highest positive correlation is found between Total hardness Total Dissolved solids , Total hardness & Calcium hardness as shown in Table 4.9 were observed and for the same regression equations were formed and regression line are drawn as shown in Fig. 4.89 to Fig. 4.100.

Table 4.9: Correlation Co-efficient of different parameters of Narsimha jhara spring water

Parameter	pH	TDS	TH	Ca	Mg	DO				
pH	1	-	-	-	-	-				
TDS	-0.027	1	-	-	-	-				
TH	-0.139	**0.806**	1	-	-	-				
Ca	-0.072	0.483	**0.816**	1	-	-				
Mg	0.077	-0.594	-0.469	-0.534	1	-				
DO	0.402	-0.245	0.437	0.312	0.137	1				
No3	-0.056	-0.604	-0.543	-0.720	-0.453	0.094				
So4	-0.222	0.514	0.347	0.381	0.391	-0.917	-0.488	1	-	-
Cl	0.022	-0.864	-0.226	-0.699	-0.359	0.440	0.189	0.615	1	-
Alkalinity	-0.141	-0.558	-0.144	-0.442	-0.214	0.267	-0.028	0.334	0.05	1

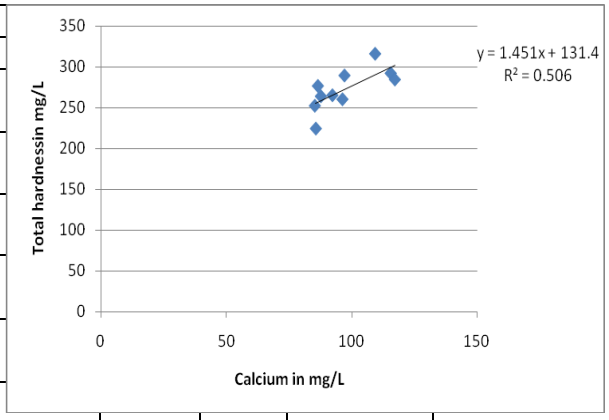


Fig. 4.47 Regression Line for TH v/s Ca in mg\L at NSW.

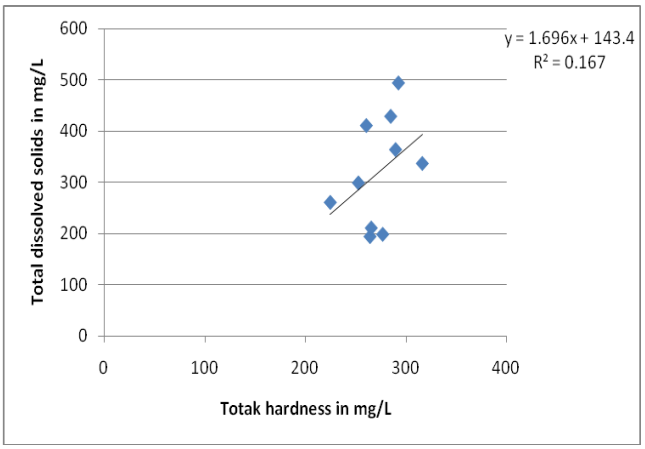


Fig. 4.46 Regression Line for TH v/s TDS in mg\L at NSW.

III. CONCLUSIONS

After the careful study of analysis interpretation and discussion of the numerical data following conclusion have been drawn.

1. The Physico-chemical characteristics are found moderate in Narsimha jhara water where as Gurudwara water are low. But there is no found high characteristics.

2. The Physico-chemical Characteristics of Bidar ground water different sampling points were analysized and found all the values are within the permissible limits.
3. The pH in Bidar water is in between 6.04 to 7.63
4. The DO in Bidar water varies from 4.89 to 8.8 mg/L.
5. As study of all the aspects Bidar water quality is good for drinking.
6. Gurudwara bore well water, water quality index is 32.03 have a good quality of water and high water quality index found in Narsimha jhara open well water.

7. Factor analysis has Narsimha jhara water has shown that So4 is rich in water.

8. Factor analysis for Guradwara water has shown that Ca and Mg is in moderate value.
9. The quality of water of Gurudwara and Narsimha jhara water is good and water also suitable for drinking.
10.

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