International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2021; SP-9(2): 36-40

Received: 11-12-2020
Accepted: 23-02-2021

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Anatomization of Irrigation water quality parameters of Chaka block, Yamuna river bank, Prayagraj, Uttar Pradesh, India

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DOI: https://doi.org/10.22271/chemi.2021.v9.i2a.11903

Abstract
Water is an important natural resource on the surface of earth. Approximately 70% of the water is utilized in the agricultural sectors. Yamuna River having a total drainage area of 366,220 sq Kilometer's is now highly prone to pollution causing a major threat to the water quality. The present investigation was carried at Sam Higginbottom University of agriculture technology and sciences in the department of Soil Science and Agricultural Chemistry lab. In this study, a total of 24 water samples were collected on 01 November 2020 in Chaka block of Prayagraj district and from each village 3 water samples were collected and analyzed for their primary and secondary irrigation water quality parameters by using standard laboratory techniques. Through this, the results stated that pH is in the range of 6.22-7.34 with mean valve 6.74, EC in the range of 0.61-1.13 dS m^{-1} with mean valve 0.83, and Irrigation water quality index was in the range of 107.6-177.8, where 100% of the water samples are in poor condition. These analyses concluded that still, improvement has to be done to improve irrigation water quality.

Keywords: Irrigation water quality, Chaka block, Yamuna and water quality index

Introduction
Water is a renewable resource on surface of earth were amount of water always remains the same. Most of the water is unavailable for human beings more than 70% of the earth's surface is covered by water were only 1% of the freshwater is available to humans. For human beings' main source of water come from surface water which is now under environment stress due to development of infrastructures, industrial extant, agricultural activities. Sufficient amount of water quality is necessary to supply water for agricultural land. Water quality differ from place to place, with the climate factors, with the environmental variations and types of soil and rocks along which it moves. Water from rain moves through the ground, the water dissolve minerals in rocks and soil, but commonly dissolved substance in water are salts or minerals, are referred as dissolved solids include common constituents and plant constituents (Gail, 2014) [4].
Rivers are precious elements of mother nature. Rivers play major role in integrating and organizing the landscape (Das, 2018) [6]. Yamuna originates Yamunotri Glacier of Uttar Kashi in Uttar Pradesh. The Yamuna River is one of the important rivers of India. It is the second largest tributary of the river Ganga. It has four main tributaries in the Himalayan region: Rishi Ganga, Hanuman Ganga, Tons and Giri (Upadhyay, 2013). It flows through the states of Delhi, Haryana, and Uttar Pradesh were merges with the Ganga at Triveni Sangam, Prayagraj district. The total Length around 1,370 kilometers with a total drainage of 366,220 sq kilometers. In the world, Yamuna is the polluted river, where about 22 discharge drains waste water are released in water (Misra, 2010) [10]. Approximately 57 million people are depending on the river for their basic needs.
Irrigation is an important use of Yamuna river water. In the entire Yamuna basin about 12.3 million hectares are irrigated lands and approximately 49% of land is irrigated from surface water (CPCB, 2006) [5]. The concentration and composition of soluble salts in water determines Irrigation water quality (Zaman, 2018) [11]. Water quality describes Physical, chemical and biological components of water that has been analysed and reported for drinking water (Chapman, 1996) [3]. Water quality for agricultural purposes is based on the effect of water on the quality and yield of crop (FAO, 1985) [8]. The problems related to water quality is high in areas where there is dense population and Industrial areas. Prayagraj is Metro area with huge population of 1.3 million (as per 2019 data). The soil problems are related to quality of irrigation water include salinity, water infiltration, toxicity and miscellaneous problems

(USDA, 1954) [13]. The present work deals with Anatomization of irrigation water quality parameters of Chaka block, Yamuna river bank, Prayagraj district, Uttar Pradesh, India.

Materials and Methods

Chaka is a block in Prayagraj district of the Indian state in the Southern part of Uttar Pradesh at an elevation of 98 meters (322 ft). Prayagraj is also a metropolis city in the Indian state of Uttar Pradesh. It is located at 25.45^0 N and 81.84^0 E and lies 102m above the mean sea level. The geographical area of the district is 5437.2 Sq. kms (as per 1991 data). Prayagraj comes under three agro-climates zones are Agro-climate zone-IV, Middle Gangetic plains region Agro-climate Zone-V and Upper Gangetic Plains region and Agro-climate Zone-VIII. Prayagraj district consists of 7 Tehsils, 20 locks, 218 Nyaya panchayats, and 1472 Gram panchayats. The place shows a humid subtropical climate with temperature varies from 10^0c to 28^0c in winters and 23^0c to 42^0c in summer and annual rainfall is 981mm.

Analysis of water quality parameters

Total 24 samples were collected from eight different villages in each village three samples were collected in different sites. Collected samples were stored in plastic bottle, 2-3 drops of toluene were also added in each sample for stop growth of microbes. The collected water samples were analyzed for Physico-chemical water quality parameters such as pH, Electrical conductivity, Total Alkalinity (Carbonate and bicarbonate), Chloride, Potassium, Calcium, Calcium + Magnesium and Sodium by using standard laboratory techniques (APHA, 1992) [1]. The primary water quality parameters are pH was measured by digital pH meter and Electrical Conductivity were measured by digital conductivity meter; it is expressed in dSm^{-1}. Alkalinity was determined by Acidimetric titration method by utilizing 0.05 N of sulphuric acid solution for determination of carbonate phenolphthalein as indicator where presence of carbonate colour turn into pink whereas methyl orange red indicator is used for determination of the bicarbonate presence of bicarbonate initial colour yellow turns into final colour rose red. Chloride in water samples analyzed by Mohr's titration method were 0.02 N of silver nitrate solution utilized for titration by adding Potassium chromate indicator in water samples then titrate initial color dark yellow turns into brick red.

Calcium and Calcium + Magnesium in water samples were determined by Complex metric titration method by using 0.01N EDTA solution for calcium determination Murexide indicator used through titration method the initial colour prink turn into purple for Calcium + Magnesium Erichrome Black-T as indicator the initial color light pink changes into blue. Potassium measured by flame photometer instrument calibrate with 0, 5, 10, 15 and 20ppm standard solutions of 1000ppm and 250ppm Potassium chloride (KCl). Sodium also measured by flame photometer instrument with series of 1, 2.5, 5.0, 7.5, and 10.0 standard solutions of sodium chloride (NaCl).

The secondary water quality parameters are Kelly's ratio (KR), Permeability Index (PI), Residual sodium carbonate (RSC), Sodium adsorption ratio (SAR), Soluble sodium percentage (SSP) and Irrigation Water Quality Index (IWQI) are examined from dominant water parameters.

Kelly's Ratio

Irrigation water suitability purposes is evaluated on bases of Kelly's ratio (Kelly, 1951). It is calculated by using following expression. Were, its expressed as Meq L^{-1}.

$$KR = \frac{Na^+}{Ca^{2+} + Mg^{2+}}$$

Kelly's ratio of more than indicates the excess sodium in water. Therefore, Kelly's ratio with water less than one is suitable for irrigation, while ratio more than one is unsuitable (Nagaraju, 2014) [12].

Permeability Index

The soil permeability index affected by long-term irrigation influenced by Na^+, Ca^{2+}, Mg^{2+}, and HCO_3^- (Chandu *et al.*, 1995). The permeability Index (PI) used for evaluation of irrigation purpose. It is expressed as Meq L^{-1}

$$PI = \frac{Na + \sqrt{HCO3} \times 100}{Ca + Mg + Na}$$

Residual sodium carbonate (RSC)

It is used to estimate the Alkainity hazard in water. The Residual sodium Carbonate is calculated by following expression. It is expressed in Meq L^{-1}(Eaton, 1950) [7].

$$RSC = (CO_3^{2-} + HCO_3^-) - (Ca^{2+} + Mg^{2+})$$

Sodium adsorption ratio (SAR)

The amount of Sodium (Na^+) relative to Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) is a measure of SAR (Richards, 1954). It is calculated by following expression where concentrations of all ions are in Meq L^{-1}.

$$SAR = \frac{Na}{\sqrt{Ca} + Mg/2}$$

Soluble sodium percentage (SSP)

Soluble sodium percentage is most important for clear about sodium content of studying sodium hazard (Todd, 1980). The SSP is calculated by using following formula where concentrations of all ions are in Meq L^{-1}.

$$SSP = \frac{Na \times 100}{Ca + Mg + Na}$$

Irrigation Water Quality Index

Irrigation Water Quality Index was developed by (Meireles *et al.*, 2007) [9]. It is mainly evaluating the function level of primary quality parameters. Irrigation Water quality parameters have potential negative impact on soil quality and crop yield (Spandana, 2013) [15]. Irrigation water quality main purpose to define the suitability for agriculture use. In the primary step, selection of quality parameters for this we have to study the Indian Standard (BIS, 1991) [19] for drinking water quality.

Computation of WQI: -

In this we have to follow three steps

1. Assigning of weight (w_i) to the selected parameters according through the relative important in overall quality of water (*e.g.*, pH, EC, HCO_3, Ca, Mg, Cl, K, Na…etc.
2. Computation of relative weight (W_i) of the chemical parameters using following equation

   $W_i = w_i / \sum w_i$ (i=1 to n)

Where

W_i = is the relative weight
W_i = weight of each parameter
N = number of parameters

3. Assigning of a quality rate scale (qi) for each parameter, as below;

   qi= (Ci/Si) × 100

Where

Qi = quality rating

Ci = Concentration of each chemical parameter in each water sample in mg/l

Si = Guide line valve given in BIS 1991 [19].

For computation of WQI, the sub-index (SI) is first determined for each chemical parameter, given below

$Sl_i = W_i \times q_i$

$WQI = \sum Sl_i$ 1-n

Where Sli = sub-index of ith parameter

W_i= Relative weight of ith parameter

q_i= Rating based on the concentration of ith parameter

n= Number of chemical parameters.

Results and Discussion

The results of primary and secondary parameters of irrigation water samples different sites in Chaka Block of Prayagraj district are given in table 1 and 2.

Table 1: Irrigation water quality parameters of Chaka block of Prayagraj district of Uttar Pradesh

Sample No.	pH	EC (dSm^{-1})	CO_3^{2-} (Meq L^{-1})	HCO_3 (Meq L^{-1})	Cl^- (Meq L^{-1})	Ca (Meq L^{-1})	Ca+ Mg (Meq L^{-1})	Mg (Meq L^{-1})	K^+ (Meq L^{-1})	Na^+ (Meq L^{-1})
W_1	6.26	0.98	0	12	9.2	7.6	10	2.4	0.103	0.217
W_2	6.68	0.72	0	10	9.2	5.6	7.6	02	0.051	0.130
W_3	6.63	0.87	0	09	10.4	6.2	10.6	4.4	0.154	0.174
W_4	6.57	1.06	0	12	10.4	6.6	11.8	5.2	0.128	0.217
W_5	6.65	1.12	0	09	10.8	08	12	04	0.103	0.217
W_6	6.83	1.13	0	18	10.4	07	13.2	6.2	0.154	0.174
W_7	7.12	0.67	0	11	8.4	05	7.4	2.4	0.077	0.087
W_8	6.35	0.83	0	07	7.2	4.8	8.4	3.6	0.051	0.087
W_9	6.22	0.65	0	06	8.8	4.2	7.6	3.4	0.077	0.087
W_{10}	6.75	0.83	0	12	8.8	04	10	06	0.051	0.087
W_{11}	6.96	0.82	0	13	8.8	05	11	06	0.077	0.174
W_{12}	6.90	0.84	0	13	9.2	4.6	9.8	5.2	0.077	0.130
W_{13}	7.26	0.61	0	08	9.2	3.6	6.4	2.8	0.103	0.087
W_{14}	6.79	0.6	0	02	9.2	3.8	7.8	04	0.077	0.174
W_{15}	6.27	0.71	0	11	8.4	04	7.4	3.4	0.077	0.087
W_{16}	6.51	0.85	0	13	10.8	3.8	9.8	06	0.077	0.130
W_{17}	6.71	0.89	0	14	9.2	04	9.6	5.6	0.103	0.087
W_{18}	7.04	0.91	0	12	9.6	3.8	9.4	5.6	0.077	0.130
W_{19}	6.55	0.71	0	11	11.2	5.6	09	3.4	0.026	0.000
W_{20}	6.47	1.03	0	07	12	9.2	11.6	2.4	0.000	0.130
W_{21}	6.51	0.92	0	09	11.2	7.6	10.4	2.8	0.026	0.087
W_{22}	7.22	0.76	0	09	11.6	02	9.2	7.2	0.051	0.087
W_{23}	7.11	0.66	0	06	9.2	6.8	9.6	2.8	0.051	0.087
W_{24}	7.34	0.79	0	08	10	4.2	10.4	6.2	0.051	0.043
Mean	6.73	0.834	0	10.083	9.716	5.291	9.583	4.291	0.079	0.121
S. D.	0.327	0.15	0	3.309	1.164	1.742	1.685	1.550	0.037	0.055
C.V. (%)	4.85	17.9	0	32.8	11.9	32.9	17.5	36.1	49.3	46
Range	6.22-7.34	0.61-1.13	0-0	02-18	7.2-12	02-9.2	6.4-13.2	02-7.2	0-0.037	0-0.217

Table 2: Irrigation water quality parameters of Chaka block of Prayagraj district in Uttar Pradesh

Sample No.	SAR (Meq L^{-1})	SSP (Meq L^{-1})	KR (Meq L^{-1})	PI (Meq L^{-1})	RSC (Meq L^{-1})	IQWI (Meq L^{-1})
W_1	0.10	3.10	0.022	36.03	02	144.6
W_2	0.07	2.34	0.017	42.59	2.4	134.0
W_3	0.08	3.00	0.016	29.46	-1.6	154.6
W_4	0.09	2.85	0.018	30.63	0.2	177.8
W_5	0.09	2.60	0.018	26.33	-3	178.11
W_6	0.07	2.42	0.013	33.02	4.8	187.88
W_7	0.05	2.17	0.012	45.46	3.6	129.91
W_8	0.04	1.62	0.010	32.20	-1.4	129.06
W_9	0.04	2.11	0.011	33.00	-1.6	116.27
W_{10}	0.04	1.36	0.009	35.20	02	149.32
W_{11}	0.07	2.23	0.016	33.82	02	155.35
W_{12}	0.06	2.07	0.013	37.62	3.2	154.20
W_{13}	0.05	2.88	0.014	44.94	1.6	118.54
W_{14}	0.09	3.12	0.022	19.92	-5.8	111.45
W_{15}	0.05	2.17	0.012	45.46	3.6	107.68
W_{16}	0.06	2.07	0.013	37.62	3.2	158.54
W_{17}	0.04	1.94	0.009	39.52	4.4	159.11
W_{18}	0.06	2.16	0.014	37.72	2.6	156.21
W_{19}	0.00	0.28	0.000	36.85	02	143.85
W_{20}	0.05	1.11	0.011	23.67	-4.6	169.10
W_{21}	0.04	1.07	0.008	29.44	-1.4	159.44
W_{22}	0.04	1.48	0.009	33.24	-0.2	143.98
W_{23}	0.04	1.42	0.009	26.18	-3.6	126.34
W_{24}	0.02	0.90	0.004	27.50	-2.4	143.42
Mean	0.06	2.02	0.013	34.06	0.5	146.19
S. D.	0.023	0.742	0.005	6.808	2.989	21.444
C.V. (%)	42.1	36.7	40.4	19.9	59.85	14.6
Range	0-0.097	0.284-3.12	0-0.022	19.9-45.46	-5.8-4.8	107.68-177.8

Note: SAR = Sodium adsorption ratio, RSC = Residual sodium carbonate, KR = Kelly's ratio, SSP = Soluble sodium percentage, PI = Permeability index, IWQI = Irrigation water quality

The present study analysis of Irrigation Water samples are evaluated on the basis of standard guidelines. The value of irrigation water quality parameters were analyzed and correlated. The pH of the water samples is range from 6.22 to 7.34 with 6.74 as a mean value, 0.33 as a standard deviation and 4.85 as a coefficient of variation. The present analyze concluded that water sample are in neutral to slightly alkaline condition. In that suitable range of pH was found in 19 samples (79.16%) out of total sample and moderately suitable range of pH was found in 5 samples (20.83%) out of total sample. The coefficient of variation of the water sample ranged from 0.61 to 1.13dS m^{-1} with 0.83 as a mean value 0.15 as a standard deviation and 17.97 as a coefficient of variation. The present analyze concluded that suitable range of sample was found only 5(20.83%) sample out of total sample and moderately suitable was found in 19 (79.16%) samples. The alkalinity of the water samples are carbonate and bicarbonate. The carbonate analyzes concluded that carbonate concentration in water sample is absent in total sample. The bicarbonate concentration is ranged from 2 Meq L^{-1} to 18 Meq L^{-1} with 10.08 Meq L^{-1} as mean value, 3.30 as a standard deviation and 32.81 as a coefficient of variation. The estimated samples concluded that only 7 (29.16%) sample are moderately suitable and 17 (70.83%) are not suitable out of total samples. Chloride concentration in water samples is ranged from 7.2 Meq L^{-1} to 12 Meq L^{-1} with 9.71 Meq L^{-1} as a mean value, 1.16 as a standard deviation and 11.98 as a coefficient of variation. The results show that 15(62.5%) sample and out of 9(37.5%) samples are not suitable for the sample. The range of Potassium concentration in water sample 0.00 Meq L^{-1} to 0.154 Meq L^{-1} with 0.076 as a mean value, 0.037 as a standard deviation and 49.31 as a coefficient of variation. Sodium concentration in water sample varied from 0.00 Meq L^{-1} to 0.217 Meq L^{-1} with 0.121 Meq L^{-1} as a mean value, 0.05 as a standard deviation. The results considered that total samples & found suitable condition in 24 (100%) samples. Calcium concentration of the water samples are varied from 2 Meq L^{-1} to 9.2 Meq L^{-1} with 5.29 Meq L^{-1} as a mean value, 1.74 as a standard deviation and 32.92 as a coefficient of variation. Meanwhile calcium + Magnesium concentration in water sample is ranged from 6.4 5.29 Meq L^{-1} to 13.2 5.29 Meq $L^{-1}$with 9.5 as a mean value, 1.68 as a standard deviation and 17.58 as a coefficient of variation as well as Magnesium concentration in water samples are ranged from 2 Meq $L^{-1}$to 7.2 Meq L^{-1} with 4.29 as a mean value, 1.55 as a standard deviation and 36.12 as a coefficient of variation. The irrigation water quality Index of water sample are ranged from 107.67 Meq L^{-1} to 17.78 Meq L^{-1} with 146.19 Meq L^{-1} as a mean value, 21.44 as a standard deviation and 14.66 as a coefficient of variation. The results stated that total water samples 24 (100%) are in the poor range of irrigation. In water sample SAR value is ranged from 0.0 Meq L^{-1-} to 0.06 as a mean value, 0.02 Meq L^{-1} with 0.06 as a mean value, 0.02 as a standard deviation and 42.13 as a coefficient of variation. The results stated total sample 24(100%) are showed very low sodium hazard for irrigation purpose. The SSP in the water samples are varied from 0.28 Meq $L^{-1}$to 3.12 Meq L^{-1} with 2.02 as a mean value, 0.74 as a standard deviation and 36.79 as a coefficient of variation. The analyze concluded total sample 24 (100%) are good condition for irrigation. KR in the water samples is examined it showed various range values from 0.00 Meq L^{-1} to 0.02 Meq L^{-1} with 0.01 as a mean value, 0.005 as a standard deviation and 40.4 as a coefficient of variation. The evaluation concluded as total sample 24(100%) are good for irrigation. The PI of water samples are showed range from 19.92 Meq L^{-1} to 45.46 Meq L^{-1} with 34.06 Meq L^{-1} as a mean value, 6.80 as a standard deviation and 19.99 as a coefficient of variation. The analyze concluded that only 2 samples (8.3%) are not suitable for irrigation, rest of 22 samples (91.6%) are good condition for irrigation. RSC concentration in water sample is varied from -5.8 Meq L^{-1} to 4.8 Meq L^{-1} with 0.5 Meq L^{-1} as a mean value, 2.98 as a standard deviation and 597.8 as a coefficient of variation. The results considered as out of total sample 11 (20.83%) are low hazard condition, 5(20.83%) samples are high hazard for irrigation.

Correlation matrix between Irrigation water Quality Parameters

The correlation between Irrigation Water Quality parameters is given in table 3. The pH of the water sample is corelated with positively non-significantly with chloride (r = 0.047), potassium (r = 0.014), magnesium (r = 0.362), permeability index (r = 0.042), residual sodium bicarbonate (r = 0.025) and negatively non-significantly corelated with EC (r = -0.262), bicarbonate (r = -0.0006), sodium (r = -0.206), calcium (r = -0.367), Calcium + Magnesium (r = -0.045), SAR (r = -0.202), SSP (r = -0.086), Kelly's ratio (r = -0.182) and Irrigation water quality Index (r = -0.010). The EC is Positively significantly corelated with bicarbonate (r = 0.478), chloride (r = 0.436), sodium (r = 0.618), calcium (r = 0.614), SAR (r = 0.467) while positively non-significantly corelated with potassium (r = 0.320), calcium + magnesium (r = 0.874), magnesium (r = 0.260), SSP (r = 0.138), KR (r = 0.267), RSC (r = 0.036), IQWI (r = 0.895) and negatively non-significantly corelated with PI (r = -0.329). The bicarbonate of the water samples is Positively significantly corelated with potassium (r = 0.406), calcium + magnesium (r = 0.435), Magnesium (r = 0.435), PI (r = 0.504), IQWI (r = 0.595) while positively non-significantly corelated with the chloride (r = 0.060), sodium (r = 0.167), calcium (r = 0.033), SAR (r = 0.066), SSP (r = 0.049), RSC (r = 0.861) and negatively non-significantly corelated with KR (r = -0.052). The chloride of water sample is positively significantly corelated with Calcium + Magnesium (r = 0.534), IQWI (r = 0.585) while positively non-significantly related with sodium (r = 0.075), calcium (r = 0.359), Magnesium (r = 0.176) and negatively non-significantly corelated with potassium (r = -0.140), SAR (r = -0.037), SSP (r = -0.284), KR (r = -0.164), PI (r = -0.386) and RSC (r = -0.234)The potassium of water sample positively significantly corelated with Sodium (r = 0.598), SAR (r = 0.580) KR (r = 0.533), positively non-significantly corelated with Calcium + Magnesium (r = 0.243), Magnesium (r = 0.267) SSP (r = 0.775) PI (r = 0.127), RSC (r = 0.312), IQWI (r = 0.2634) and the negatively non-significantly corelated with the Calcium (r = 0.001). The sodium of the water sample is positively significantly corelated with Calcium (r = 0.420), Calcium + Magnesium (r = 0.488), IQWI (r = 0.447), Positively non-significantly corelated with Magnesium (r = 0.058), SAR (0.977), SSP (0.778), KR (0.898), and the Sodium negatively non-significant corelated with PI (r = 0.286) and RSC (r = 0.089). The calcium of the water sample is positively significantly corelated with the Calcium + Magnesium (r = 0.591) IQWI (r = 0.501) non-significantly corelated with SAR (r = 0.317), KR (r = 0.183) and negatively significant corelated with Magnesium (r = -0.480), PI (r = 0.408) non-significantly corelated with the SSP (r = 0.0004) and RSC (r = 0.29). The Calcium + Magnesium of the water sample is positively significantly corelated with Magnesium (r = 0.422), non-significantly corelated with SAR (r = 0.302), KR (0.068), IQWI (r = 0.905) and negatively significant corelated with PI (r = -0.515), non-significant corelated with SSP (r = -0.063), RSC (r = -0.082) Magnesium of water sample positively significantly corelated with the IQWI (r = 0.421), positively non-significantly corelated with the RSC (0.244) and negatively non-significant corelated with SAR (r = 0.028), SSP (r = -0.067), KR (r = -0.131), PI (r = -0.100). The SAR of the water sample positively non-significantly corelated with SSP (r = 0.859), KR (r = 0.970), IQWI (r = 0.273) and negatively non-significantly corelated with KR (r = -0.216), RSC (r = -0.096). The SSP of the water sample positively non-significantly corelated with KR (r = 0.910), PI (r = 0.099), RSC (r = 0.090) and negatively non-significantly corelated with PI (r = 0.118) RSC (r = -0.096), PI of the water sample positively non-significantly corelated with RSC (r = 0.848), negatively non-significantly corelated with IQWI (r = -0.256) and RSC of the water sample positively non-significantly corelated with IQWI (r = -0.148). The similar results are reported with (Shashi Kant *et al.*, 2015) [14].

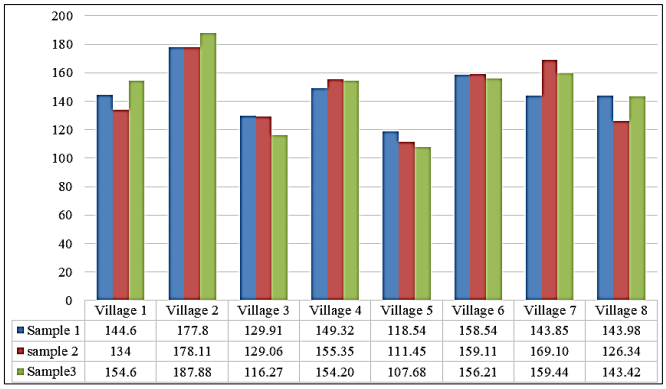

Fig 1: Irrigation water quality index status of Chaka block, Prayagraj

Table 3: Correlation between irrigation water quality parameters of Chaka block of Prayagraj district of Uttar Pradesh

Parameters	pH	EC	HCO_3	Cl^-	K^+	Na	Ca	Ca + Mg	Mg	SAR	SSP	KR	PI	RSC	IQWI
pH	1														
EC	-0.262	1													
HCO_3	-0.006	0.478*	1												
Cl	0.047	0.436*	0.060	1											
K	0.014	0.320	0.406*	-0.140	1										
Na	-0.206	0.618*	0.167	0.075	0.598*	1									
Ca	-0.367	0.614*	0.033	0.359	-0.001	0.420*	1								
Ca + Mg	-0.045	0.874	0.435*	0.534*	0.243	0.488*	0.591*	1							
Mg	0.362	0.260	0.435*	0.176	0.267	0.058	-0.480*	0.422*	1						
SAR	-0.202	0.467*	0.066	-0.037	0.580*	0.977	0.317	0.302	-0.028	1					
SSP	-0.086	0.138	0.049	-0.284	0.775	0.778	-0.004	-0.062	-0.067	0.859	1				
KR	-0.182	0.267	-0.052	-0.164	0.533*	0.898	0.183	0.068	-0.131	0.970	0.910	1			
PI	0.042	-0.329	0.504*	-0.386	0.127	-0.286	-0.408*	-0.515*	-0.100	-0.216	0.099	-0.118	1		
RSC	0.025	0.036	0.861	-0.234	0.312	-0.089	-0.296	-0.082	0.244	-0.096	0.090	-0.096	0.848	1	
IQWI	-0.010	0.895	0.595*	0.585*	0.263	0.447*	0.501*	0.905	0.421*	-0.273	-0.036	0.056	-0.256	0.148	1

Note: - (*) represents significant at 0.05 level

Conclusion

Due to usage of high fertilizers and pesticides by farmers and also due to inappropriate management practices. The pH was found to be acidic to slightly alkaline and all the water sample shown very low sodium hazard. The accumulation of soluble salts which resulted 79.16% of sample are moderate range of EC concentration in samples. Alkalinity of water samples have shown 70.83% of samples are not suitable for irrigation. Total hardness of the water samples was low and Moderate range of soluble salts in water sample indicated poor Irrigation Water Quality Index, where 100% of the samples were in poor condition for Irrigation purpose. This analysis concluded that still improvement has to be done to improve the irrigation water quality mainly by improving management practices with the knowledge and experience grained through study may be developed in future to help the farmers regarding the quality produce, high yields through soil and water conservation and maintain better environment protection.

Acknowledgements

The authors would like to thank the Hon'ble Vice Chancellor, SHUATS and HoD, Department of Soil Science and Agricultural Chemistry, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences for the support. The thankfulness is also extended to all professors, friends and technicians for their continuous help and support.

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