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PHYSICO-CHEMICAL ASSESSMENT OF WATER SAMPLES COLLECTED FROM SOME SELECTED STREAMS AND RIVERS IN DISTRICT GILGIT, PAKISTAN

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ABSTRACT

This study aims to provide information about the drinking water quality of two streams in Chakarkote Sai and Demote Sai and two rivers in Gilgit and Hunza. Parameters were tested including physical, and chemical. The physical parameters were temperature, pH, electric conductivity (EC), total dissolved solids (TDS), turbidity, dissolved oxygen (DO), ammonia (NH_4),total nitrogen (TN), total phosphorus (TP) and reactive orthophosphate (PO_4). The ranges of these parameters set by WHO and NEQs, as most of the Asian countries also follow the WHO standards. All the samples were tested in the EPA certified laboratory of biological sciences department Karakorum international university Gilgit Baltistan. The minimum and maximum values of temperature 15.2-18.4, PH 6.78-6.09, EC 109.3-297 µS, TDS 53.8-149 ppm, Turbidity 0.29-88.4 NTU, DO 7.1-8.9 mg/l, TN 5.63-7.13 mg/l, $NH_{4\ 0.0106}$-0.0151 mg/l, TP 0.042-0.143mg/l, and PO_4 0.0059-0.016 mg/l. Independent T test was applied separately for both streams and rivers to determine significant difference of water properties with respect to location wise. Water parameters like DO and TP were significantly, while temperature, PH, EC, TDS, turbidity, TN, NH_4, PO_4 were non-significant in streams and TDS, turbidity, DO and TN were significant, while temperature, PH, EC, NH_4, TP, PO_4 were non-significant in rivers according to area wise.

KEY WORDS: Assessment, Water quality, Water parameter, Contamination, Stream, River

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1. INTRODUCTION

Fresh water is the basic requirement for both humans and biodiversity [1]. Water is used for different purposes like domestic and agricultural use [2, 3]. Each year diarrhea kills around 760 000 children under five and globally, there are nearly 1.7 billion cases of diarrheal disease every year [4]. As the population increases people need more and more clean water to meet their different purposes. The global food production depends on water not only in the formof precipitation but alsoin the form ofavailable water resources for irrigation [5]. Population increase has a great impact on the contamination of clean drinking water due to increase in agricultural practices, grazing of domestic animals around the streams and other anthropogenic activities [6, 7].The health effects of chemical contaminants have long term exposures and cause adverse effects [8]. Disposal of slag materials generated by steel industries can cause adverse effects on the surrounding aquatic environments. Factors like organic matter decomposition [9], nitrates, and phosphorus had a great impact on water streams that are flowing besides small forests, orchards and agricultural land [10].

Pakistan is one of the country having largest glaciers outside the polar region and these glaciers feed them mountain livelihood and the whole country. A large number of people around the globe suffer from health problems associated to water [11, 12]. Human induced influences on surface water quality reflect not only waste discharge directly into a stream, but also include contaminated surface runoff [13]. In Pakistan, a large number of rural and urban populations do not have access to safe drinking water [14]. Inadequate water supply, sanitation and hygiene results in high incidences of water and sanitation related diseases in Pakistan [15]. It is estimated that, in Pakistan, 30% of all diseases and 40% of all deaths are due to poor water quality [16]. There is a lack of drinking water quality monitoring and surveillance programs in the country [12]. Due to rapid increase in population and industrialization many drains of Pakistan carry industrial and municipal effluents and this water is carried into rivers, canals and used for irrigation purposes [17]. Population in Gilgit Baltistan feed directly from glacial melt water down the valley streams [18]. Many of the freshwater sources are contaminated by use of pesticides in agricultural fields and other anthropogenic activities that completely altered the physical, chemical, and biological processes associated with water resources [19, 20].Water borne diseases like diarrhea, Cholera, Typhoid and Hepatitis are endemic in this area and also due to the presence of pathogenic organisms in drinking water [21]. Encroachment in the areas around the streams and cutting of forest for wood and agricultural land altered the whole watershed of the streams in many valleys. Good quality drinking water means keeping away public from dangerous water related diseases [22]. This study was aimed to find status of the drinking water from streams and rivers in Gilgit, is according to the standards set by WHO and National drinking water policy of Pakistan. The samples were tested and compared with the National environmental quality standards (NEQs) of Pakistan.

2. METHODOLOGY

2.1 Study Area:

The research was conducted in the Gilgit in Chakarkote Sai stream (CSS) and Damote Sai stream (DSS), Gilgit River (GR) and Hunza River (HR). Geographically the study region is mountainous, with temperature zero in winter, while in summer it may go beyond from 35 °C. People of Damote Sai and chakarkote Sai valley are totally depend on both two streams water for drinking purpose and people settled the merging zone of Gilgit and Hunza river fulfill the need of water for drinking purpose from that both rivers.

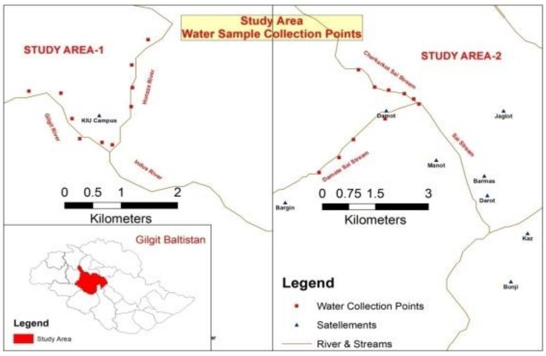

Fig A: Map showing the sampling points of the study area.

2.2 Sampling Design:

Water sampling was done by using simple random sampling method with at least 20-30 cm water deep. The parameters include temperature,EC,TDS was measured with (EC/TDS/SAL Pocketester) and DO was measured with (HI 5001 DO meter) in a field during the time of samples collection. A total of 20 water samples were taken, 5 in each study sites. Approximately 500 ml of each water sample were stored in separate plastic bottle with proper labeling. The water samples were taken to the lab (EPA certified water quality laboratory in Department Biological Sciences Karakorum International University Gilgit Baltistan) for the analysis. Water PH was measured with (JENAWAY 3510 PH Meter), turbidity was measured with (Velp ScientificaTB1 Turbidimeter). Water NH_4, PO_4, TP, TN was determined by National research council for Ecosystem Study Verbania Pallanza ItalyWater chemistry laboratory analytical methods [23].

2.3 Statistical Analysis

The date after to determined the physiochemical status of water by location wise difference. "Independent Sampling "T" Test" was applied separate for streams and rivers to determine the significant difference.

3 RESULTS AND DISCUSSION

Independent sample T test indicated that DO and TP differed significantly, while temperature, PH, EC, TDS, turbidity, TN, NH_4, PO_4 were non-significant in streams and TDS, turbidity, DO and TN were significant, while temperature, PH, EC, NH_4, TP, PO_4 were non-significant in rivers as shown in table 1.

Table 1: Independent Sampling "T" Test.

Locations	Tem	PH	EC	TDS	Turbidity	DO	TN	NH_4	TP	PO_4
CSS and DSS	8.792*	1.841^{ns}	2.904^{ns}	2.887^{ns}	-1.116^{ns}	-2.716**	.213^{ns}	.640^{ns}	2.207*	.924^{ns}
HR and GR	31.117^{ns}	1.230^{ns}	36.782^{ns}	28.o19***	4.527***	-2.341***	-9.365*	1.061^{ns}	.249^{ns}	1.041^{ns}

Note: *, **, ***, and "ns" indicates p<0.05(5%), p<0.01(1%), p<0.001 and "ns" non-significant respectively, WHO; World Health Organization, NEQs; National Environmental Quality standards, EC; Electric conductivity, TDS; Total dissolved solid, DO; Dissolved Oxygen, TN; Total Nitrogen, NH_4; Ammonia, TP; total Phosphorus, PO_4; Reactive ortho phosphate, CSS; Chakarkote Sai Stream, DSS; Damote Sai Straem, HR; Hunza River, GR; Gilgit.

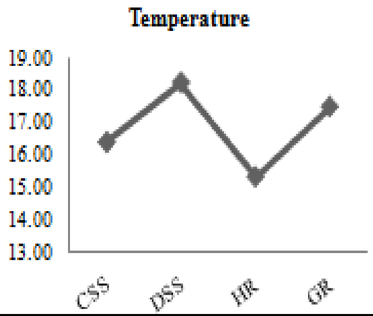

Fig B: Mean values of temperature according to location wise in °C.

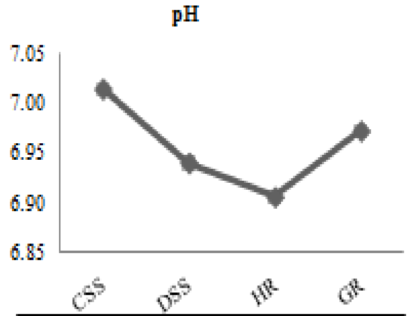

Fig C: Mean values of pH according to location wise.

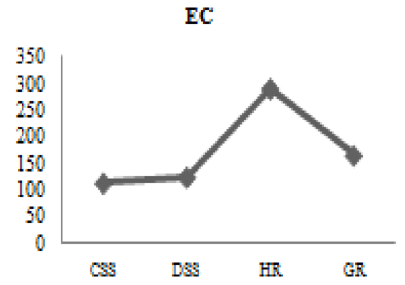

Fig D: Mean values of EC according to location wise in µS.

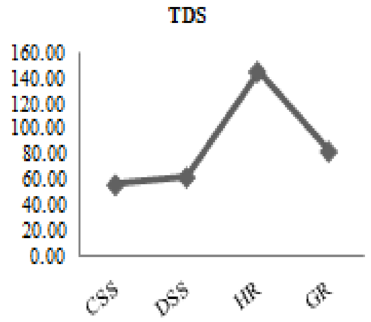

Fig E: Mean values of TDS according to location wise in ppm.

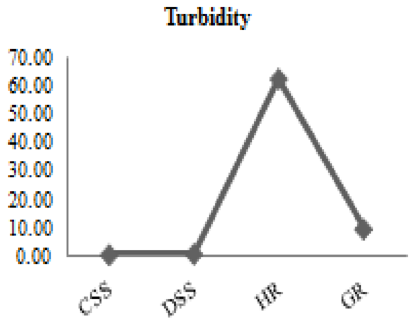

Fig F: Mean values of turbidity according to location wise in NTU.

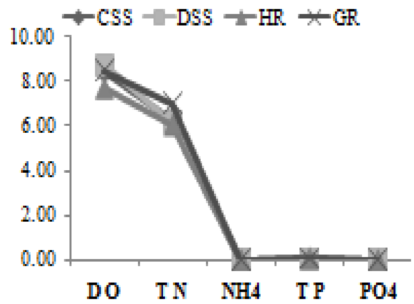

Fig G: Mean values of D O, T N, NH_4, T P and PO_4 according to location wise in mg/l.

Temperature is biologically an important factor which plays a vital role in proper functioning of all living things [3].The temperature of selected water samples was moderate as this study was taken out in a start of summer season. In study areas temperature was ranges from15.2-18.4 °C.

The pH is mutually supporting with further water quality parameters, such as carbon dioxide, alkalinity, and hardness. It can be poisonous in itself at a certain point, and also known to power the toxicity as well of hydrogen sulfide, cyanides, heavy metals, and ammonia [24]. PH of the selected water samples was in the limits of WHO and NEQs guidelines which is 6.5 - 8.5. PH in samples was varied 6.78- 7.09. Hence, in study areas the pH values were not exceed the standard limit on the other hand these were falling in basic or alkaline range.

Electrical conductivity (EC) is actually measures the ionic practice of a solution that enables it to convey current. According to WHO and NEQs guideline EC value must not exceeded 400 µS/cm. In study areas, EC value varied from 109.3-297 µS/cm.

Water has the capacity to dissolve a broad variety of inorganic and various organic minerals or salts. These minerals formed ineffective taste and diluted color in water. WHO and NEQs guideline limit of total dissolved solids (TDS) is 1,000 ppm. In study areas TDS value were ranges from 53.3-149 ppm. Hence, this range was satisfactory and concentration of TDS is harmless.

Turbidity may show the existence of disease causing organisms. These organisms consist of bacteria, viruses, parasites that can cause nausea, cramps, diarrhea and related headaches [25]. According to world health organization (WHO) and NEQs the turbidity of drinking water should be less than 5 NTU. In study areas turbidity value were ranges from 0.29-88.4 NTU. Hence, the range was satisfactory and within limits of WHO and NEQs in streams, but exceed in rivers. Rivers water is not fit for drinking purpose.

Dissolved oxygen (DO) is necessary for respiration by the majority of aquatic animals. In study areas DO values were within limits of WHO and NEQs guideline range from 7.1-8.9 mg/l.

Nitrogen is one of the restrictive nutrients throughout photosynthesis. It enters into the water bodies through rainfall, fixation, river run-off, and transmission from sediments, uneaten feeds, and fish wastes. Huge quantity of ammonia causes a raise in pH and ammonia quantity in the blood of the fish which can harm the gills, the red blood cells, have an effect on osmoregulation, reduce the oxygen transportability of blood and raise the oxygen demand of tissues [26]. In study areas total nitrogen and ammonia are within limit of WHO and NEQs guidelines. Total nitrogen values were range from 5.63-7.13 mg/l and ammonia value were range from 0.0106-0.015 mg/l in study areas.

Phosphorus is found in the variety of inorganic and organic phosphates (PO4) in normal waters. Inorganic phosphates consist of orthophosphate and polyphosphate while organic forms are those in nature bound phosphates. Phosphorous is a restrictive nutrient required for the growth of all plants-aquatic plants [27]. In study areas total phosphorus and phosphate are within limit of WHO and NEQs guidelines. Total phosphorus values were range from 0.042-0.143 mg/l and phosphate value were range from 0.0059-0.0160 mg/l in study areas.

3. CONCLUSION

From this research it is concluded that the parameters tested in the streams and rivers water samples were in the limits of WHO and NEQs guidelines except turbidity in rivers water sample. There is a dire need that there would be awareness in the public that they could not use rivers water for drinking purpose.

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