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Qualititative investigation of pollutants water by different methods at tea garden, Shinkiari

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Abstract

Deterioration of water quality of lakes, rivers and groundwater aquifers has resulted in increased waterborne diseases and other health impacts.The reuse of treated polluted water for agricultural irrigation has expanded, especially in arid and semi-arid regions, helping to relieve water scarcity and improving the means for local food production.Six parameter of water quality analyzed in the lab of M.Biology, Hazara University, Mansehra . Each parameter analyzed 3 times. Samples were collected at Bio-remediation garden from different points i.e., (Inlet, Wetland, P1, P2, P3, P5 and Outlet) on July 10, 20 and 30 , 2013 .Overall performances of the Bio-remediation garden showed that pH (3.8%), increased. However, parameters which decrease are Turbidity (84.2%)> Calcium (34.25%)> Bicarbonate (31.65%)> Chloride (22.04%)>Total Dissolved Solids (13.5%)>.

Keywords: *Pollutants water; bio-remediatin ; Turbidity ; Calcium ; Bicarbonate ;Chloride TDS.*

1. Introduction

Water is a chemical substances with the chemical formula H_2O, liquied at Temp.>) 0 °C (272.15 K, 32 °F at sea level but it offten co-exosts with its solid state , ice and gaseous state(water vapour or stem))[1-2]. Water covers 71% of the earth's surface, [3] and is vital for all known forms of life. [3]. Nowadays, 400050 Million populations in 29 different countries is facing the problem of water shortages [4]. When water becomes polluted, it loses its value and can become a threat to agric, animals as well as human health and to the survival of aquatic fauna living in it. The inadequate supplies of water due to drought and many other reasons raise the trouble of maintaining water quality particularly when there are many sources of water pollution for example sewage, industrial effluents and agricultural surplus [5]. Contaminated sediments are another significant source of water pollution. These may be derived from inputs of suspended solids to which toxic substances are absorbed; such as

soil particles in surface water run-off from fields treated with pesticides. Pesticides are useful tolls in agriculture but their contribution to the gradual degradation of the aquatic ecosystem cannot be ignored [6]. Water pollution that it accounts for the deaths of more than 14,000 people daily[7]. Some 90% of China's cities suffer from some degree of water pollution, [7] and nearly 500 million people lack access to safe drinking water[7] . The polychlorinated biphenyls (PCBs) and dioxins in small quantity cause the pollution of sea water [8]. Mining is another vital source of water pollution. Toxic metals go with water during grinding process, like the utilization of sedimentation ponds such as Pb and Zn ores usually contain the much more toxic Cd as a minor component. The cadmium is the major water pollutant [9]. The use in agriculture can cause water pollution in agricultural areas, which cannot be eradicated which leads to increase the quantity of nitrates in the areas and water specially [8]. Mercury is highly volatile in nature and enters the water from industries. The bacterial activities in water reservoir such as river, lake and coastal water increase the mercury level in water and thus become a source of pollution [10]. Heavy metals are health hazard to human and animal fauna because of their high molecular weights, if their level exceed from their naturally occurring concentrations. Encephalopathy is a primary reason of death in patients among mutually sensitive and continual heavy metal poisoning. Copper ions can originate food toxicity nuisance, vomiting, nausea and diarrhea, at lower doses [11-12]. Wastewater and sewage are big sources of water pollution [13].

The population of Pakistan increased up to 153 million in 2006. Addition of 120.5 million people in the last six decades with a projected population of 263 million by the year 2025 pose a serious threat to limited resources [14]. High population growth rate coupled with urban migrations have changed demographic features [15]. Pakistan, once having surplus water is currently a water deficit country. Per capita water availability now reduced to 1105 m^3, just touching the water scarcity level of 1000 m^3 [15]. The main reasons for declining fresh water availability are the rapid growth, depleting water storage facilities, and pollution/contaminants of existing water resources due to discharge of untreated industrial and sewage effluents into streams/rivers [15].Domestic waste containing household effluent and human waste is either discharged directly to a sewer system, a natural drain or water body, a nearby field or an internal septic tank. It is estimated that only some 8% of urban wastewater is treated in municipal treatment plants [16]. The treated wastewater generally flows into open drains, and there are no provisions for reuse of the treated wastewater for agriculture or other municipal uses. Ten large urban centers of the country, which produced more than 60% of the total urban wastewater including household, industrial and commercial wastewater [16].The removal of contaminants using living organisms has recently been attracting a lot of public attention and research and development spending [17]. Biological processes for the removal of contaminants are cheaper when compared to the conventional technologies. The expansion of phytoremediation work has promoted the eco-friendly and cost-effective technology [18]. Different mechanism involve in phytoremediation, for the removal of contaminants from effluents/wastewater. (i) Phytoextraction, in which contaminants accumulating plants are used to transport and concentrate contaminants into the harvestable parts of roots and above-ground shoot [19]. (ii) Rhizofiltration, in which plant roots absorb, precipitate, and concentrate toxic contaminants from polluted effluents [20]. (iii) Phytostablization, in which mobility of contaminants is reduced through the use of tolerant plants [17]. (iv) Phytotransformation/phytodegradation, in which a contaminant can be eliminated via phytodegradation or phytotransformation by plant enzymes or enzyme co-factors [21].Rapidly growing algae or submerged aquatic vegetation remove CO_2 from the

water during photosynthesis, significantly increasing pH levels. Water with high or low pH is not suitable for irrigation. At low pH most of the metals become soluble and become available and therefore could be hazardous in the environment. At high pH most of the metals become insoluble and accumulate in the sludge and sediments [21]. Metals such as potassium, sodium, chloride, carbonate, sulfate, calcium, and magnesium all contribute to the dissolved solids in the water. Measuring total dissolved solids is a way to estimate the suitability of water for irrigation. High concentrations of TDS may also reduce water clarity, contribute to a decrease in photosynthesis, combine with toxic compounds and heavy metals, and lead to an increase in water temperature. Water with high TDS often has a bad taste and/or high water hardness[22].

Consumption of contaminants drinking water, crops, vegetables and fish etc, ultimately affect human health. Farmers who irrigated their lands with untreated wastewater around Haroonabad had a significantly highly occurrences of diarrhea diseases than those who irrigated their land with canal or tube well water [23].When the accumulated chloride concentration in leaves exceeds the crop's tolerance, injury symptoms develop in the form of leaf burn. This starts at the tips of leaves and progresses from the tip back, along the edges, as the severity increases. In extreme cases chloride toxicity manifests itself in early leaf drop. Crop quality is affected by chloride-induced leaf injury in plants whose leaves are the marketed product, or where fruit size and appearance are affected by chloride-induced yield decreases [24].Wastewater carries a wide range of pathogenic organisms posing a risk to agriculture workers, crop handlers and consumers. High level of nitrogen in wastewater may result in nitrate pollution of groundwater, which could lead to adverse effects on human health [24].

Eichhornia crassipess is known as water hyacinth belongs to family Pontederiaceae. Free-floating, spongy- inflated aquatic plant grows throughout the year in the tropics, but freezing temperatures kill the leaves of the plant in the northern portions of its range.[25]. *Pistia stratiotes* is water lettuce belongs to family Araceae. Free-floating aquatic capable of forming dense mats on the surface of lakes, ponds, rivers and other bodies of water [26]. *Hydrocotyle umbellatta* is known as pennywort belongs to family Apiaceae. Free-floating aquatic plant, found on moist soil as well as in water. *Typha latifolia* known as cat tail belongs to family Typhaceae. It is emergent rooted flate leaved aquatic plant. They grow up to six feet tall, with ribbon like leaves that taper to a point. Cattails make an excellent buffer plant around pond perimeters because of their ability to take up nutrients from the water, thereby cleaning run off before it enters the water body. They are also good for erosion control and for filtering out sediment suspended in flowing water [27]. *Phragmites australis* common name is Common Reed belongs to family Poaceae. It is emergent aquatic rooted grass & a wetland species that grows from a thick, white, hollow root (rhizome) system buried deep in the substrate in areas with fresh to brackish water [27]. Under climatic /topographic/and weather conditions of district Mansehra different streams and small rivers are lying through its surroundings due to increasing the population day to day the pollutions are also increasing as it accordingly. It has so many reasons e.g. uneven rainfall, decreasing forest , increasing constructions , building of raods , shifting of populations from rural to urban area . now the water capacity is almost decrease up 40-50 % . Which not affect the human being but also affected the eco- system. Therefore Bioremediation is a "natural process" and usually do not produce toxic by-products and destroys the target contaminants. It is usually less expensive than other technologies. The findings might help in identifying suitable plants to be recommended for phytoremediation under natural conditions. Research on bioremediation process to

make used water fit for irrigation, irrigation with treated waste water has some organic contents, which can be helpful for crop yield and soil fertility. This study helps awareness arising in the field of bioremediation for the wastewater management. It also helps the policy makers to think about this bioremediation and take some effective measures for the management of industrial and domestic wastewater. It gives an option/mitigation measures for the control of wastewater contamination in fresh water.

2. Materials and methods

2.1. Experimental location

The experiment " Qualititive investigation of pollutants water by different methods at tea garden, Shinkiari conducted at National Tea & High Value Crops Research Institute (NTHRI), Shinkiari, Mansehra, KPK. During 2013. Following figures are showing the latitude and longitude of permissible area.

Latitude	34.4667	Longitude	73.2833	Altitude (feet)	3346
Lat (DMS)	34° 28' 0N	Long (DMS)	73° 16' 60E	Altitude (meters)	1019

Approximate population for 1 km radius from this point: 40710

* Source Agro-Met Weather Station NTRI Shinkiari "KPK" Pakistan.

2.2.Exprimental site map

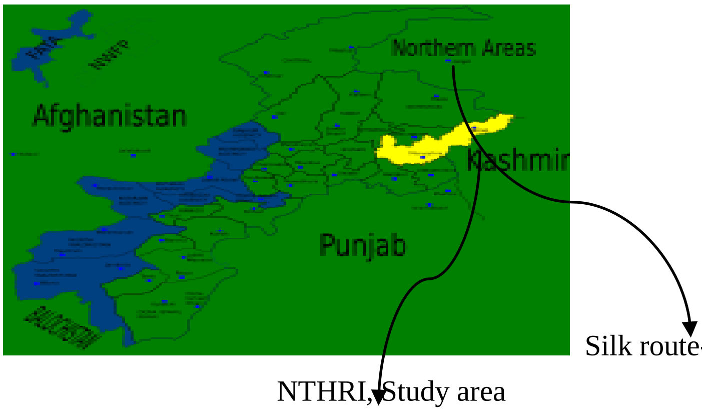

Figure 1 : *Researchable area & Location (highlighted in yellow) within the (KPK Province, Pakistan)*

Figure 2: *Researchable area /Location & source of water*

2.2 NTHRI, Garden

Tea Garden is located in Shiniari,Mansehra (KPK). It spread over an area of 50 acres of land and consists of a Tea Garden, Fruit & Vegetable section besides high value medicinal crops grown over there, while it has moistland and six ponds for the purpose of experimentation. Mechanism of treatment is exclusively based on bio-remediation i.e. using indigenous plants and microbes.

2.3 Moist land

It is comprised of one surface flow constructed moistland. To check the leaching of the water, polyethylene sheet of 500 micron is spread on the subsurface of soil . It build of a material such as gravel, stones, pieces of brick, sand, crush spread in various layers. Introduced floras are *Typha latifolia*, *Cryprus papyrus*, *Vitiveriazizaniodes*, *Phragmitesaustralis*, *Scripusacutus*, *Hydrocotyleverticillata* .

Table 1. Ponds composition with plants introduced and their usage* .

Ponds #	Plants Introduced	Local/common name of plants Introduced	Dimention	Usage
1	*Pistia stratiotes*	Water Lettuce	6x6x6	To remove organic and inorganic contaminants including heavy metals and hazardous material, reduction in BOD, COD.
2	*Pistia stratiotes*	Water Lettuce	6x6x6	-Do-
3	*Eichhornia crassipess*	Water Hyacinth	6x6x6	Water hyacinth uptake of heavy metal e.g., Pb, Cu, Cd, Hg from ontaminated water.
4	Empty	Empty	6x6x6	Check
5	*Hydrocotyle umbellatta*	Water Pennywort	6x6x6	Reduction in BOD, COD, TSS and TDS.
6	_	_	6x6x6	Clean water reservoir for multipurpose usege.

***Source :** NTHRI, Shinikiari , Mansehra. All plants collected from Bioremediation programme NARC, Islamabad.

2.4 Polluted water sampling and physico-chemical analysis

One liter of water sample was collected from inlet, outlet and all bio-treatment ponds. For sample collection the bottles were treated as per standrad rules. Physical parameters of collected water samples were studied immediately, which were collected in replicates from inlet, outlet and all the bio-treatment ponds. In physical parameters analysis pH, Turbidity and TDS were studied,while Chloride, Bicarbonate and Calcium, were studied in the Microbiological lab of Hazara University Mansehra . Following are analytical procedure given by APHA for water analysis.

2.5 pH

The pH of the polluted water determined by pH meter (WA-2015). First standardize the pH meter by means of the standard solution . Pour a 40 ml sample into the glass beaker. Stir the water sample vigorously using a clean glass stirring rod. Immerse the electrode of the pH meter into the water sample for proper reading .

2.6 Total Dissolved Solids (TDS)

Total Dissolved Solids determined by TDS Meter (WA-2015). Poured 40 ml sample into the glass beaker. Stirred the water sample vigorously using a clean glass stirring rod. Immersed the electrode of the TDS meter into the water sample for proper reading .

2.7 Turbidity

Determined by turbidity meter (HANNA, HI-93703-11). Poured 40 ml sample into the glass beaker. Stirred the water sample vigorously using a clean glass stirring rod. Immersed the electrode of the turbidity meter into the water sample.

2.8 Chloride (Cl^{-1})

Chloride determined by titration method. Took $AgNO_3$ standard solution by dissolving 2.3987 g/l. This gave 0.0141N solution. Took 20 ml of each sample in a beaker. Added 3 to 4 drops of K_2CrO_4 in to the sample. Titrated with $AgNO_3$ of sample until its color changed. Formula for chloride in water = ml of titrant used × N × 35.5 × 1000 ÷ 20.

2.9 Bicarbonates (HCO_3^{-1})

Analysed by titration method. For standardization took 5 ml of Na_2CO_3 and titrated with HCL, if the reading is around 12.5 than HCL is standardized. Mythyl Orange is used as indicator, so end point is pink color. Bicarbonates was present in every sample for titration of bicarbonates, prepared a 0.1 N HCL solution which is standardize with 0.5 N Na_2Co_3 solutions. For 0.1 N HCL take 8.3 ml of HCl and diluted to 1000 ml. Took 200 ml of this and diluted to 1000 ml, this gave 0.02 N solution of HCL.Formula for Bicarbonates in water = ml of titrant used × 100

2.10 Calcium (Ca^{+2})

Calcium determined by titrimetric methods using EDTA as a titrant. Took 30ml of water sample in a conical flask. Added 2.0 ml of 8% NaOH solution and 0.2g murexide indicator shaked well pink color appeared, titrated it against EDTA .The appearance of purple color was the indication of end point. Formula for calcium in water = ml of titrant used× 40.

3. Results and Discussions

3.1. Physio-chemical analysis different parameters .

In physio-chemical analysis different parameters (pH, Turbidity, TDS, Chloride, Bicarbonate and Calcium) were studied. Each parameter analyzed 3 times with samples collected from Bio-remediation Orchard. Experiments were conducted on July 10, 20, 30 , 2013 respectively . Results are presented in tables following 2-11. Overall performance of the system resulted that pH (3.8%), Turbidity

(84.2%), TDS (13.5%), Chloride (22.0%), Bicarbonate (31.6%) and Calcium (34.2%) after analysis accordingly.

It was observed that pond 1 and pond 2 showed decreased in pH, the acidic conditions in the ponds could be due to the inability of the *Pistia stratiotes* plants to use up all the CO_2 produced during respiration. The CO_2 then pass through the roots into the water medium. [28]. The CO_2 is readily available for the leaves, which are exposed to the atmosphere. Unlike algae, CO_2 is always a limiting factor because it must be dissolved in the water medium in which they grow. However, this drives a reaction in equation to produce more OH^-, creating the alkaline conditions found in algal ponds as explained in the equations here:

$$CO_2 + H_2O \leftrightarrow H_2CO_3$$
$$H_2CO_3 \leftrightarrow H^+ + HCO_3^{-1}$$
$$HCO_3^{-1} \leftrightarrow H^+ + CO_3^{-2}$$
$$CO_3^{-2} + H_2O \leftrightarrow HCO_3^{-1} + OH^{-1}$$

Table 2. Physico-chemical analysis of water at bio-remediation garden, NTHRI, on 10 July, 2013 at 35 ^oC

S.No	Water Quality Parameters [1]	pH	Turbidity	TDS	Cl^{-1}	CO_3^{-2}	HCO_3^{-1}	Ca^{+2}
	Permissible limit[2]	6.5 – 8.5	10	0-2000	0-1065	0-3	0-610	200
1	Inlet	7.9	74	790	50.05	0	550	92
2	moistland	8.00	28.18	740	50.05	0	550	100
3	P1	7.7	14	730	45.54	0	500	70
4	P2	7.6	15.4	688	43.4	0	480	68
5	P3	7.5	14.9	681	45.01	0	500	73
6	P5	7.9	13.9	697	44.73	0	470	73
7	Outlet	8.1	12.98	687	42.91	0	390	52

Table 3. Physico-chemical analysis of water at Bio-remediation garden, on 20 July, 2013 at 35 ^oC

S.No	Water Quality Parameters	pH	Turbidity	TDS	Cl^{-1}	CO_3^{-2}	HCO_3^{-1}	Ca^{+2}
	Permissible limit	6.5 – 8.5	10	0-2000	0-1065	0-3	0-610	200
1	Inlet	7.80	88	775	62.12	0	550	100
2	Moistland	8.03	29.3	773	62.12	0	550	100
3	P1	7.60	15.3	746	59.09	0	500	80
4	P2	7.90	14.1	693	46.03	0	500	77
5	P3	7.55	15.7	697	52.12	0	400	80
6	P5	7.78	13.7	695	47.02	0	450	80
7	Outlet	8.14	13.39	649	46.01	0	350	68

[1] APHA, 20th Edition
[2] United States Department of Agriculture

Table 4 Physico-chemical analysis of water at Bio-remediation garden on 30 July, 2013 at 35 ^oC

S.No	Water Quality Parameters	Ph	Turbidity	TDS	Cl^{-1}	CO_3^{-2}	HCO_3^{-1}	Ca^{+2}
	Permissible limit	6.5 – 8.5	10	0-2000	0-1065	0-3	0-610	200
1	Inlet	7.90	91	767	57.15	0	570	98
2	Moistland	8.04	32.7	770	61.11	0	560	100
3	P1	7.60	15.3	739	60.3	0	510	87
4	P2	7.79	15.8	691	59.6	0	510	80
5	P3	7.73	15.3	701	60.2	0	460	85
6	P5	7.90	14.1	691	58.8	0	410	83
7	Outlet	8.30	13.79	680	43.07	0	400	71

Table 5. Overall Performance of the system physico-chemical analysis of water at bio-remediation garden at NTHRI

S.No	Water Quality Parameters	pH	Turbidity **	TDS**	Cl^{-1}*	CO_3^{-2}*	HCO_3^{-1}*	Ca^{+2}*
	Permissible limit	6.5 – 8.5	10	0-2000	0-1065	0-3	0-610	200
1	Inlet	7.8	84.3	777	56.44	0	556	96.66
2	Outlet	8.1	13.3	672	44	0	380	63.66
3	Percentage	3.8%↑	84.2%↓	13.5%↓	22.0%↓	0	31.6%↓	34.2%↓

↓ = Decreased , ↑ = Increased , *** = dS/m, ** = NTU, * = ppm, ,[1] APHA, 20th Edition [2] USA Deptt. of Agric.

Bicarbonates accumulation is good in moistland and also in all treatted ponds. Selected macrophytes show good results for the accumulation of bicarbonates. Moistland decreased bicarbonates 10 ppm, water lettuce also 10 ppm, water hyacinth 50 ppm and water pennyworth also accumulates 50 ppm of bicarbonates. Turbidity decreased in moistland and all other treatment ponds very significantly. moistland shown better results and decreased the turbidity 60%. Water lettuce, water hyacinth and pennywort also had shown good results. In pond 1 water lettuce increased the concentration of nitrate, but in pond 2, which is also planted by water lettuce shown decreased in concentration. In pond 1 water lettuce planted earlier than in pond 2 so it decomposed in the water. Treated water at bioremediation garden with in permissible limits given by United States of Agriculture Department. Irrigation with treated water will be safe for crop growth and yield.

3.2 Water Quality Parameter

3.2.1 pH

During 1st experimentation the pH values of inlet, wetland, P1, P2, P3, P5 and outlet are 7.9, 8, 7.7, 7.6, 7.5, 7.9 and 8.1 respectively. So in P1, P2 and P3 the pH value decreased by 0.3, 0.1 and 0.1

respectively. But in wetland, P5 and outlet it increased by 0.1, 0.4 and 0.2 respectively. In 2nd experiment the pH values of inlet, wetland, P1, P2, P3, P5 and outlet are 7.8, 8.03, 7.84, 7.9, 7.55, 7.78 and 8.14 respectively. So in P1 and P3 it decreased by 0.19 and 0.35. But in wetland, P2, P5 and outlet it increased by 0.5, 0.06, 0.23 and 0.36 respectively. While in 3rd experiment the pH values of inlet, wetland, P1, P2, P3, P5 and outlet are 7.9, 8.04, 7.6, 7.79, 7.73, 7.9 and 8.3 respectively. So in P1 and P3 it deceased by 0.44 and 0.017. But in wetland, P2, P5 and outlet value increased by 0.14, 0.19, 0.17 and 0.4 respectively.

3.2.2 Turbidity

Turbidity values of inlet, wetland, P1, P2, P3, P5 and outlet are 74 NTU, 28.18 NTU, 14 NTU, 15.4 NTU, 14.9 NTU, 13.9 NTU and 12.98 NTU respectively. So in wetland, P1, P3, P5 and outlet it decreased by 45.82 NTU, 14.18 NTU, 0.5 NTU, 1.0 NTU and 0.92 NTU respectively. But only in P2 turbidity increased by 1.4 NTU. However 2nd experiment resulted the turbidity values of inlet, wetland, P1, P2, P3, P5 and outlet are 88 NTU, 29.3 NTU, 13.7 NTU, 14.1 NTU, 14.2 NTU, 13.7 NTU and 13.39 NTU respectively. So in wetland, P1, P5 and outlet turbidity decreased by 58.7 NTU, 15.6 NTU, 0.5 NTU and 0.31 NTU respectively. But in P2 and P3 its values increased by 0.4 NTU and 0.1 NTU. While the 3rd experiment the turbidity values of inlet, wetland, P1, P2, P3, P5 and outlet are 91 NTU, 32.7 NTU, 15.3 NTU, 15.8 NTU, 15.3 NTU, 14.1 NTU and 13.79 NTUrespectively. So in wetland, P1, P3, P5 and outlet it values decreased by 58.3 NTU, 17.4 NTU, 0.5 NTU, 12 NTU and 0.31 NTU. But in P2 it values increased by 0.5 NTU and 10 NTU.

Table 6. Water Quality parameters observance in three split experiments for pH

Observance dates	Inlet	Moist land	Pond1	Ponds2	Ponds3	Ponds5	Out let
10.7.13	7.9	8	7.7	7.6	7.5	7.9	8.1
		0.1 i	0.3 d	0.1 d	0.1d	0.4 i	0.2 i
20.7.13	7.8	8.3	7.84	7.9	7.55	7.88	8.14
		0.5 i	0.1 d	0.6 i	0.3 d	0.2i	0.3i
30.7.13	7.9	8.4	7.6	7.7	7.7	7.9	8.3
		0.1 i	0.4 d	0.1 i	0.1d	0.1 i	0.4 i

(i) Stand for Incresased and (d) decereased

Table 7. Water Quality parameters observance in three split experiments for TDS(ppm)

Observance dates	Inlet	Moist land	Pond1	Ponds2	Ponds3	Ponds5	Out let
10.7.13	790	740	730	688	681	697	687
		50 d	10 d	7 d	10 d	16 i	2 i
20.7.13	775	773	746	693	697	695	649
		2d	27d	53d	4 i	3d	46d
30.7.13	767	770	739	691	701	691	680
		3 i	31 d	48 d	10 i	10 d	11 d

(i) Stand for Incresased and (d) decereased

Table 8. Water Quality parameters observance in three split experiments for Turbidity (NTU)

Observance dates	Inlet	Moist land	Pond1	Ponds2	Ponds3	Ponds5	Out let
10.7.13	74	28	14	15	14	13	12
		45d	14 d	1.4 i	0.5 d	1.0 d	0.9 d
20.7.13	88	29	13	14	14	13	13
		58 d	0.5 i	04 i	0.1 i	58 d	15 d
30.7.13	91	32	15	15	15	14	13
		58 d	17d	0.5 i	0.5 d	12 d	0.3 d

(i) Stand for Incresased and (d) decereased

Table 9. Water Quality parameters observance in three split experiments for Chloride (Cr^{-1}) ppm

Observance dates	Inlet	Moist land	Pond1	Ponds2	Ponds3	Ponds5	Out let
10.7.13	50	50	45	43	45	44	42
		1.0 i	4.5 d	2.2 d	1.6 i	0.2 d	1.8 d
20.7.13	62	62	59	46	52	47	46
		5.9 i	3.0 d	13.0 d	6.0 i	5.1 d	1.0 d
30.7.13	57	61	60	59	60	58	43
		3.9 i	0.81d	0.7 d	3.9 i	15.7d	0.6 i

(i) Stand for Incresased and (d) decereased

Table 10. Water Quality parameters observance in three split experiments for Bicarbonate (HCO_3^{-1}) ppm

Observance dates	Inlet	Moist land	Pond1	Ponds2	Ponds3	Ponds5	Out let
10.7.13	550	550	500	480	500	470	390
		550*	50 d	20 d	20 i	30 d	50 d
20.7.13	550	550	500	500	400	450	350
		550*	50 d	500*	100 d	50 i	100 d
30.7.13	570	560	510	510	460	410	400
		10	50	510*	50	50	10

(i) Stand for Incresased and (d) decereased , (ii) * remains same

Table 11. Water Quality parameters observance in three split experiments for Calcium (Ca^{+2}) ppm

Observance dates	Inlet	Moist land	Pond1	Ponds2	Ponds3	Ponds5	Out let
10.7.13	92	100	70	68	73	73	52
		8 i	30 d	2 d	5 i	73*	30 d
20.7.13	100	100	80	77	80	80	68
		100*	20 d	3 d	3 i	80*	12 d
30.7.13	98	100	87	80	85	83	71
		2 i	13 d	7 d	5 i	2 d	12 d

(i) Stand for Incresased and (d) decereased , (ii) * remains same

3.2.3 Total Dissolved Solid (TDS)

Experiment on 10 July revelaed that the TDS in the inlet, wetland, P1, P2, P3, P5 and outlet are 790 ppm, 740 ppm, 730 ppm, 688 ppm, 681 ppm, 697 ppm and 687 ppm respectively. TDS decreased in wetland, P1, P2, P3 and outlet by 50 ppm, 10 ppm, 42 ppm, 7 ppm and 10 ppm. But in 16 ppm TDS increased. While 2nd experiment the TDS in the inlet, wetland, P1, P2, P3, P5 and outlet are 775 ppm, 773 ppm, 746 ppm, 693p ppm, 697 ppm, 695 ppm and 649 ppm respectively. TDS decreased in wetland, P1, P2, P5 and outlet by 2 ppm, 27 ppm, 53 ppm, 3 ppm and 46 ppm. But in P3 it increased by 4 ppm. The 3rd experiment resulted that the TDS in the inlet, wetland, P1, P2, P3, P5 and outlet are 767 ppm, 770 ppm, 739 ppm, 691 ppm, 701 ppm 691 ppm and 680 ppm respectively. TDS decreased in P1, P2, P5 and outlet by 31 ppm, 48 ppm, 10 ppm and 11 ppm. But in wetland and P3 it increased by 3 ppm and 10 ppm.

3.2.4 Chloride (Cl^{-1})

In 1st experiment the chloride in the inlet, wetland, P1, P2, P3, P5 and outlet are 50.05 ppm, 50.05 ppm, 45.54 ppm, 43.4 ppm, 45.01 ppm, 44.73 ppm and 42.91 ppm respectively. Chloride decreased in P1, P2, P5 and outlet by 4.51 ppm, 2.24 ppm, 0.28 ppm and 1.82 ppm respectively. But in P3 chloride increased by 1.61 ppm. In 2nd experiment the chloride in the inlet, wetland, P1, P2, P3, P5 and outlet are 62.12 ppm, 62.12 ppm, 59.09 ppm, 46.03 ppm, 52.12 ppm, 47.02 ppm and 46.01 ppm respectively. Chloride decreased in P1, P2, P5 and outlet by 3.03 ppm, 13.06 ppm, 5.1 ppm and 1.01 ppm. But in P3 chloride increased by 6.09 ppm. In 3rd experiment the chloride in the inlet, wetland, P1, P2, P3, P5 and outlet are 57.15 ppm, 61.11 ppm, 60.3 ppm, 59.6 ppm, 60.2 ppm, 58.8 ppm and 43.07 ppm respectively. Chloride decreased in P1, P2, P5 and outlet by 0.81 ppm, 0.7 ppm, 1.4 ppm and 15.73 ppm. But it increased in wetland and P3 by 3.96 ppm and 0.6 ppm.

3.2.5 Bicarbonate (HCO_3^{-1})

The bicarbonate in the inlet, wetland, P1, P2, P3, P5 and outlet are 550 ppm, 550 ppm, 500 ppm, 480 ppm, 500 ppm, 470 ppm and 390 respectively. Bicarbonate decreased in P1, P2, P5 and outlet by 50 ppm, 20 ppm, 30 ppm and 80 ppm. But in P3 it increased by 20 ppm, and remains same in the wetland. Experiment at 2nd time observed that the bicarbonate in the inlet, wetland, P1, P2, P3, P5 and outlet are 550 ppm, 550 ppm, 500pmm, 500 ppm, 400 ppm, 450 ppm and 350 ppm respectively. Bicarbonates decreased in P1, P3 and outlet by 50 ppm, 100 ppm and 100 ppm. But in P5 it increased by 50 ppm, and concentration in wetland and P2 remain same. In 3rd experiment the bicarbonate in the inlet, wetland, P1, P2, P3, P5 and outlet are 570 ppm, 560 ppm, 510 ppm, 510 ppm, 460 ppm, 410 and 400 ppm respectively. Bicarbonates decreased in wetland, P1, P3, P5 and outlet by 10 ppm, 50 ppm, 50 ppm, 50 ppm and 10 ppm. But in P2 it concentration remain same.

3.2.6 Calcium (Ca^{+2})

Calcium in the inlet, wetland, P1, P2, P3, P5 and outlet are 92 ppm, 100 ppm, 70 ppm, 68 ppm, 73 ppm, 73 ppm and 52 ppm respectively. Calcium decreased in P1, P2 and outlet by 30 ppm, 2 ppm and 21 ppm. But increased in wetland and P3 by 8 ppm and 5 ppm, and concentration remain same in P5. 2nd time noted that calcium in the inlet, wetland, P1, P2, P3, P5 and outlet are 100 ppm, 100 ppm, 80 ppm, 77 ppm, 80 ppm, 80 ppm and 68 ppm respectively. Calcium decreased in P1, P2 and outlet by 20

ppm, 3 ppm and 12 ppm. But increased in P3 by 3 ppm, and concentration remain same in wetland and P5. While 3rd time experiment the calcium in the inlet, wetland, P1, P2, P3, P5 and outlet are 98 ppm, 100 ppm, 87 ppm, 80 ppm, 85 ppm, 83 ppm and 71 ppm respectively. Calcium decreased in P1, P2, P5 and outlet by 13 ppm, 7 ppm, 2 ppm and12 ppm. But increased in wetland and P3 by 2 ppm and 5 ppm.

4. Conclusion

Pakistan is facing a scarcity of freshwater resources .The per capita water availability was 5300 m^3 in 1951 had reduced to 1105 m^3. However, Agriculture is the single largest user of fresh water in the world, in Pakistan nearly 88% fresh water used for irrigation.The main reasons for declining water availability are rapid population growth, depleting water storage facilities, and pollution/contaminants of existing water resources due to discharge of untreated industrial and sewage effluents into streams/rivers. Based on above facts these results/findings will help to make better choice of polluted water plant system because because of this vary new technology is not so expensive , rather easy to adopt. The ponds are suitable as water storage, fish farms and can use for irrigation purpose too after treatments. However some more research studies need to be clarified further.

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References

[1] C. Henniker , *Rev.Mod.Phys.*, 21, (1949) 322.
[2] P. Gerald, *Water Sci.Uni. of Washington* ., (2011) 02-05.
[3] UN report 2010 *"United Nations". Un.org*. (2005) 03-22.
[4] UNEP report , */http://www.unep.org/summary.htms*., (2002).
[5] M. Afzal , *ALP Final Report NARC,* (2007) 1-165.
[6] M.Z.Rehman, *NAGA*., 25, (2002) 8-12.
[7] W. Lerry , *Surv.Sci Inves.Report.,23*(2006)2012-5184.
[8] A.L. Yassi, D. T .Kjellstrom ,T. Guidotti**.,** *Essent. G.Health ., New York: Oxford Uni. Press***.** (2001) 126.
[9] T. Kjellstrom ., *Acta Pharm. Toxicol.* 58(1986)137-83.
[10] K. Murata, P.Weihe, E. Budtz, P. Jorgensen,P. Grandjean,, *J. Pediatrics* ., 144, (2004) 177-83.
[11] L. Knobeloch , *Env.Health..Prosp.*, 102, (1994) 958-961.
[12] L.C. Stenhammar, *Eup. J. Med. Res.*, 4, (1999) 217–218.
[13] Y.C. Hong, H.R. Azad, D.A.Cooksey *Prt.Nat. Acadm. Sci.USA.*, 93, (1996) 7315-7320.
[14] Annon. *Strateg.Count. Env.Assess.Report* ., (2006) 1-180.
[15]Annon.*Water Aid in Pak,. Water Q. Testing Prot.Pakistan.*, (2010) 1-175
[16]S.Feenstra , R.Hussain , W.Van-der-Hoek., *Pak. IWMI Report. Lahore*.(2005)107.
[17] D.E.Salt, M. Blaylock , P.B.Kumar, V. Dushenkov , D. Ensley , I. Chet , I. Raskin ,.*Env.Using Plants. Bio. Tech.* (1995) 340-355.
[18] A. G .Khan., C.Kuek, T. M Chaudhry., C. S Khoo., W. J. Hayes., *Role of Plants,. Hong Kong*. 41(2000)231-239.
[19] P.B.A.N. Kumar, V. Dushenkov, H. Motto, I. Raskin ., *Environ. Sci. Tech*. 21(1995) 134-146.

[20] V. Dushenkov, P.B.A.N. Kumar, H. Motto, I. Raskin ., *Environ. Sci. Tech*. 22(1995) 284-290.

[21] S.Susarla, V.F.Medina, S.C. McCutcheon., *Ecol. Engg*. 18(5)(2002)647-658.

[22]R. Mohamed, *Int. J. Sus. Dev. Plann*. 4(2) (2009)41–55.

[23] W.V. Hoek , M. Hassan , J. H. J.Ensink , S. Feenstra , L. R-Sally , S. Munir , R. Aslam , N. Ali , R. Hussain , Y. Mastuno ., *Res.Report 63. Int.Water Manag.Inst*. (2002) 1-213.

[24]H. Imran., 2005. *Electron. J. Environ. Agric. Food Chem.* 4(4)(2005) 994-1004.

[25] C.D.K. Cook, B.J. Gut , E.M. Rix , J. Schneller , M. Seitz , *The Hague*.(1974) 329-330.

[26] C.D. Sculthorpe , *The Biology of Aquatic Vasc. Plants. St. Martin's Press. N.York.*(1967) 1-610

[27] D.R. Lide ., *H.book of Chem.& Phy. CRC Press. Boca Raton*. (1995.) 76th ed.

[28] E. Awuah , M. Oppong-Peprah , H.J. Lubberding , H.J.Gijzen ., *J. of Toxi.& Env.Health.* 26(67)(2004)1727-39.