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Research Article

Seasonal Variation in Water Physical and Chemical Parameters of Gilgit River: A Perspective Study for Organic Agriculture

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Abstract

The most important extrinsic demonstrate the present study was to evaluate the seasonal fluctuation in physic-chemical limitation of watercourse. The physico-chemical parameters on the subject of Gilgit-River was studied from July 2019 to March 2020. Four different samples were collected throughout the year at the same location. The parameters like; pH, Temperature, Alkalinity, Electrical Conductivity, Dissolve Oxygen, Total dissolve solids, Calcium-hardness and Total-hardness were determined in the research Lab (SEED LAB) of Karakoram International University. These results were paralleled by means of standards of WHO. From the results the situation was found that most of parameters like pH, Temperature, EC, TDS, and Total-hardness are within the permissible limit of WHO and ICMR while Alkalinity, Ca-hardness and Dissolve oxygen values are not now the acceptable limits specified by WHO and EPA. These result shown the logical calculations of correlation coefficient between the seasonal physic-chemical parameters of water.

Keywords: Gilgit-River; Water Pollution; River Water Quality; Physico-Chemical Characteristics; Temperature; pH; Alkalinity; EC; TDS; Ca-Harness; Total Hardness; DO; Correlation

Introduction

All living organisms need water for survival, as Allah almighty says in the beneficent Quran "And, We build from water every living thing" (Surah Al-Anbiya:21:30). Water and air are the most important natural sources on earth [1]. It is necessary for the growth and maintenance of human body and regulation of many life activities. During its mobility water carries solid suspended particles and dissolves impurities. It becomes impure and unsafe for human health due to presence of heavy metals and imbalanced minerals. Metal contamination is due to climatic deposition, weathering or release of agricultural, peopled or construction runoff. 66% of drinking water in Pakistan is achieved through pipe and hand pumps. According to GWSSAR 30% of disease is waterborne and 40% of people die due to inaccessibility of clean and safe water [2].

The main component of human body is water that estimated to be 60% of adult body weight. The water produce by metabolism or indigestion of food is enough to fulfill our body needs. So we have to pay attention of our drinking water regularly. Water is important constituent of cell, tissue and organs [3-4]. Water has various characters in the human body. It acts as building material; as a solvent, Reaction intermediate, or as a transporter for nutrients and excess product in thermoregulation, and as a lubricant and shock absorber [5].

Many water resources are unhealthy because of harmful physical, chemical and biological agents. At least 2.5 billion peoples in developing countries have poor hygienic water system and over 780 million people have no right to use benign drinking water. As a result across the world about 2.3 billion people suffering from water related disease [6]. Due to occurrence of high concentration of chemicals or its poor quantity in water nay cause different disease like goiter and Cancer etc. [7]. Due to lack of cleanliness and better sewage treatment, improper processing and use of extremely dirty water many gastrointestinal illnesses are in common. Dental fluorosis is cause by little or high level of fluoride ions concentration in water. Goiter is mainly due to low concentration of iodine in human [9]. There would be 200 million estimated cases of diarrhea and 2.1 million death cause by diarrheal complaint each year if everyone had pure drinking water and satisfactory hygiene service [10]. Different acute and chronic health issue may cause because of toxic inorganic chemicals in water such as vomiting, nausea, dizziness, lungs irritation, skin rash and sometime death.. Cancer, birth faults, organ destruction and some disorders of nervous system and immune system have been reported as chronic effect [11]. According to WHO in total, there is 1400 million billion liters of waters. But most of this water is not used for consumption because 97% of it is sea water on only 3% is fresh water. Our of which 2% is moved in the polar icecaps and glaciers, only 1% water is accessible for drinking purpose, whereas major water goes for irrigation than to drinking and all other use. At the present situation, only 80% of the population in case of urban areas and only 11% in

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case of rural areas have access to the piped water [12].

Besides the need of water is not only limited use for drinking purpose but also play an important role in different area of economy such as cultivation, livestock production, forestry, industrial activities, hydropower generation, fisheries and other creative activities. Due to some significant aspects like increasing population, industrial development, urbanization etc, the viability and quality of water either surface or ground, have been disintegrate. Many of the fresh water sources are polluted by use of insecticidies in agricultural fields and other anthropogenic activities that completely change the physical, chemical, and biological process related to water resources [13]. By using physical, chemical and biological parameters water quality of any definite area or definite source can be measured. Is the values of these parameters become more than definite limits, is considered harmful for human health [14].

The best gifts given by nature to all living creature is "WATER". Water is mandatory in favor of human body grown and maintenance as well as for various biological actions [17]. Water interpret as a key function intended for continued existence of all living genre that are existing on the earth besides it works such as a universal solvent [18]. Water among with a shrinking than 1% dissolved saline absorption is recognized as fresh water. Two types of fresh water sources are there, that is earth water as well as surface water. "Earth water" holds underground aquifer so as to acquire on the way to float up throughout springs, yawning wells and artesian well while in "surface water", water firmed as rainwater with snow excess furthermore land leakage, collected within resources, lakes and rivers. Clean water is inadequate source oppressed in every part of feasible ways [19].

In order to gratify household as well as unpretentious gardening and manufacturing requirement there is at least one hundred and twenty five cubic meter in keeping with man or woman per year is consumed [20]. Other purposes of human water use are salable consumption, for strength plant cooling and electric powered era. These demands depend to come cross the water requirement in the region of technological field and host of the other characteristics [21]. For different purposes different sectors of the world exploit water for ingestion, removing, reducing wastes, producing synthetic items, developing foodstuffs by means of energy. Water required for each activities fluctuate with weather conditions, existence fashion, subculture, traditions, food regiment, technology and wealth and so on [22]. Water activity motivates the rate of fatty acid decomposition, deficiency of vitamins, enzymatic reactions in addition to protein distortion [23]. Importance of water in addition to its dominance for several traditions or way of life has promoted a progress about ascertains water as per human right also construct governmental responsibilities to make available for citizens using adequate water assets [24].

The quality of water is firmed by means of a variety of physico-chemical factors. The examination in excellence water is one and only the large imperative feature in floor water studies. Purpose of physico-chemical diagnosis about water remains crucial for evaluating the appropriateness related to water for assorted purposes as conjugal, irrigation and drinking. The earth water eminence may also fluctuate with seasonal modifications and exists mainly command through the settlement and degree of suspend solids [25]. tors, while they may have an effect on its superiority either directly or indirectly [35]. Fabric industries are one of the prevalent addict and polluter's follow-on during elevated water waste production [26,27]. It has been projected to facilitate the shortage of uncontaminated drinking water in addition to sanitation use, leads to a lot of hundreds of millions of incidence of diseases interconnected to water also involving five and ten million deaths yearly, mostly the little kids [28,29].

In order to reduce the figure of diseases also put together certain safe and sound delivery of drinking water, it must be liberated from every sort of pollution whether microbial or physic-chemical. World Health Organization has proposed average guiding principle in favor of drinking water superiority and if the nature of water are contained by the permeable confines, water is regarded as clean [30].

Methodology

About the Study Area

The study area is to be found at elevated altitude in the Himalay-Karakoram-Hindukush area. It emanate from Shandoor Lake. The lake is protected in HKH hilly assortment [31]. Gilgit settlement is located at the union of Gilgit & Hunza River. It lies between 35'46'05 to 36'51'16 North Latitude and 72'25'02 to 74'19'25 East longitude [32]. The southern branch of Gilgit catchment holds highest quantity of rainwater of about 1,000 mm/year despite the fact that the quantity of rainwater in tillage areas is not as much of 500 mm/year. The highest temperature now elevated height valleys placed Gilgit drainage is 10-15C privileged yetthose placed at Astore, Ganche, Skardu and Hunza-Nagar (Hashmi A, 2003). In the catchment, there are 923 entire glaciers in count along with the area of 858.168Km2 [33]. Temperature at HKH area has ardent by just about 1.5C that is nearly two times associated to other parts of Pakistan (0.76C) [34]. After 2010 sudden increase were observed in yearly maximum and

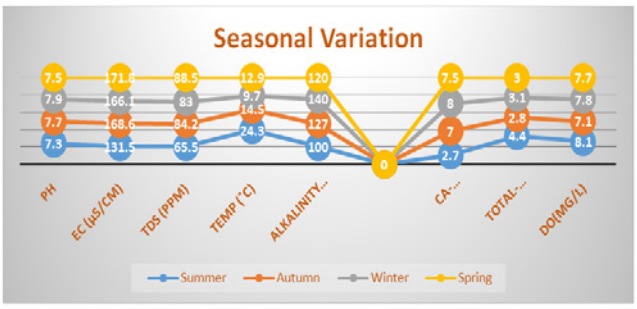


Figure 1:

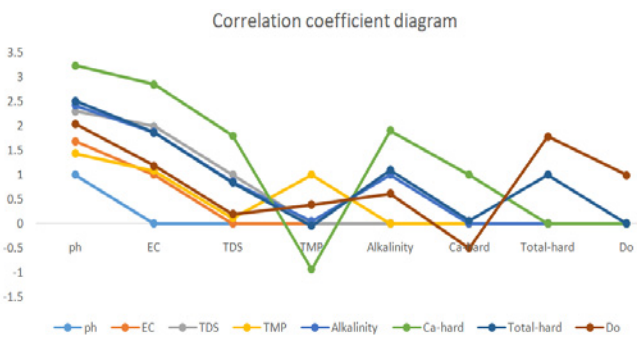


Figure 2:

Table 1: Methods used to estimate physic-chemical Parameters along with average values, WHO & EPA standards.

Sr.No	Physical Parameters	Methods/Instrument	Range	WHO	EPA	Permissible limit	Non-Permissible limit
1	pH	pH-meter	7.3-7.9	6.5-8.5	6.5-9.5	Permissible	
2	EC	EC/TDS Temperature meter	131.5-171.8	750	2500	Permissible	
3	TDS	EC/TDS Temperature meter	65.5-88.5	259-500	500	Permissible	
4	Temperature	EC/TDS Temperature meter	9.7-24.3	30-32	-	Permissible	
5	Alkalinity	PC-MULTIDIRECT	100-140	100	-		Non-Permissible
6	Calcium-hardness	PC-MULTIDIRECT	48.33-143.2	100	-		Non-Permissible
7	Total-hardness	PC-MULTIDIRECT	50.12-78.76	300	<200	Permissible	
8	DO	DO meter	7.1-8.1	5.0-7.5	-		Non-permissible

Table 2: Seasonal Values of parameters along with range, mean value and standard deviation value.

Parameters	Summer	Autumn	Winter	Spring	Range	Mean value	SD
pH	7.3	7.7	7.9	7.5	7.3-7.9	7.6	0.25819889
EC	131.5	168.6	166.1	171.8	131.5-171.8	151.65	18.81187568
TDS	65.5	84.2	83.0	88.5	65.5-88.5	77	10.14527805
Temperature	24.3	14.5	9.7	12.9	9.7-24.3	17	6.291528696
Alkalinity	100	127	140	120	100-140	120	16.70079838
Ca-hardness	2.7	7.0	8.0	7.5	2.7-8.0	5.35	2.434474618
Total-hardness	4.4	2.8	3.1	3.0	2.8-4.4	3.6	0.727438428
DO	8.1	7.1	7.8	7.7	7.1-8.1	7.6	0.419324854

Table 3: Correlation Coefficient of physic-chemical parameters of river water.

	ph	*EC*	*TDS*	*TMP*	*Alkalinity*	*Ca-hard*	*Total-hard*	*Do*
ph	1							
EC	0.690383	1						
TDS	0.614774	0.99394059	1					
TMP	-0.86593	-0.9174623	-0.8914964	1				
Alkalinity	0.981727	0.80178667	0.74248386	-0.9452109	1			
Ca-hard	0.816657	0.96913118	0.94980667	-0.9871664	0.90921754	1		
Total-hard	-0.72763	-0.9831088	-0.9622592	0.88382464	-0.8142092	-0.9430071	1	
Do	-0.46181	-0.6761079	-0.6370901	0.44538038	-0.4771724	-0.5518354	0.78953203	1

minimum temperature. This was owing to climate crises in Gilgit, Pakistan [15].

Sampling Approach

Sample area is the Gilgit River and the site from where sample is collected is the junction Point of Gilgit River and Hunza River called Indus River. Water sample is collected from main Gilgit or Indus River at 1 site throughout the year (or 4 seasons). Total Four samples were collected in 1 ½ liter washed cold drink (Pepsi) bottles from Gilgit River during 2019-2020. All four sample were carried to KIU Water Lab for advance study.

Physico-Chemical Properties of Water

The quality of water is firmed by means of a variety of physico-chemical factors, while they may have an effect on its superiority either directly or indirectly [35]. The entire existing organisms boast bearable confines of water quality parameters during which they execute optimally. An acute descend on increase inside these point of accumulation comprise unpleasant results on their body parts [36,37]. The parameters are temperature, pH, alkalinity, TDS, EC, DO, calcium hardness and total hardness.

Outcomes and Discussion

Seasonal variant in Physico-chemical Parameters of Gilgit-River.

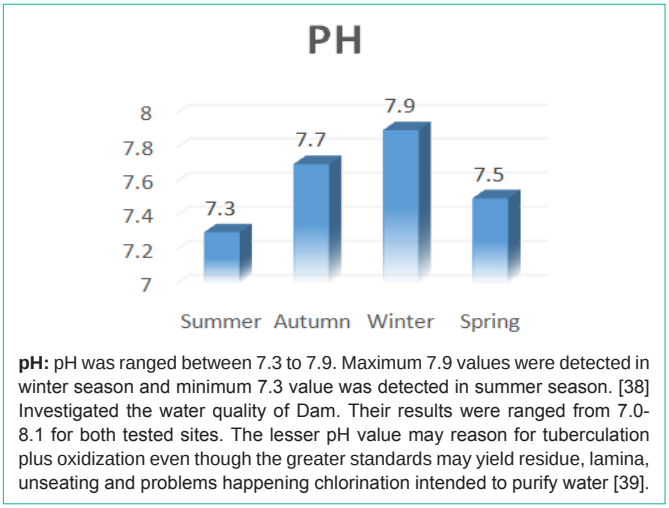
Correlation

Correlation is the way to assess the gradation of relationship held among two or more variables. The correlation standards of physico-chemical parameters on the subject of water not only support to evaluate the inclusive water feature however also computes the comparative deliberation of several contaminants in water [16].

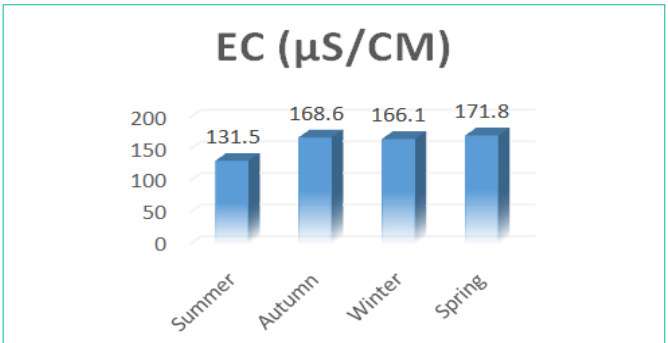
Conclusion

Water and life are the two face of a similar coin. In view of the fact that water sustains all the purposes of life. The water quality is a fundamental apprehension for human being as, it instantly connected by means of human health and ecological defense and is very important designed for determination of water utility. The

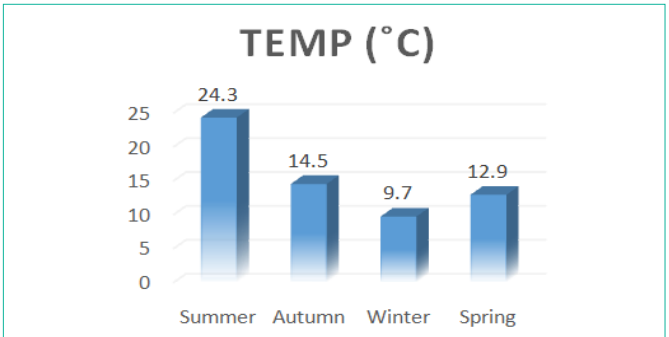
Analysis of physicochemical properties:



pH: pH was ranged between 7.3 to 7.9. Maximum 7.9 values were detected in winter season and minimum 7.3 value was detected in summer season. [38] Investigated the water quality of Dam. Their results were ranged from 7.0-8.1 for both tested sites. The lesser pH value may reason for tuberculation plus oxidization even though the greater standards may yield residue, lamina, unseating and problems happening chlorination intended to purify water [39].

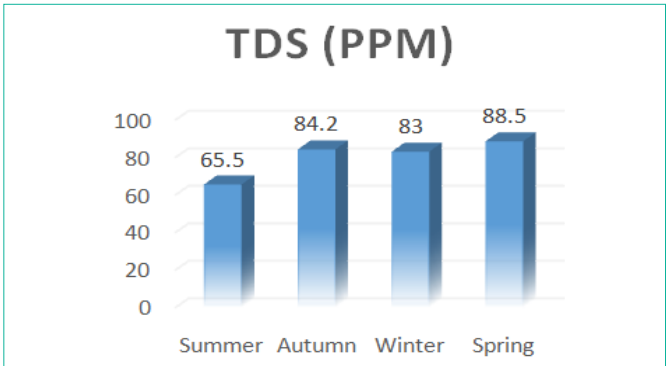


Electrical Conductivity: Electrical conductivity was ranged from 131.5 to 171.8. Minimum value of EC was estimated in summer and recorded high value in spring season. A study was reported in which EC was observed higher during summer (3.54 Ω/cm) while observed lower in winter season was 3.08 Ω/cm [44]**.** The greater the value of electrical conductivity for the period of summer shows the contamination status along with tropic levels of the aquatic body [45].

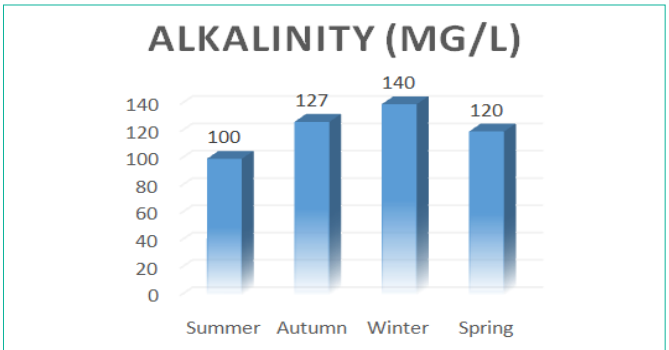


Temperature: Temperature of river water was recorded throughout the year that ranged between 9.7°C-24.5°C. Minimum value of temperature is estimated in winter while higher temperature during summer was due to heating.

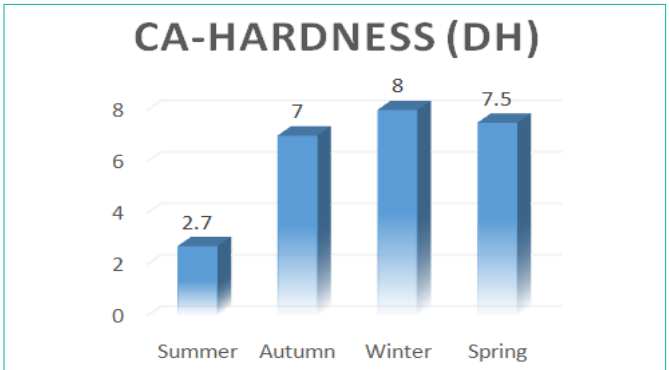
A contradicted study was conducted by [38], in which water sample temperature varied from 19°C TO 28°C. One of the main essential ecological aspects is air temperature, which regulate the physiological activities of aquatic scheme and dissemination of the microbes [40,41].



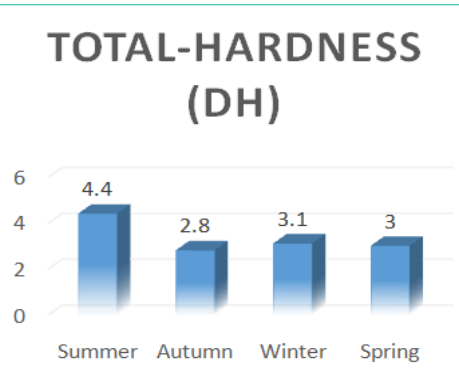
Total Dissolve Solids: Total dissolve solid was ranged from 64.8 to 88.5. The value of TDS recorded maximum in spring while its vale was minimum recorded in summer season. A controverter outcome was stated by Jindal and sharma (2010). In place of potrerodelos Funes River the TDS range was estimated 156-582 mg/l. This might remain situated in line for near sewage discharge then anthropogenic activities laterally the river bank taking place all of the sites [46].



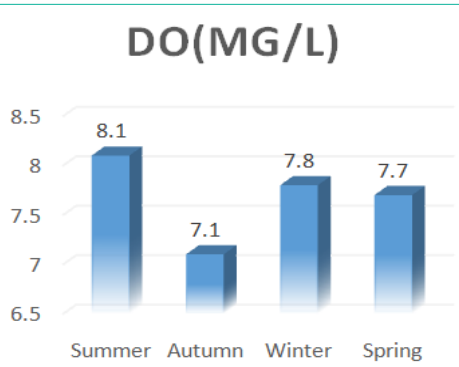
Total-Alkalinity: The value of alkalinity varied from season to season. Minimum value of alkalinity is recorded in summer that is 100 mg/l however highest value 140 mg/l is recorded in winter. Bicarbonates characterize the enlarge shape of alkalinity. Bicarbonate is shaped in significant quantity from the motion of $C0_2$ upon primary substances in soil and different salts of vulnerable acids [42,43]. A contradicted study were reported, in which alkalinity of collected samples of Dam water fluctuated as of 59.25 mg/l to 72.25 mg/l [38].



Ca-hardness: Calcium hardness of river water was recorded in summer, autumn, winter and spring season are 2.7dh, 7.0dh, 8.0dh and 7.5dh respectively. Minimum value of calcium hardness is estimated in summer where as high Ca-hardness during winter. A report were studied in which calcium hardness of ground water was estimated at different sites in Ghazipur city. The range of Ca-hardness at different selected areas of Ghazipur was 99 mg/l to 158 mg/l.



Total-hardness: Total hardness was oscillated between 2.8dh to 4.4dh whereas maximum value 4.4dh in summer season while minimum value 2.8dh was observed in autumn season. A contradicted report were studied where the entire hardness of all the accumulated water specimen of Deoli Bhorus obstruction become determined with inside the variety of 110.75 mg/l to 120.91 mg/l [38]. The value of hardness of water becomes high due to dehydration during summer then insertion of calcium as well as magnesium salts by means of vegetation and subsistence organisms [47].



Dissolve Oxygen: Dissolved oxygen was fluctuated from 7.1 to 8.1 whereas the maximum rate was sensed in summer period while minimum value was verified in autumn period. [48] Examined the tributary water quality of Narmada, Madhya Pradesh, India. The results of DO were fluctuated as of 2.4 to 7.8 mg/l such as all situates (S_1-S_6).The low concentration of DO was due to unwanted liberations, which is excessive in natural constituent and nutriment contiguous to the river area also owing to rise bacteriological activities materialize at some stage in degradation of the carbon-based substance [49].

studies of physico-chemical individuality of water offer a significant approaching keen on the water quality here in the river. The escalating deliberation of assorted chemicals originating as of the industries and their subsequent liberated to their surrounding and the household water liberated into the drains lifted a large extend furthermore magnifying public apprehension over their unfavorable issues on human health and surroundings. Estimation of water quality is an important feature intended for assessment of contamination levels. The results since the current research evidently pointed out that the water are polluted despite the fact that they restrain high levels of waste product of industries, hospitals and drainage system. Further, the studies of DO and Ca-hardness values are not acceptable limits specified by WHO &EPA and between the parameters there is no strong correlation.

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