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The Quality of Soil Surrounding Capakcur River and its Usability for Agriculture Purpose: An Analytical Study

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ABSTRACT

Some parameters were investigated in this research report, and their results were discovered in Capakcur wastewater and the soil surrounding it in the Bingol province of Turkey. Potentiometric process, titrimetric method, flame photometric method, gravimetric method, walkley-black method, spectrophotometric, calcimeter method, walkley-black wet digestion method, olsen method, and CEM digestion system were used to analyze parameters. pH, EC, CaCO3, organic matter, PO3, K, Na, and heavy metal ions (Mn+2, Zn+2, Fe+2, Cu+2, Ni+2, Cd+2, and Pb+2) in soil samples were 7.947, 268.908, 12.983, 16.481, 0.092, 11.147, 4.930, 0.122, 0.052, 2.569, 0.831, 1.608, 0.011, 0.082 in the units mS/cm, according to the findings of this report, the concentrations of heavy metals in soil and water samples were minimal.

Keywords: Wastewater, soil, Capakcur River, parameters, analyzing.

1.INTRODUCTION

Pollution may be chemical matter or electricity, such as noise, heat, or light. A pollutant is a waste substance that pollutes the environment by polluting the air, water, or soil. In our world, where the value of population growth cannot be regulated, the hunger crisis is becoming more acute by the day, and humanity must reorganize its relationships with the environment. Soil and water runoff, in particular, have historically had an effect on food quality, posing a potential danger to public health. The increased use of automobiles for transportation in most developed countries has led to widespread anxiety over vehicular emissions. Pollutants introduced by human activities have severely degraded our climate in many parts of the world [1]. Soil emissions may be caused by residential, farming, or manufacturing activities. Industrial waste is often produced without concern for the environmental effects on the receiving soil body [2] [3]. Heavy metal pollution in the natural atmosphere is a worldwide issue since these metals are not destroyed and most of them are harmful to living beings. Heavy metals reach the soil through dumping wastes, effluents resulting in heavy metal drainage from terrestrial systems (industrial and domestic effluents), and geological weathering [3]. Any heavy metals bound to soil particles can be separated from soil surfaces and transported to other locations by the action of water and wind [4] [5] [6]. Municipal wastewater irrigation can alter soil properties such as physical, chemical, or biological properties. These properties are crucial in the transformation of nutrients found in the applied wastewater [7]. In addition, Irrigation of wastewater can expand usable water availability, which has economic benefits, and use of wastewater for agricultural sites offers an inexpensive alternative to surface water drainage, and improves the nutrient cycle, while pollutants can collect in soil and pose a risk to soil quality and long-term productivity [8]. The environmental impact of wastewater application varies depending on the form of soil, the properties of the wastewater, and the vegetation in the irrigated soil. Irrigation of urban wastewater into the soil can alter the soil's natural, chemical, or biological properties. The properties of the soil are essential in the conversion of nutrients into wastewater [7]. Heavy metal pollution in the atmosphere is a common issue since these minerals are indestructible and most have harmful effects on living species where permitted concentration limits are surpassed. Heavy metals that are commonly mentioned in the literature in terms of possible hazards and dropping into polluted soil are Cd, Cr, Pb, Zn, Fe, and Cu [9]. Automobile exhausts, as well as other manufacturing processes, emit heavy metals, exposing the soil, trees, and even the people along high-traffic roads to increasing amounts of heavy metal emissions [6]. To stop costs above expectations, each emissions challenge necessitates professional manufacturing. Decisions should be taken, for example, on optimum sampling of hot spots to determine the average concentration or volume of polluted soil, but also on balancing the selection of emerging technology in the cleaned-up site against the conventional. A recovery strategy is developed based on the evidence and experience gathered. Metals in the Capakcur River are obtained from both natural and artificial causes. Natural sources include rock weathering, soil degradation, and wastewater from human activities. The study's aim was to classify the origins of possible harmful elements and organic compounds in wastewater and the soil surrounding it, as well as to perform qualitative and quantitative measurements.

1.1.MATERIALS AND METHODS

The content of water and the soil around it were calculated by measuring parameters in this study. As seen in Figure 1, the Capakcur River was split into six points to collect six samples in two seasons: winter and spring. The first water sample was taken from the beginning of the river when it entered the province, the second from the middle of the river, The third water sample was collected from the point before mixing the Capakcur and Gayt rivers, the fourth water sample was collected after mixing both rivers as specified, the fifth water sample was collected before mixing the Goynuk and Capakcur rivers, and the final sixth sample was collected after mixing all three rivers Capakcur, Goynuk, and Gayt, and samples were then transported to the laboratory for analysis.

1.2. Description of the Study Area

The region that has been worked on has been called Capakcur Dam, which is narrower than the river and is situated in the center of Bingol province; it also blends with two other rivers, the Goynuk and Gayt River. Bingol got its name from Bingol Mountain, which is situated in the Varto governorate on the Erzurum-Muş frontier. Capakcur is an official name. Since Capakcur Castle is located in a mountainous location, the city center has been relocated to evlig or olig in the creek bed at some point in its existence. Bingol is situated in the Upper Euphrates zone of East Anatolia, between 41°20' and 39°54' North latitudes and 38°27' and 40°27' Eastern meridians, with Mus to the east, Elazig to the west, Erzurum to the north, and Diyarbaki to the south. According to data from the, the average annual temperature in Bingol is 12.1 degrees, the annual rainfall is 873.7 mm, the number of snowy days is 24.5 days, and the number of frosty days is 94.1 days (General Directorate of Meteorology Affairs 2015).

Figure 1. Work location map

Source: [58]

1.3. Meteorological Conditions

The climatic characteristics of the Bingol province vary significantly depending on the topographic composition and location of the provinces. On the eastern boundary, there is a terrestrial with dry and hot summers and hot and cold winters. Rainfall occurs in the form of rain in the spring and summer, as well as snow in the winter. The peak temperature in the research region is in July and August (34.5oC), with annual precipitation of 936.9 mm and gross annual evaporation of 1202.5 mm (-6,1oC). Summer temperatures cause evaporation to rise, reaching a peak of 262.7 mm in July. When analyzing climate evidence, the temperature structure is Xeric (Soil Survey Staff 2014). (Table 1). since the normal temperature in Bingol is 12oC and the temperature differential between summer and winter is 5oC Winters are dry, while summers are humid and gloomy. Table 1 shows the historical climate data for Bingöl province over a long period of time (1965-2015) (Meteorology Bingöl Station Directorate 2015).

Table 1. The average climate data for long years of Bingöl province (1965-2015). Source [57]

Months	**Temperature °C**			**Cover. Precipitation (mm)**	**Relative humidity (%)**	**Wind Speed (m/s)**	**Evaporation (mm)**	**Soil Temperature °C**		
	Max.	Min.	Ort.					5 cm	20 cm	50 cm
J	2.1	-6.1	-2.4	133.5	72.4	1.2	0	-0.6	0.6	2.8
F	3.4	-5.3	-1.5	132.9	72.1	1.2	0	0.2	0.6	2.1
M	9.1	-0.5	3.8	126.7	66.8	1.6	0	5.6	5	4.7
A	16.3	5.6	10.7	121	62.6	1.8	55.4	12.5	11.2	10.1
M	22.7	10.1	16.3	75.1	55.8	1.9	132.4	19.4	17.7	15.7
J	29.3	14.6	22.1	20.6	43.5	2.1	208.1	27.1	24.6	22
J	34.5	18.9	26.7	5.7	35.9	2.2	262.7	32.4	29.4	26.8
A	34.5	18.5	26.4	3.3	35.1	2.1	255.0	31.9	29.5	27.9
S	29.6	13.5	21.1	10.4	41	1.9	183.1	25.4	24.8	24.8
O	21.5	8.1	14	63.3	57	1.6	91.4	15.8	16.7	18.4
N	12.4	2.2	6.6	109.9	68.2	1.4	13.7	7.2	8.5	11
D	4.9	-3	0.5	134.5	74	1.2	0.7	1.7	3.1	5.7
Yearly	18.4	6.4	12.0	936.9	57.0	1.7	1202.5	14.9	14.33	14.29

2. Method of Soil Analysis

- pH and Soluble salts (conductivity-EC): pH and EC were determined by standard procedure water suspensions at 1:2.5 described by [19] and [20].
- Soil lime ($CaCO_3$): $CaCO_3$ was determined using the Calcimeter method [20].
- Organic matter (OM): OM content was determined using the Walkley-Black wet digestion method [20].
- Soil available phosphorus was determined with or Olsen Method [21].
- Heavy metal: Total amount of heavy metals (Na, Cu, Pb, Cd, K, Mn, Zn, Fe, and Ni) were determined in soil by king solution CEM digestion method described by [22].

2.1. Results of Soil Samples

Soil samples were taken on the right and left sides of the Capakcur River, and soil analysis findings are shown below.

2.1.1. Soil pH

Descriptive figures of the pH values of the soil samples collected from the observation site on the right and left sides. Table 2 shows that the pH concentrations on the right side are 7.46-8.3, on the left side are 7.19-8.09, and the CaCO3 concentrations on the right side are 3-40.4 and on the left side are 1.8-35.2. One of the most essential chemical properties of soil is its pH. The pH range for maximum nutrient abundance has been stated to be 6.5-7.0 [23]. The model and parameters used to calculate the pH of the soil in the sample area are shown below.

Table 2. pH values of the Right and Left side soil sample taken from the observation site.

Soil parameters		**Right side**	**Left side**	**Mean**
pH	Min.	7.46	7.19	
	Max.	8.3	8.09	
	Average	8.09	7.80	7.95

2.1.2 Soil EC

the EC values of the soil samples obtained from the observation site on the right and left sides. The findings of the study are seen in Table 3. EC concentrations on the right side range from 109.9 to 298 and on the left side from 232.2-425. The most important measure of soil salinity is electrical conductivity (EC). The sum of salts in the soil is measured by soil EC. Salt levels rise as a result of cropping, irrigation, and land management. Soil EC can be increased by management practices that result in low organic matter, poor penetration, and saturated soil pressure [24].

Table 3. EC values of the Right and Left side soil sample taken from the observation site.

Soil parameters		Right side	Left side	Mean
EC μS/cm	Min.	109.9	232.2	
	Max.	298	425	
	Average	188.23	349.58	268.91

2.1.3. Soil $CaCO_3$

CaCo3 values of soil samples taken from the observation site's right and left sides Table 4 shows that the CaCO3 concentration on the right side is 3-40.4 and on the left side is 1.8-35.2. The volume and distribution of carbonates have an effect on soil fertility; an increase in calcium carbonate in soil produces a slew of fertilization and nutrient supply issues. The chemical and physical properties of the soil (e.g., particle size and mineralogy) influence the volume and rate of carbonates in the soil [25]. [26] Formalized paraphrase the rise in soil pH as soil CaCO3 content increases [27].

Table 4. CaCO3 values of the Right and Left side soil sample taken from the observation site.

Soil parameters		Right side	Left side	Mean
$CaCO_3$ mg/L	Min.	3	1.8	
	Max.	40.4	35.2	
	Average	16.33	9.63	12.98

2.1.4. Soil Organic Matter

Organic matter values of soil samples obtained from the observation site on the right and left sides. Table 5 shows that the organic matter concentration on the right-side ranges between 10.03 and 19.38 and on the left side ranges between 12.53 and 18.57. Soil organic matter is one of the most significant criteria for agricultural soil fertility [28]. It has an effect on soil physical, chemical, and biological properties such as cation exchange capability, soil composition, water holding capacity, and pesticide adsorption [29]. There are many techniques for determining soil organic matter, each with its own set of benefits and drawbacks, such as the wet oxidation process and the Walkley-Black (WB) approach [30].

Table 5. Organic matter values of the Right and Left side soil sample taken from the observation site.

Soil parameters		Right side	Left side	Mean
Organic matter mg/L	Min.	10.03	12.53	
	Max.	19.38	18.57	
	Average	16.56	16.41	16.48

2.1.5. Soil Phosphorus

Phosphorus (P) values of soil samples collected from the observation site on the right and left sides. The findings of the study in Table 6 reveal that the (P) concentration of the right side is between 0-0.48 and the left side is between 0-0.23. Phosphorus is one of the most important regulating nutrients for plant growth since it is applied to agricultural soils as fertilizer to increase crop production because it plays an important part in the conversion of energy in living species. Phosphate's fertilizer is critical to farm development. And there are two types of (P) in soil: organic and inorganic. Since plants may only use inorganic (P), mineralization of organic (P) is used by plants to transform organic (P) to inorganic (P) for growth [31].

Table 6. Phosphorus values of the Right and Left side soil sample taken from the observation site.

Soil Phosphorus		Right side	Left side	Mean
Conc.	Min.	0	0	

	Max.	0.48	0.23	
	Average	0.11	0.08	0.09

3. Soil Total Element

Soil total factor descriptive statistics include (Fe, Mn, Cu, Zn, Pb, Cd, Ni, Na, K).

3.1. Iron (Fe)

Fe values of soil samples obtained from the observation site's right and left sides Table 7 shows that the Fe concentration on the right-side ranges between 0.494 and 4.413 and on the left side ranges between 2.597 and 4.108. Fe is the second most common metal in the Earth's crust after aluminum (Al), with an average level of 40 g kg1 [32]. Iron (Fe) is another important micronutrient for plants [33].

Table 7. Fe values of the Right and Left side soil sample taken from the observation site

Soil parameters		Right side	Left side	Mean
Fe mg/L	Min.	0.494	2.597	
	Max.	4.413	4.108	
	Average	1.92	3.22	2.57

3.2. Manganese (Mn)

Mn values of soil samples obtained from the observation site on the right and left sides. The findings of the study in Table 8 reveal that the Mn concentration on the right side is between 0.053-0.173 and on the left side is between 0.098-0.152. Mn may be substituted by other metal ions and is commonly used as an enzyme activator. Manganese is similar to Mn in biochemical activity and is involved in the initiation of enzyme-stimulating reactions such as phosphorylations, decarboxylations, reductions, and hydrolysis reactions, which influences processes such as respiration, amino acid synthesis, and hormone levels in plants. The key involvement of Mn in nature is its interaction in oxygen evolution in photosynthesis in green plants [34].

Table 8. Mn values of the Right and Left side soil sample taken from the observation site.

Soilparameters		Right side	Left side	Mean
Mn mg/L	Min.	0.053	0.098	
	Max.	0.173	0.152	
	Average	0.12	0.13	0.12

3.3. Copper (Cu)

Cu values of soil samples obtained from the observation site on the right and left sides. Table 9 shows that the Cu concentration on the right-side ranges between 0.361 and 1.927 and on the left side ranges between 0.536 and 1.242. Cu is an essential micronutrient for all species, but excessive exposure is toxic [35]. Cu is mostly obtained from parental rocks. However, it is possible that it is derived from anthropogenic origins in certain soils. Cu mobility in polluted soils is primarily influenced by physicochemical soil properties (e.g., pH), copper distribution among soil components, erosion, and agricultural practices [36]. Cu, for example, is more readily mobilized in acidic soils like granite rocks than in calcareous rocks [37].

Table 9. Cu values of the Right and Left side soil sample taken from the observation site.

Soilparameters		Right side	Left side	Mean
Cu mg/L	Min.	0.361	0.536	
	Max.	1.927	1.242	
	Average	0.82	0.84	0.83

3.3. Zinc (Zn)

Zn values of soil samples obtained from the observation site on the right and left sides. Table 10 shows that the Zn incidence on the right side is 0.005-0.043 and on the left side is 0.003-0.682. Zinc (Zn) is a necessary micronutrient with significant biological impact; it serves as a regulatory co-factor in enzymes involved in a variety of cellular functions [38]. It has a long shelf life in the soil and can quickly bio-accumulate in the food chain [39]. Soil organic matter plays a dynamic function in zinc division in the soil, and it may also have an effect on Zn solubility. Zn can be leached into the soil during organic matter litter decomposition on the soil surface [40]. By integrating Zinc into surface functional units, solid organic matter reduces Zn solubility, while dissolved organic matter increases Zn solubility and mobility [41].

Table 10. Zn values of the Right and Left side soil sample taken from the observation site.

Soil parameters		Right side	Left side	Mean
Zn mg/L	Min.	0.005	0.003	
	Max.	0.043	0.682	
	Average	0.03	0.08	0.05

3.4. Lead (Pb)

Pb values of soil samples obtained from the observation site on the right and left sides. Table 11 shows that the Pb concentration on the right side is 0.069-0.15 and on the left side is 0.004-0.097. Lead (Pb) is a highly poisonous element (PTE) that is abundant in anthropogenic contaminated soils [42], and it is a non-essential heavy metal that has been formed by humans throughout history [43]. Human actions will quickly unload Pb into agricultural ecosystems, having negative effects on the atmosphere and human health [44]; [45]. As a result, Pb-contaminated soils must be handled directly.

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Table 11. Pb values of the Right and Left side soil sample taken from the observation site.

Soil parameters		Right side	Left side	Mean
Pb mg/L	Min.	0.069	0.004	
	Max.	0.15	0.097	
	Average	0.11	0.05	0.08

3.5. Cadmium (Cd)

Cd values of soil samples obtained from the observation site on the right and left sides. Table 12 shows that the Cd abundance on the right side is 0.003-0.028 and on the left side is 0.002-0.019. Cadmium (Cd) is a non-essential element that, at high concentrations, can induce a variety of negative health effects [46]. It occurs naturally as a pollutant in all phosphate minerals, with amounts varying based on the source of the parental content. Cd concentrations in igneous rock range from 0.7 to 30 mg/kg P derived from rock phosphate [47]. Cd pollution of agricultural soils is exacerbated by significant causes such as sludge application and sewer drainage, which has resulted in crop growth inhibition. It, like other toxic elements, has a negative impact on rice development, particularly in the roots, due to the induction of oxidative stress, which causes plant cells to be damaged [48].

Table 12. Cd values of the Right and Left side soil sample taken from the observation site.

Soil parameters		Right side	Left side	Mean
Cd mg/L	Min.	0.003	0.002	
	Max.	0.028	0.019	
	Average	0.01	0.01	0.01

3.6. Nickel (Ni)

Ni values of soil samples drawn from the observation site on the right and left sides. Table 13 shows that the Ni concentration on the right-side ranges from 0.247 to 2.677 and on the left side ranges from 1.013 to 3.128. Nickel is a necessary nutrient for bacteria, where it helps with a number of cellular processes. Axel Cronstedt, a Swedish chemist, was the first to separate nickel from the mineral niccolite in 1751. The word “Nickel” is derived from the expression, Kupfernickel, and it naturally occurs in the ecosystem, being allowed from both natural and anthropogenic sources [49]. Many microbes are capable of detecting cellular nickel ion concentrations and absorbing this nutrient through ATP-binding transport systems [50].

Table 13. Ni values of the Right and Left side soil sample taken from the observation site.

Soil parameters		Right side	Left side	Mean
Ni mg/L	Min.	0.247	1.013	
	Max.	2.677	3.128	
	Average	1.55	1.67	1.61

3.7. Sodium (Na)

Na values of soil samples taken from the observation site on the right and left sides. The findings of the study, seen in Table 14, indicate that the Na concentration on the right-side ranges from 3.053 to 10.16 and on the left side ranges from 1.575 to 6.506. Irrigation of drainage can result in the adding of significant quantities of salt, specifically sodium (Na), to the soil, which can have a negative impact on soil properties such as swelling and dispersion. influencing plant growth [51]. Sodium (Na) is a necessary nutrient for the proper functioning of the human body. A "sodic" soil is one that has a wide range of sodium and occupies an additional amount of space on soil exchange sites. Soluble calcium levels decline as soil sodium levels rise; soluble calcium contributes to soil's friable, loamy, and permeable composition [52].

Table 14. Na values of the Right and Left side soil sample taken from the observation site

Soil parameters		Right side	Left side	Mean
Na mg/L	Min.	3.053	1.575	
	Max.	10.16	6.506	
	Average	6.23	3.63	4.93

3.8. Potassium (K)

K values of soil samples obtained from the observation site on the right and left sides. Table 15 shows that the K concentration on the right-side ranges from 6.013 to 13.84 and on the left side ranges from 10.19 to 27.02. Potassium (K) is a mobile ion in soils, and large concentrations can be lost by leaching [53]. In soils, K is the most abundant element. The crust of the Earth K in soil exists in four forms: solution, exchangeable, nonexchangeable, and structural or mineral [54]. Igneous rocks have higher K contents than sedimentary rocks. Soil K types are, in order of plant availability, solution > exchangeable > non exchangeable > mineral [55].

Table 15. K values of the Right and Left side soil sample taken from the observation site

Soil parameters		Right side	Left side	Mean
K mg/L	Min.	6.013	10.19	
	Max.	13.84	27.02	
	Average	8.80	13.50	11.15

4. Statistical Soil Analysis Right Side

Table 16 provides a description of the mean, standard deviation, and variance values of nine calculated parameters for one time data for the physical and chemical parameters of right-side soil samples under Capakcur River sampled.

Table 16. Descriptive

		N	Mean	Std. Deviation	Std. Error
Fe	1.0	3	4.29700	.199188	.115001
	2.0	3	3.81900	.487776	.281617
	3.0	3	.71133	.245101	.141509
	4.0	3	.58033	.061849	.035709

	5.0	3	1.05000	.175034	.101056
	6.0	3	1.06333	.146172	.084393
	Total	18	1.92017	1.586618	.373970
Mn	1.0	3	.14700	.020075	.011590
	2.0	3	.12967	.066583	.038442
	3.0	3	.10100	.009165	.005292
	4.0	3	.10833	.009292	.005364
	5.0	3	.10533	.008327	.004807
	6.0	3	.09800	.011790	.006807
	Total	18	.11489	.030694	.007235
Cu	1.0	3	.37800	.018083	.010440
	2.0	3	.66167	.033710	.019462
	3.0	3	.71467	.071598	.041337
	4.0	3	.68733	.121550	.070177
	5.0	3	1.34433	.522093	.301431
	6.0	3	1.15633	.053463	.030867
	Total	18	.82372	.383857	.090476
Zn	1.0	3	.027333	.0025166	.0014530
	2.0	3	.017000	.0120000	.0069282
	3.0	3	.026667	.0148436	.0085700
	4.0	3	.027000	.0045826	.0026458
	5.0	3	.027333	.0020817	.0012019
	6.0	3	.024000	.0010000	.0005774
	Total	18	.024889	.0078282	.0018451
Pb	1.0	3	.09267	.013317	.007688
	2.0	3	.08433	.013429	.007753
	3.0	3	.13033	.004726	.002728
	4.0	3	.11833	.008386	.004842
	5.0	3	.12733	.014468	.008353
	6.0	3	.13367	.024090	.013908
	Total	18	.11444	.023050	.005433
Cd	1.0	3	.007667	.0045092	.0026034
	2.0	3	.008667	.0030551	.0017638
	3.0	3	.015667	.0030551	.0017638
	4.0	3	.022667	.0025166	.0014530
	5.0	3	.019667	.0076376	.0044096
	6.0	3	.009333	.0028868	.0016667
	Total	18	.013944	.0069661	.0016419
Ni	1.0	3	.28833	.041004	.023674
	2.0	3	2.11100	.102269	.059045
	3.0	3	1.99933	.199963	.115449
	4.0	3	.88167	.015567	.008988
	5.0	3	1.48067	.277907	.160450
	6.0	3	2.55333	.123500	.071303
	Total	18	1.55239	.804010	.189507
Na	1.0	3	3.26033	.182747	.105509
	2.0	3	6.39833	.997428	.575865
	3.0	3	7.07333	.527972	.304825
	4.0	3	7.34933	.260993	.150684
	5.0	3	7.99433	2.212394	1.277326
	6.0	3	5.28933	.342534	.197762
	Total	18	6.22750	1.834337	.432357
K	1.0	3	6.61567	.605013	.349305

	2.0	3	9.18700	.105532	.060929
	3.0	3	8.83200	.938177	.541657
	4.0	3	7.19800	.133686	.077184
	5.0	3	7.71900	1.539648	.888916
	6.0	3	13.24667	.934041	.539269
	Total	18	8.79972	2.355545	.555207

5. ANOVA Tests for Comparison of the Measurement Parameters at Different Stations

The results of ANOVA one-way (sites) are given in table 17, the objective of data (bold color) is the significance of discriminate feature and to determine significance variable that result in right side soil quality variation in one period, Fe, Cu, Pb, Cd, Ni, Na, and K parameters were significantly affected according to Capakcur river station. There was no discernible distinction between the Mn and Zn matter of different stations.

Table 17. The results of the one-way ANOVA (Sites), mean ± standard error and probability (p) of the physicochemical variables.

Water Variables	S1	S2	S3	S4	S5	S6	F-value	P-value
Fe	4.30±.12	3.82±.28	.71±.14	.58±.04	1.05±.10	1.06±.08	128.10	**.001**
Mn	.15±.012	.13±.04	.10±.01	.11±.01	.11±.004	.10±.01	1.285	.332
Cu	.38±.01	.66±.019	.71±.04	.69±.07	1.34±.30	1.16±.031	7.727	**.002**
Zn	.027±.002	.017±.01	.027±.01	.028±.003	.027±.001	.024±.001	.749	.602
Pb	.093±.008	.084±.008	.13±.004	.12±.005	.13±.008	.134±.014	6.34	**.004**
Cd	.008±.0026	.009±.002	.02±.002	.022667±.0014530	.019667±.0044096	.009±.002	6.44	**.004**
Ni	.29±.024	2.11±.06	1.10±.12	.88167±.008988	1.48067±.160450	2.55±.071	88.64	**.001**
Na	3.26±.10	6.39±.58	7.07±.30	7.34933±.150684	7.99433±1.277326	5.29±.12	8.35	**.001**
K	6.62±.34	9.19±.061	8.83±.54	7.12±.08	7.71900±.888916	13.25±.54	22.66	**.001**

Different superscript letters in a row show significant differences ($P < 0.05$) indicated by Tukey Honest significant difference tests.
* indicates significantly calculated F-value

6. Statistical Soil Analysis Left Side

Table 18 provides a rundown of the mean, standard deviation, and variance values of nine calculated parameters for one-time data for the physical and chemical parameters of left side soil samples under Capakcur River tested.

Table 18. Descriptive.

		N	Mean	Std. Deviation	Std. Error
Fe	1.0	3	2.74467	.182467	.105348
	2.0	3	2.90233	.243241	.140435
	3.0	3	3.41067	.511039	.295049
	4.0	3	2.74300	.249423	.144005
	5.0	3	3.64300	.472486	.272790

	6.0	3	3.86333	.327714	.189206
	Total	18	3.21783	.544680	.128382
Mn	1.0	3	.11300	.013229	.007638
	2.0	3	.12633	.002517	.001453
	3.0	3	.14500	.011269	.006506
	4.0	3	.12900	.010583	.006110
	5.0	3	.13800	.013748	.007937
	6.0	3	.12700	.007810	.004509
	Total	18	.12972	.013598	.003205
Cu	1.0	3	.70767	.030534	.017629
	2.0	3	.93367	.087689	.050627
	3.0	3	1.08633	.138001	.079675
	4.0	3	.55200	.021932	.012662
	5.0	3	.73167	.104006	.060048
	6.0	3	1.02267	.243377	.140514
	Total	18	.83900	.222475	.052438
Zn	1.0	3	.031000	.0036056	.0020817
	2.0	3	.017667	.0092376	.0053333
	3.0	3	.023000	.0072111	.0041633
	4.0	3	.033667	.0135031	.0077960
	5.0	3	.295333	.3427278	.1978740
	6.0	3	.076333	.1270171	.0733333
	Total	18	.079500	.1612533	.0380078
Pb	1.0	3	.092000	.0062450	.0036056
	2.0	3	.066000	.0105830	.0061101
	3.0	3	.058667	.0205994	.0118930
	4.0	3	.056333	.0152753	.0088192
	5.0	3	.012667	.0057735	.0033333
	6.0	3	.021333	.0161658	.0093333
	Total	18	.051167	.0299357	.0070559
Cd	1.0	3	.005333	.0011547	.0006667
	2.0	3	.004667	.0030551	.0017638
	3.0	3	.005333	.0035119	.0020276
	4.0	3	.016333	.0025166	.0014530
	5.0	3	.007333	.0025166	.0014530
	6.0	3	.010000	.0010000	.0005774
	Total	18	.008167	.0046684	.0011004
Ni	1.0	3	1.54000	.176553	.101933
	2.0	3	1.38733	.076061	.043914
	3.0	3	2.16633	.353441	.204059
	4.0	3	1.09300	.084285	.048662
	5.0	3	1.27333	.205768	.118800
	6.0	3	2.53133	.679980	.392586
	Total	18	1.66522	.597688	.140876
Na	1.0	3	5.97700	.621177	.358637
	2.0	3	5.60667	.102574	.059221
	3.0	3	2.47000	.240763	.139005
	4.0	3	1.90700	.335040	.193436
	5.0	3	2.96000	.163612	.094462
	6.0	3	2.88167	.794114	.458482
	Total	18	3.63372	1.656791	.390509
K	1.0	3	11.0833	.74460	.42990
	2.0	3	10.4233	.21385	.12347

	3.0	3	13.9167	2.80522	1.61959
	4.0	3	11.3400	.60008	.34646
	5.0	3	12.1533	1.75665	1.01420
	6.0	3	22.0567	5.69440	3.28767
	Total	18	13.4956	4.69173	1.10585

7. ANOVA Tests for Comparison of the Measurement Parameters at Different Stations

The results of ANOVA one-way (sites) are given in table 19, the objective of data (bold color) is the significance of discriminate feature and to determine significance variable that result in left side soil quality variation in one period, Mn, Cu, Pb, Cd, Ni, Na, and K parameters were significantly affected according to Capakcur river station. There was no discernible distinction between Fe and Zn matter from different stations.

Table 19. The results of the one-way ANOVA (Sites), mean ± standard error and probability (p) of the physicochemical variables.

Water Variables	S1	S2	S3	S4	S5	S6	F-value ANOVA	P-value
Fe	2.74±.11	2.90±.14	3.41±.30	2.74±.14	3.64±.27	3.87±.19	5.71	.006
Mn	.11±.008	.13±.0014	.15±.007	.13±.006	.14±.01	.12700±.004509	3.23	**.045**
Cu	.71±.018	.934±.051	1.09±.08	.55±.013	.73±.06	1.02±.14	7.88	**.002**
Zn	.031±.002	.018±.005	.023±.004	.034±.08	.30±.12	.076±.07	1.56	.244
Pb	.09±.004	.07±.0061	.06±.019	.06±.009	.013±.003	.021±.01	14.17	**.001**
Cd	.005±.001	.005±.0018	.005±.002	.016±.0014	.007±.001	.010±.001	9.72	**.001**
Ni	1.54000±.10	1.39±.044	2.17±.204	1.09±.05	1.28±.12	2.53±.39	8.42	**.001**
Na	5.98±.36	5.61±.059	2.47±.14	1.91±.19	2.96±.09	2.88±.46	43.35	**.001**
K	11.08±.43	10.42±.12	13.92±1.62	11.34±.35	12.15±1.01	22.07±3.29	7.73	**.002**

Different superscript letters in a row show significant differences (P < 0.05) indicated by Tukey Honest significant difference tests.
* indicates significantly calculated F-value.

8. Conclusion

The soil pH, EC, CaCO3, organic matter, and P levels in the sample area ranged from 7,19 to 8,3, from 109,9 to 425 S/cm, from 1,8 to 40,4 percent, from 10,03 to 19,38, and from 0 to 0.48. Because of the absence of a heavy metal source in the region, the Mn, Zn, Fe, Cu, Ni, Cd, and Pb contents of soil samples in the area were found to be non-toxic. The high concentration of heavy metals in soil is linked to soil parent products, industrial, and factories. In general, heavy metal inflows into the studied region may be attributed to fertilizer and parent products. The analysis of soil and water samples collected in the vicinity of Capakcur in Bingol showed a strong low content of heavy metals. On soil and water quality, both of the samples had low concentrations.

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REFERENCE

1. Soylak M, Türkoglu O (1999) Trace metal accumulation caused by traffic in an agricultural soil near a motorway in Kayseri, Turkey. Journal of Trace and Microprobe Techniques 17(2): 209-217
2. Soylak M, Elci L, Dogan M (2000) Lead concentrations of dust samples from Nigde City-Turkey. Fresenius Environmental Bulletin 9(1-2): 036-039
3. Ghaedi M (2006) Pyrimidine-2-thiol as selective and sensitive ligand for preconcentration and determination of Pb2+. Chemia analityczna 51(4): 593-602
4. Harrison JM, Pliska SR (1981) Martingales and stochastic integrals in the theory of continuous trading. Stochastic processes and their applications 11(3): 215-260
5. Harrison JM, Pliska SR (1981) Martingales and stochastic integrals in the theory of continuous trading. Stochastic processes and their applications 11(3): 215-260
6. Ghrefat H, Yusuf, N (2006) Assessing Mn, Fe, Cu, Zn, and Cd pollution in bottom sediments of Wadi Al-Arab Dam, Jordan.Chemosphere 65(11): 2114-2121
7. 7.Sparling GP, Williamson JC, Magesan GN, Schipper LA, Lloyd-Jones AR (1999) Hydraulic conductivity in soils irrigated with wastewaters of differing strengths: Field and laboratory studies. Soil Research 37(2): 391-402
8. Friedel JK, Langer T, Siebe C, Stahr K (2000) Effects of long-term waste water irrigation on soil organic matter, soil microbial biomass and its activities in central Mexico. Biology and Fertility of Soils 31(5): 414-421
9. Akoto O, Ephraim JH, Darko G (2008) Heavy Metals Pollution in Surface Soils in the Vicinity of Abundant Railway Servicing Workshop in Kumasi, Ghana. International Journal of Environmental Research 2(4)
10. Okx JP, Stein A (2000) An expert support model for in situ soil remediation. Water, Air, & Soil Pollution 118(3): 357-376
11. Begum A, Ramaiah M, Khan I, Veena K (2009) Analysis of heavy metals concentration in soil and litchens from various localities of hosur road, Bangalore, India. Journal of Chemistry 6(1): 13-22
12. Mleczek M, Łukaszewski M, Kaczmarek Z, Rissmann I, Golinski P (2009) Efficiency of selected heavy metals accumulation by Salix viminalis roots. Environmental and experimental botany 65(1): 48-53
13. Sharma S, Prasad FM (2010) Accumulation of lead and cadmium in soil and vegetable crops along major highways in Agra (India). Journal of Chemistry 7(4): 1174-1183
14. Wuana RA, Okieimen FE (2011) Heavy metals in contaminated soils: a review of sources, chemistry, risks and best available strategies for remediation. Isrn Ecology
15. Naser HM, Sultana S, Gomes R, Noor S (2012) Heavy metal pollution of soil and vegetable grown near roadside at Gazipur. Bangladesh Journal of Agricultural Research 37(1): 9-17
16. Radulescu C, Stihi C, Popescu IV, Dulama ID, Chelarescu ED, Chilian A (2013) Heavy metal accumulation and translocation in different parts of Brassica oleracea L Romanian Journal of Physics 58(9-10): 1337-54
17. Hanc A, Szakova J, Ochecova P (2014) Differences in the mobility of Cd, Cu, Pb and Zn during composting of two types of household bio-waste collected in four seasons. Bioresource technology 168: 204-213
18. Islam S, Ahmed K, Masunaga S (2015) Potential ecological risk of hazardous elements in different land-use urban soils of Bangladesh. Science of the total Environment 512: 94-102
19. Richards LA (1954) Diagnosis and improvement of saline and alkali soils Washington: United States Department of Agriculture. Agriculture handbook p: 60
20. Tüzüner A (1990) Toprak ve su analiz laboratuvarları el kitabı. Tarım Orman ve Köy İşleri Bakanlığı, Köy Hizmetleri Genel Müdürlüğü, Ankara
21. Olsen SR (1954) Estimation of available phosphorus in soils by extraction with sodium bicarbonate. United States Department Of Agriculture; Washington

22. Kacar DJ, Kacar CR (1990) US Patent No 4,943,105 Washington, DC: US Patent and Trademark Office
23. Akıncı Ş (2011) Hümik asitler, bitki büyümesi ve besleyici alımı
24. Adviento-Borbe MAA, Doran JW, Drijber RA, Dobermann A (2006) Soil electrical conductivity and water content affect nitrous oxide and carbon dioxide emissions in intensively managed soils. Journal of Environmental Quality 35(6): 1999
25. Hamid YS (2009) Dissolution kinetics of carbonates in soil. Szent Istvan University, Hungary
26. Del Campillo MC, Torrent J, Loeppert RH (1992) The reactivity of carbonates in selected soils of southern Spain. Geoderma 52(1-2): 149-160
27. Bockheim JG, Gennadiyev AN, Hartemink AE, Brevik EC (2014) Soil-forming factors and Soil Taxonomy. Geoderma 226: 231-237
28. Pitts MJ, Hummel JW, Butler BJ (1986) Sensors utilizing light reflection to measure soil organic matter. Transactions of the ASAE 29(2): 422-0428
29. Ding G, Novak JM, Amarasiriwardena D, Hunt PG, Xing B (2002) Soil organic matter characteristics as affected by tillage management. Soil Science Society of America Journal 66(2): 421-429
30. Nelson DW, Sommers L (1982) Total carbon, organic carbon, and organic matter Methods of soil analysis. Part 2 Chemical and microbiological properties, (methodsofsoilan2) p: 539-579
31. Raghothama KG (2005) Phosphorus and plant nutrition: an overview Phosphorus: agriculture and the environment, (phosphorusagric) p: 355-378
32. Sparks DL (2003) Environmental soil chemistry. Academic press
33. Gattullo CE, Youry PII, Allegretta I, Medıcı L, Cesco S, Mımmo T, Terzano R (2017) Iron Mobilization and Mineralogical Alterations Induced by Fe Deficient Cucumber Plants in a Calcareous Soil. Pedosphere
34. Burnell J (1988) The biochemistry of manganese in plants In ‘Manganese in soils and plants’(Eds RD Graham, RJ Hannam and NC Uren) pp. 125-137
35. Adriano DC (2001) Arsenic In Trace elements in terrestrial environments. Springer New York pp: 219-261
36. Brunetto G, Miotto A, Ceretta CA, Schmitt DE, Heinzen J, de Moraes MP, Girotto E (2014) Mobility of copper and zinc fractions in fungicide-amended vineyard sandy soils. Archives of Agronomy and Soil Science 60(5): 609-624
37. Brun LA, Maillet J, Richarte J, Herrmann P, Remy JC (1998) Relationships between extractable copper, soil properties and copper uptake by wild plants in vineyard soils. Environmental pollution 102(2): 151-161
38. Hofmann NR (2012) Nicotianamine in zinc and iron homeostasis
39. Frey B, Keller C, Zierold K (2000) Distribution of Zn in functionally different leaf epidermal cells of the hyperaccumulator Thlaspi caerulescens. Plant, Cell & Environment 23(7): 675-687
40. Scheid S, Günthardt-Goerg MS, Schulin R, Nowack B (2009) Accumulation and solubility of metals during leaf litter decomposition in non-polluted and polluted soil. European Journal of Soil Science 60(4): 613-621
41. Opfergelt S, Cornélis JT, Houben D, Givron C, Burton KW, Mattielli N (2017) The influence of weathering and soil organic matter on Zn isotopes in soils. Chemical Geology
42. McCann CM, Gray ND, Tourney J, Davenport RJ, Wade M, Finlay N, Johnson KL (2015) Remediation of a historically Pb contaminated soil using a model natural Mn oxide waste. Chemosphere 138: 211-217
43. Bermudez GM, Jasan R, Plá R, Pignata ML (2011) Heavy metal and trace element concentrations in wheat grains: assessment of potential non-carcinogenic health hazard through their consumption. Journal of hazardous materials, 193, 264-271
44. Broos K, Mertens J, Smolders E (2005) Toxicity of heavy metals in soil assessed with various soil microbial and plant growth assays: a comparative study. Environmental Toxicology and Chemistry 24(3): 634-640
45. Liu G, Yu Y, Hou J, Xue W, Liu X, Liu Y, Liu Z (2014) An ecological risk assessment of heavy metal pollution of the agricultural ecosystem near a lead-acid battery factory. Ecological Indicators 47: 210-218
46. Kabata-Pendias A, Mukherjee AB (2007) Trace elements from soil to human. Springer Science & Business Media

47. Oosterhuis FH, Brouwer FM, Wijnants HJ (2000) A possible EU wide charge on cadmium in phosphate fertilisers: Economic and environmental implications
48. Fasahat P (2015) Recent progress in understanding cadmium toxicity and tolerance in rice. Emirates Journal of Food and Agriculture 27(1): 94
49. Iyaka YA (2011) Nickel in soils A review of its distribution and impacts. Scientific Research and Essays 6(33): 6774-6777
50. Sokhadze VM, Namchevadze EN, Kiziria EN, Tabatadze LV, Lejava LV, Gogichaishvili SM, Abuladze MK (2017) The study of time-course toxic impact of Ni on the thermostability of the soil Arthrobacter oxydans bacterial cell culture. Annals of Agrarian Science
51. Victoria EPA (2003) State environment protection policy (Waters of Victoria) Victorian Government Gazette S 107: 1-52
52. Clancy K (2009) Sodium affected soils. Enderby: Fusion Turf Nutrition. Turf Line News
53. Quemener J (1986) Important factors in potassium balance sheets. In Nutrient Balances and the Need for Potassium International Potash Institute Madison, WI pp: 41-72
54. Sparks DL (2001) Dynamics of K in soils and their role in management of K nutrition. International Potash Institute PR II K in nutrient management for sustainable crop production in India, New Delhi, India p: 305
55. Sparks DL, Huang PM (1985) Physical chemistry of soil potassium. Potassium in agriculture, (potassiuminagri) p: 201-276
56. Facchinelli A, Sacchi E, Mallen L (2001) Multivariate statistical and GIS-based approach to identify heavy metal sources in soils. Environmental pollution 114(3): 313-324
57. https://www.mgm.gov.tr/eng/forecast-cities.aspx.
58. https://www.google.com/maps