The Lighthouse Journal of Natural Sciences, Vol. 01, Issue 02, Winter 2022, pp. 35-48

Water Analysis Collected from Different Areas of Charsadda District Khyber Pakhtunkhwa (Pakistan) for Microbial Risk Assessment and Different Constituents in Water Bodies

Roohul Amin[1], Tauheed Ullah[2], Muhammad Haris[2], Qazi Muhammad Sharif [3], Muhammad Sajjad[1], Hussain Gulab[4], Sana Ullah[4]

ABSTRACT

In this research work five water samples are collected from different places of district Charsadda (KP), Naguman River, Sardaryab, Arat area Prang, charasadda bazar, and one sample is collected form district malakand. The purpose of research is the study of different organic and inorganic impurities present in these water samples. Initially pH, conductance, alkalinity, sulphate and chloride contents are determined in all samples and it is found that sample S4 collected from Charsadda bazaar has the worst results than other. The same sample S4 along with other samples were analyzed for the presence of biological impurities and sample S4 was declared as the worst once again. In the result of our finding, we conclude that sample S4 is the worst one which may be due to the anthropogenic activity such as entry of municipal waste in water bodies below earth surface.

Keywords: *Quantitative analysis, microbial risk assessment, censored data, acidity of water, waterborne disease*

INTRODUCTION

The provision of health effectiveness water supply system, along with administrative regulations and laws regarding security and check on drinking-water supply is considered first and foremost duty of Government. The basic and important aim of good system of water supply is the proper intake, treatment and delivery of pure and healthy water to inhabitants at appropriate and suitable quality and quantity [1, 2]. The network of water-supply is functional, it is possible that components of the system will fail, leave the obligation and function to provide supply of water to public. These failures result in a lack of water supply in good way and sometime also cause health problems.

[1] Department of Chemistry GC Peshawar , University of Peshawar
Corresponding Author's Email: roohulamin1947@gmail.com
[2] Department of Chemistry GPGC Charsadda, Bacha Khan University Charsadda
[3] PCSIR Laboratories Complex, Peshawar , 25120
[4] Department of Chemistry Bacha Khan University Charsadda

Manuscript Received: May 06, 2022
Manuscript Accepted: 29 Nov, 2022

Divya Bhardwaj and Neetu Verma stated that water in limited natural resource, therefore, its preservation is vital for conservation and safety of our natural environment [3]. Many water quality methods for monitoring are used to measure its concentration. Water quality can be determined through quality index which is analyzed through [4] different methods such as pH level, Turbidity, Conductivity, dissolved oxygen (DO) methods. The impact of water quality parameters are given along description that how water can be used on basis of various parameters. Murthal Sonepat described the water Quality Index (WQI) for quality determination of drinking water for different aims [5]. The WQI predicts the suitability of water for drinking and industrial purposes as well as for aquatic organisms. It can be measured from 0 to 100. The higher value of WQI shows better quality of water. WQI values may be affected by various water quality parameters like dissolved oxygen (DO), turbidity, pH level and electrical conductivity [6].

Jean-Claude described the treatment processes for different types of waste waters, such as industrial, municipal and agricultural including residuals managements. This controlling and assessment of quality is based on various methods such as chemical, physical and biological [7]. The waste management of solid and hazardous materials include the source characterization which effects and control the gaseous emissions [8].

According to Jerry L. Wilhm and Troy C. Dorris (1968) the foundation of water quality criteria by examination of the benthic macro invertebrate community as reflected in the diversity index, $d=-\Sigma (ni/n) \log2 (ni/n)$, is proposed [9]. The index expressed the relative influence of each component collected is independent of sample size and dimensions.

According to A. Vogelpohl, S.-U.Geissen (1997) the hydroxyl radicals are the major oxidants which govern the advanced oxidation processes (AOPs) used in water technology and also applicable for cloud water. The effectiveness of various hydroxyl groups are quantified for calibration. The generalization of results depends on governing the lifetime of hydroxyl groups. The connection between climatic hydrological and QWI parameters of concerned River Mekong was observed by L.Prathumratana and S.Sthiannopka in their study. This river is passing via four countries/areas (Cambodia, Thailand, Vietnam and Lao PDR) [10].

The secondary data of this research done on river Mekong for hydrological and climatic study is based on parameters such as precipitation, evaporation, average air temperature, mean water level and discharge ratio of flow. The parameters for water quality are included TSS, conductivity, pH, alkalinity, presence of radicals such as PO_4^{3-}, NO^{3-}, SO_4^{2-},TP , DO, COD and metals like Ca, Cl, Fe, Mg, Na, K, and Si. This relationship of different parameters was determined by using Pearson's correlation method. The precipitation range (0.375- 0.661), air temperature range (0.515–0.621), discharge flow range (0.526–0.659) with weak negative correlation of evaporation in the range of (0.169–0.468), the values for these parameters are noted [11]. The relationship of QWI showed that five parameters have precipitation values. These are PO_4^{3-}, TP, TSS,

NO_3^-, and COD also having weak to fair positive correlations with mean water level and discharge flow.

In the research of Elise Barbot and Natasa S. Vidic (2001) the exponential increase in energy was discussed and critically evaluated. In this study for the comparison Chloride was used as a reference because its concentration changes with the passage of time. Some cations in large concentration (Ca, Mg, Sr) were well-correlated with concentration of chloride whereas barium exhibited strong effect on geographic location. The analysis of water quality in this work is helpful toward water management strategies for the development of unconventional gas resources [13-15]. In this work water samples collected from different areas of district Charsadda, KP was analyzed for organic and inorganic impurities and for microbial risk assessment.

METHODOLOGY

Water sample collection

In this work various sample were collected from different places for analyzing of organic and inorganic components in water bodies. Water samples were collected in clean plastic bottles from following areas, such as Malakand, Naguman, Arat Parang (Persian well rural area) Charsadda Bazar (Charsadda main city) and Sardaryab. These research samples are labeled as S1, S2, S3, S4 and S5 respectively.

Analysis for pH and conductance

The samples were collected in clean bottles and carried for further analysis. These samples were checked for different experimental tests which are given below. The common pH meter and conductometer available in college laboratory was used for pH and conductance measurement. The pH is one of the most important parameter which showed variation in water varieties and nature of water body. If a sample has dissolved inorganic constituents, these were checked for conductivity and determined quality of water.

Determination of Total suspended solids (TSS) and total dissolved solids (TDS)

The (TDS) and (TS) are solid particles present in water samples which are filtered. These are present in water samples in different concentration depending on the nature and quality of water body. Dissolved minerals, gases and organic constituents may produce aesthetically displeasing color, taste and odor. Some dissolved organic chemicals may deplete the dissolved oxygen in water bodies and some constituents interrupted these substances via biological oxidation, whereas other toxic components have been considered carcinogenic.

Procedure for Determination of TDS and TSS

Both TDS and TSS are determined by procedures of Jhon Moore and Elizebth A Moore [13], additionally distilled water is used for washing all apparatus used in this experiments. The given water sample is filtered and the filtrate is heated to dryness in a weighted china dish to some constant weight at 179-181°C. Similarly research samples is filtered and residue were dried to a constant temperature at 103-105°C. The increase in weight of the filter paper showed the total suspended solids (TSS). The difference between the total solids (TS) and total dissolve solids (TDS) may provide an estimate of the total suspended solids.

Determination of Alkalinity, Sulphates and Chloride Contents.

The alkalinity, sulphate and Chlorides contents were determines by known procedures of Jhon Moore and Elizebth A Moore [13]. The alkalinity of the given samples is investigated to calculate its effect on the nature of water using formula given below.

$$\text{Alkalinity} = \frac{V(H2SO4)\ \text{x N(H2SO4) x Eq.wt of CaCO3 x 1000}}{Volumeofsample}$$

$$S = \frac{N(iodine)\ \text{x Eq.wt of SO3 X (Q−B) x 1000}}{Volumeofsample}$$

Where B is blank titration, While Q is volume of iodine used in sample

Similarly sulphate content in water samples were checked in all water samples under study in this research work for softness and hardness of water.

Sulphate contents:

The samples are analyzed to find sulphate content. Which are in the given table 2 and also shown in fig no 4.The sulphate content were calculated by the given formula.

$$S = \frac{N(iodine)\ \text{x Eq.wt of SO3 X (Q−B) x 1000}}{Volumeofsample}$$

Where B is blank titration, while Q is volume of iodine used in sample

Sulphate content shows the nature of water i.e softness and hardness. As $MgSO_4$ and $CaSO_4$ make water hard which are not good for health and washing purposes.

Chloride determination of water samples:

All the three samples were analyzed for the determination of chloride contents through different experiments that gives results differ from each other with a bit margin. The chlorides contents of different water sample are given in descending order below.

Total dissolve solids (TDS) and Total suspended solids (TSS) determination.

Dissolved solids and suspended solids also play a key role on the nature of water samples. Water with greater quantity of TSS and TDS are not good for health.

Biological impurities (Microbial study)

The presence of microorganism is determined in the PCSIR laboratories complex Peshawar by standard analytical method [14]. This technique of determination of microorganisms in water bodies it the most important method used for the quality estimation and suitability of drinking water. This technique is used to determine the presence of different microorganism in the water samples.

RESULT AND DISCUSSION

The experimental work was carried out in several parts and hence the data was collected from the following experiments for TDS and TSS, alkalinity and sulphate determination. The samples which were collected from different/ various areas are further investigated for pH values (Fig 1).

Table 1: pH and conductance values at different temperatures

Samples	0-20^o C		20-30^o C		30-40^o C	
	pH	Conductance (mV)	pH	Conductance (mV)	pH	Conductance (mV)
S1	7.69	233	7.35	117	7.11	011
S2	7.53	219	7.22	129	7.09	023
S3	7.41	223	7.19	113	7.05	009
S4	7.55	231	7.31	115	7.13	003
S5	6.97	211	6.99	122	7.01	007

The pH values given at different temperatures showed change in pH. Sample S1 and S4 have basic pH at 0-20^o C while sample S5 has acidic nature in the temperature range of 0- 20^{o}C.While all samples showed natural behavior in the temperature range of 30-40^o C as shown in table 1

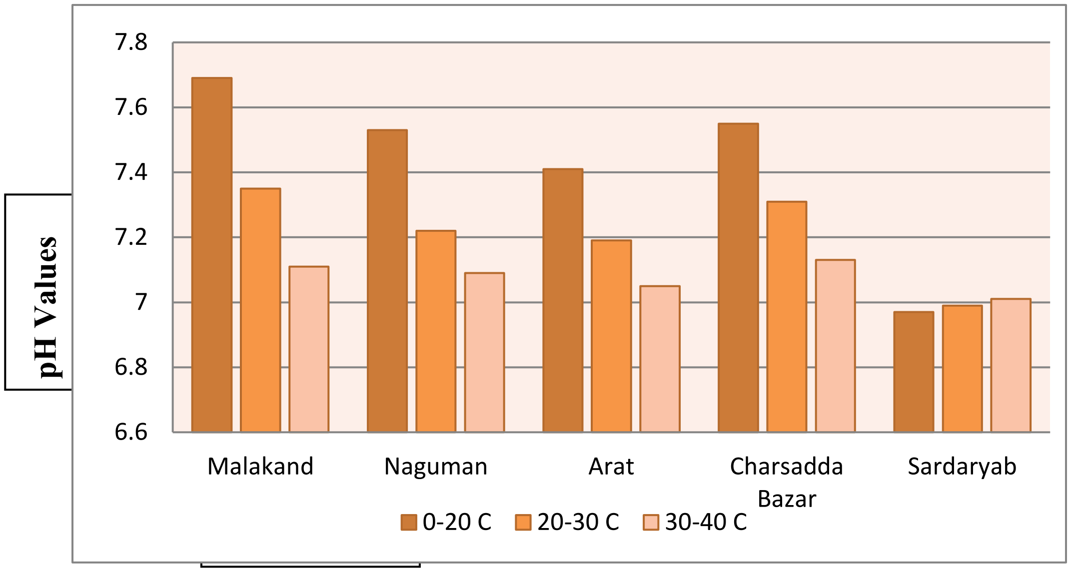

Fig. 1 pH values at different temperature

Conductance Determination

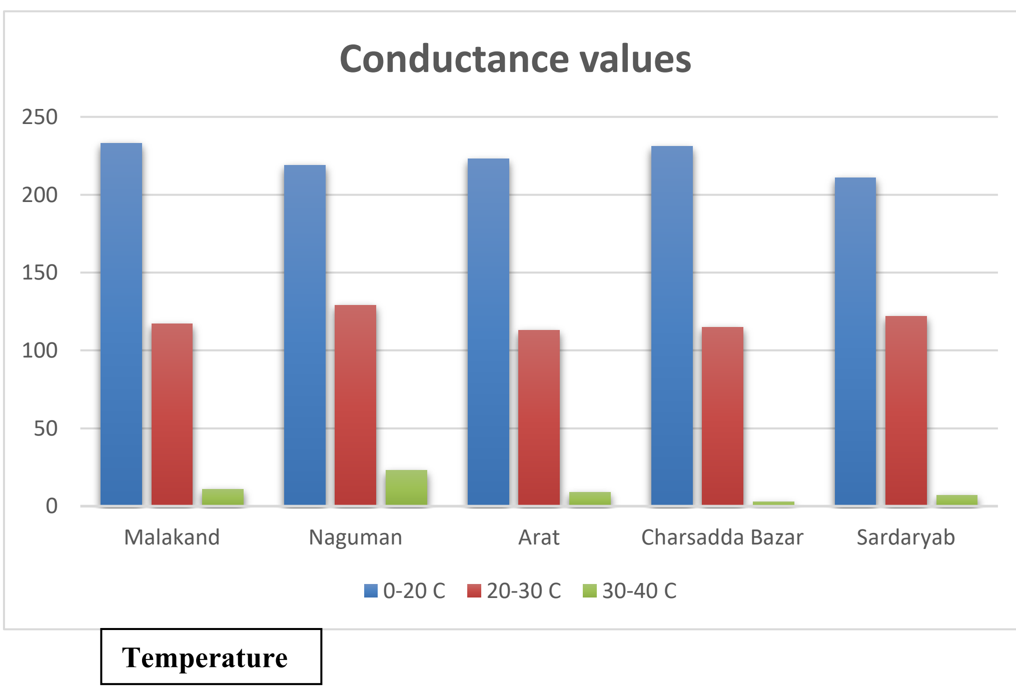

Figure 2. Conductance values at different temperatures.

The samples were analyzed to find its conductance at different temperature range. Which are plotted in the given table 1 and also shown in Fig. 2. The values of conductance are more at low temperature 20-30 ^{o}C while its value is greater at high temperature as shown in table 1.

TDS (total dissolve solid), TSS (total suspended solid)

The research samples were further analyzed to obtain the total dissolved solid in the given samples. The result of TDS is given below in table 2. Similarly the collected water samples were further analyzed for total suspended solid (TSS).

Table 2: TDS, TSS, Sulphate, alkanity and Chloride contents of different water samples

SAMPLES	TDS	TSS	Sulphate contents (g/L)	Alkalinity contents (mg/L)	Chlorides mg/L
S1	63.5	52.2	604.45	603.86	201.33
S2	55.2	52.4	589.56	598.08	215.33
S3	41.5	52.0	572.95	621.89	233.33
S4	58.5	52.3	616.35	615.76	243.67
S5	32.1	52.1	607.16	628.14	217.56

The amount of total dissolved solid and total suspended solid are shown in fig 3. Sample S5 has least amount of TDS while water sample 1 (S1) has maximum amount of TDS. Similarly sample S3 has least value of TSS and sample S2 has maximum value.

Sulphate contents:

The samples were analyzed to find sulphate content. Which are in the given table 2 and also shown in fig no 4.The sulphate content were calculated by the given formula.

$$S = \frac{N(iodine) \text{ x Eq.wt of SO3 X } (Q-B) \text{ x } 1000}{Volume of sample}$$

Where B is blank titration, while Q is volume of iodine used in sample

Sulphate content shows the nature of water i.e. softness and hardness. As $MgSO_4$ and $CaSO_4$ make water hard which is not good for health and washing purposes. Sample S1, S4 and S5 have greater sulphate content, while S3 has the least sulphate content.

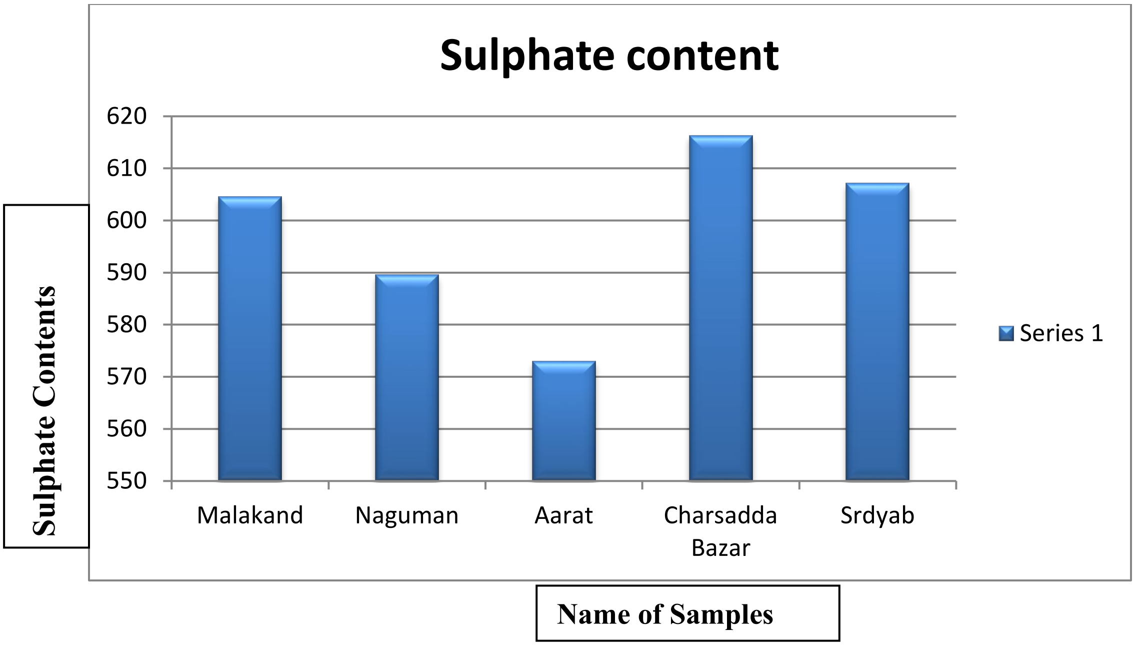

Fig no 3.sulphate contents of different water samples

Alkalinity content:

The samples were analyzed to find alkalinity content and results are plotted in the given table 2 and also shown in fig no 5.The formula through which the alkalinity is calculated is given below.

$$\text{Alkalinity} = \frac{V(H2SO4) \text{ x } N(H2SO4) \text{ x } \text{Eq.wt of } CaCO3 \text{ x } 1000}{Volume of sample}$$

Sample 5 has greater alkalinity content, and S2 has lower alkalinity content. The alkalinity of all sample is given below in descending order S5>S3>S4>S1>S2.

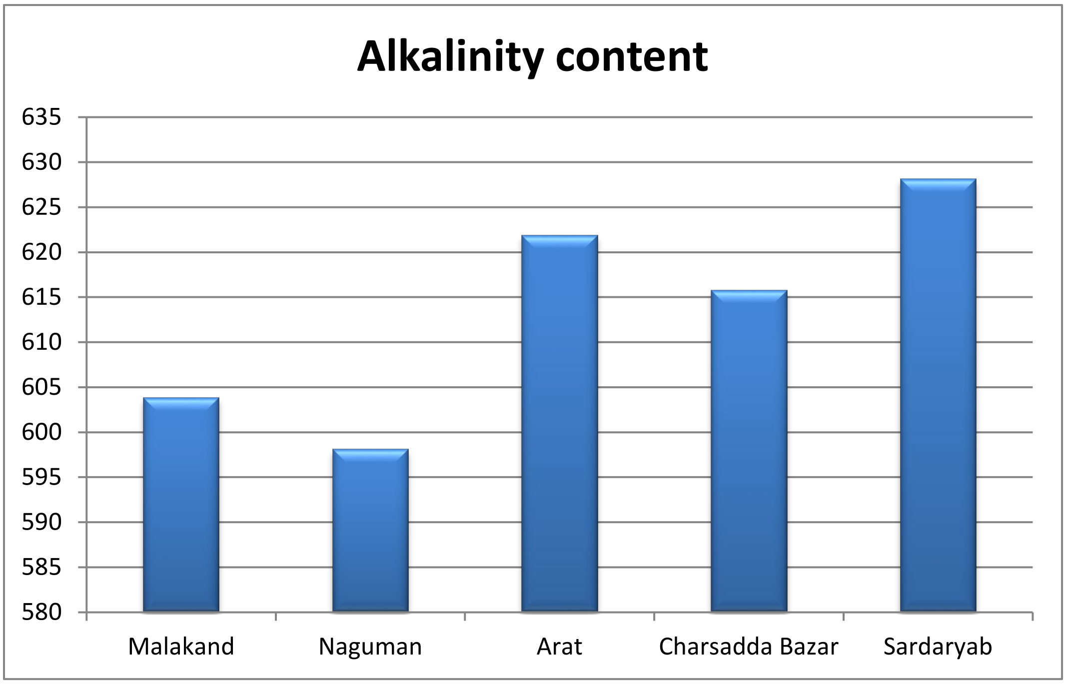

Fig.5 Alkalinity determination

Chloride determination of water samples

All the three samples were tested for the determination of chloride contents through different experiments that gives results differ from each other with a bit margin which are showing in table 2. The chlorides contents of different water sample are given in descending order below.

S4>S3>S5>S2>S1

The above results showed the total amount of chloride present in all research samples of water, which is given the figure below.

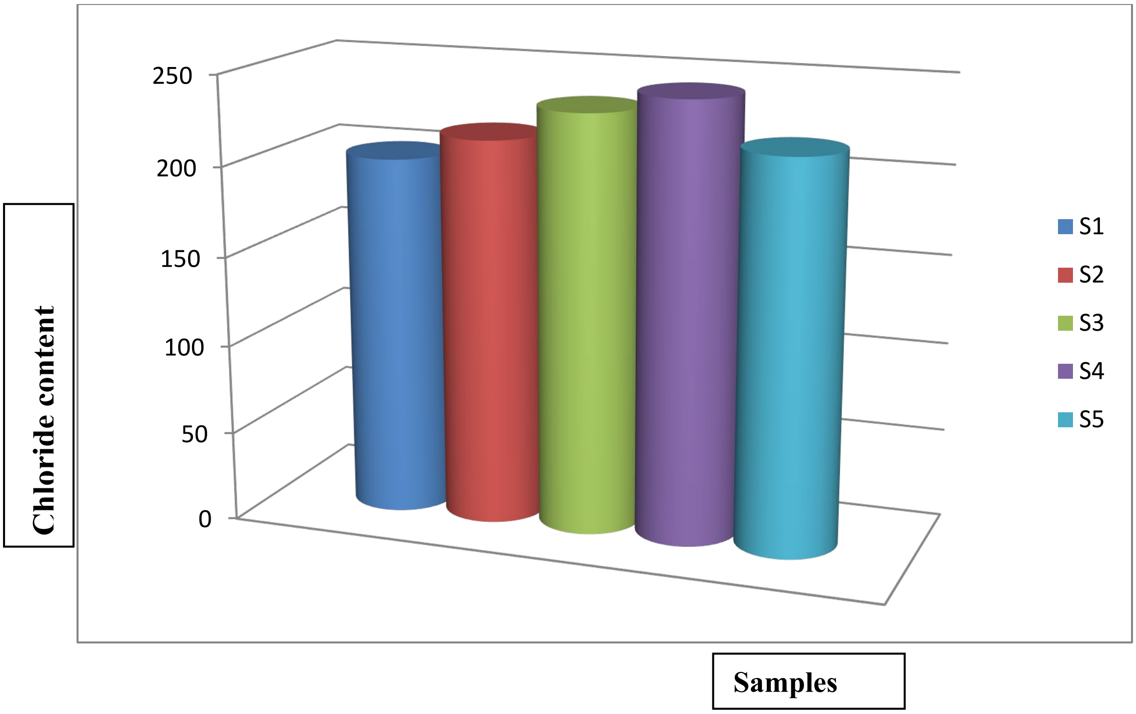

Fig 6: Chloride contents of different water samples.

Presence of Microorganisms in the research samples

The following three research samples were analyzed for the presence of microorganisms in the PCSIR laboratories Peshawar. The result of experiments are given below in fig 7.

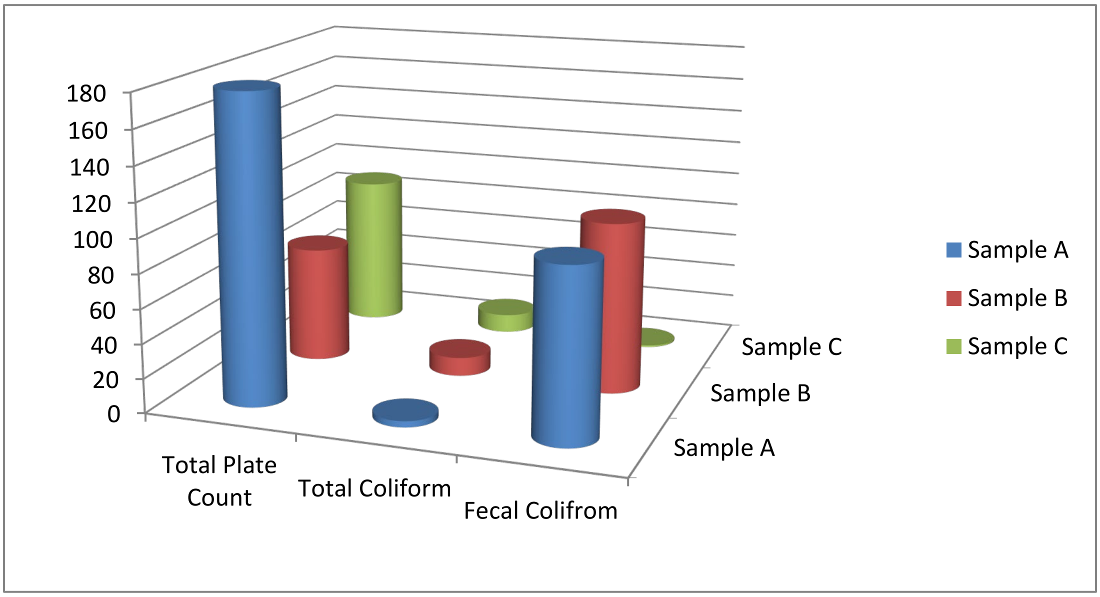

Fig 7: showing different values of organic contents in water samples

Three water samples were characterized for the presence of Microorganism (bacteria) in PCSIR laboratories Peshawar are mentioned below along name and the area from where these are collected.

Sample A =Nauguman

Sample B = Charsadda bazaar

Sample C = Sardaryb

The sample B = Charsadda bazar

In these samples, the water collected from Charsadda bazaar has the worst result for the presence of microorganisms.

CONCLUSION

In this research work water samples were collected from five different places and these samples were marked named like S1, S2, S3, S4, S5. All the samples were characterized for various parameters. Such as pH. Conductance, Alkalinity, Sulphates and chloride contents.

In the result pH level for S3 is comparatively better than other. Similarly, conductance falls in the normal range, alkalinity levels of S3 is little more than other which showed that more base present in water sample. The Sulphate content of S5 is comparatively more and showing poor quality of water for drinking and cloth washing.

So, the given result and studies showed that the sample S3 is the better one as it contains low level of contamination as compared to others and sample S4 is the worst. The bacteriological analysis of different water samples showed that sample B has the large amount of microorganisms which is not drinkable as it contains contamination while the sample A & C contain less amount of contamination.

In the result of this study, it is concluded that water collected from Charsadda bazaar have poor qualities. Therefore, this water is not good for drinking purposes.

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