REPUBLIC OF TURKEY
BİNGÖL UNIVERSITY
INSTITUTE OF SCIENCE

THE EFFECT OF WASTEWATER ON CAPAKCUR RIVER AND THE SOIL AROUND IT IN BINGOL PROVINCE-TURKEY

MASTER THESIS

PAREZ NAJAT AGHA

SOIL SCIENCE AND PLANT NUTRITION

SUPERVISOR OF THESIS
Assoc. Prof. Dr. Abdulkadir SÜRÜCÜ

BİNGÖL-2017

REPUBLIC OF TURKEY
BİNGÖL UNIVERSITY
INSTITUTE OF SCIENCE

THE EFFECT OF WASTEWATER ON CAPAKCUR RIVER AND THE SOIL AROUND IT IN BİNGOL PROVİNCE-TURKEY

MASTER'S THESIS

Parez NAJAT AGHA

Department : SOIL SCIENCE AND PLANT NUTRITION

This dissertation was accepted by the following committee on 26.12.2017 with the vote unity.

Prof. Dr. **Salih AYDEMİR** **Head of examining committee**	**Assist. Prof. Dr.** **Abdulkadir SÜRÜCÜ** **Member of examining committee**	**Assoc. Prof. Dr.** **Ali Rıza DEMİRKIRAN** **Member of examining committee**

I confirm the result above

Prof. Dr. İbrahim Y. ERDOĞAN
Director of the institute

ACKNOWLEDGMENT

First of all, Iam really very thankful to ALLAH that has gave me strength and grant me patient in finishing this research, I wish this thesis will have benefit to readers. I proud of the Bingol University and it's staff which they gave me this opportunity to study master degree in the department of soil science and plant nutrition.

I would like to express my sincere gratitude to my supervisor Dr. Abdulkadir Surucu for the continuous support of my research, for his patience, motivation, enthusiasm, and immense knowledge. I would like to pay special thankfulness, warmth and appreciation to Dr. Ali Rizza, whose help and sympathetic attitude at every point during my research.

My sincere thanks also goes to my department members especially Dr. Alaaddin and Dr. Yasin I am really indebted to him. Moreover very special thanks to all of my friends whom have assisted me during my research and encouraged me even with a word that made me pleasure.

Nobody has been more important to me in the continuation of this project than the members of my family. I would like to thank my parents, whose love and guidance are with me in whatever I pursue. Most importantly, I wish to thank my loving and supportive dad, Najat Agha who has provided me unending inspiration and has facilitated my way to reach this goal.

Parez NAJAT AGHA
Bingöl 2017

CONTENTS

LIST OF SYMBOLS AND ABBREVIATIONS

$AgNO_3$: Silver nitrate
Al : Aluminium
Ca : Calcium
Cd : Cadmium
cm : Centimeter
CO_3^{2-} : Carbonate
Cu : Copper
da : Decar
DW : Deionized water
EC : Electrical conductivity
EDTA : Ethylenediaminetetraacetic acid
EPA : Enviromental Protection Agency
$FeSO_4$: Iron sulfate
g : Gram
H_2SO_4 : Sulfuric acid
ha : Hectare
HCl : Hydrochloric acid
HCl_3N : Hydrochloric asid
HCO_3^- : Bicarbonate
HNO_3 : Nitric acid
$K_2Cr_2O_7$: Potassium dichromate
K : Potassium
KCl : Potassium chloride
kg : Kilogram
km : Kilometer
Max : Maximum
Meq : Miliequvalent

Mg : Magnesium
Min : Minimum
mm : Millimeter
N : Nitrogen
Na_2CO_3 : Sodium carbonate
Na_2SO_4 : Sodium sulphate
Na : Sodium
NaCl : Sodium chloride
NaOH : Sodium hydroxide
NH_4OH : Ammonium hydroxide
P : Phosphor
pH : Potential of hydrogen
t : Ton
TSE : Turkish Standardization Institute
USEPA : United State Enviroment Protection Agency
WHO : World Healthy Organisation
Zn : Zinc
% : Percentage

LIST OF TABLES

LIST OF FIGURES

BİNGÖL'DE ÇAPAKÇUR ÇAYI VE ETRAFINDAKİ TOPRAKLARDA ATIKSUYUNUN ETKİSİ

ÖZET

Bu çalışmada, Bingöl'de Çapakçur çayı ve etrafındaki topraklarda atık suyunun kirlilik etkisini belirlemek üzere bazı parametreler belirlendi. Analizde kullanılan metotlar, potasiyometrik metot, titrimetrik metot, alev fotometrik metot, gravimetrik metod, walkley-black metod, spektrofotometrik, kasimetrik metot, Olsen metot, ve CEM yaş yakma metotlarıdır.

Su örneklerinde pH, Eİ, HCO_3 ve CO_3, Cl, sertlik (Ca + Mg), K, Na, sediment, organik madde, ve ağır metaller (Mn^{+2}, Zn^{+2}, Fe^{+2}, Cu^{+2}, Ni^{+2}, Cd^{+2} ve Pb^{+2}) sırasıyla 8,19, 292,99, 3,56, 0,402, 2,73, 2,19, 7,203, 0,0495, 21,159, 0,148, 0,033, 0,219, 0,035, 0,130, 0,029, 0,651 mg/lt; ve toprak örneklerinde ise pH, Eİ, $CaCO_3$ (%), organik madde (%), P_2O_5, K, Na, ve ağır metaller (Mn^{+2}, Zn^{+2}, Fe^{+2}, Cu^{+2}, Ni^{+2}, Cd^{+2} ve Pb^{+2}) sırasıyla 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 (metal ve ağır metaller) mg/kg olarak elde edilmiştir. Bu çalışmanın sonuçlarına göre, toprak ve sudaki ağır metal içeriklerinin kirlilik açısından düşük düzeylerde olduğu belirlenmiştir.

Anahtar Kelimeler: Atıksu, toprak, Çapakçur çayı, ağır metaller, kirlilik.

THE EFFECT OF WASTEWATER ON CAPAKCUR RIVER AND THE SOIL AROUND IT IN BİNGOL PROVİNCE-TURKEY

ABSTRACT

In this research study some parameters were analyzed and their effects were detected in Capakcur wastewater and the soil around it in Bingol province_Turkey. Methods were used to analyzing parameters potentiometric method, titrimetric method, flame photometric method, gravimetric method, walkley-black method, spectrophotometric, calcimeter method, walkley-black wet digestion method, olsen method, and CEM digestion method.

Results obtained of pH, EC, HCO_3 and CO_3, Cl, hardness (Ca + Mg), K, Na, sediment, organic matter, and heavy metal ions (Mn^{+2}, Zn^{+2}, Fe^{+2}, Cu^{+2}, Ni^{+2}, Cd^{+2}, and Pb^{+2}) as 8.19, 292.99, 3.56, 0.402, 2.73, 2.19, 7.203, 0.0495, 21.159, 0.148, 0.033, 0.219, 0.035, 0.130, 0.029, 0.651 in the unit mS/cm, ppm, µm, %, and ppm respectively in wastewater samples, and results obtained of pH, EC, $CaCO_3$, organic matter, PO_3, K, Na, and heavy metal ions (Mn^{+2}, Zn^{+2}, Fe^{+2}, Cu^{+2}, Ni^{+2}, Cd^{+2}, and Pb^{+2}) as 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 unit mS/cm, ppm, µm, %, and ppm respectively in soil samples. This study was observed the concentration of heavy metals in soil and water sample were low according to the soil and water pollution standard.

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

1. INTRODUCTION

One of the greatest problems that the world is facing today is that of environmental pollution. Environment include both living and non living thing, like human, plant, animal, air, water, building, oceans**,** wetlands etc. Environmental pollution include five types air, water, soil, noise and light pollution. Each pollution problem needs expert treatment to avoid exceeding the estimated costs. Pollution can take the form of chemical matter or energy, such as noise, heat or light. A pollutant is a waste material that pollutes air, water or soil. In our world where the value of population growth cannot be controlled, the hunger problem becomes more and more felt every day and the human being needs to reorganize its relations with the environment.

Global warming is another important problems threatening the global environment, has begun to feel itself in different forms in different areas, One of the most important effects of global warming is the decrease of water resources. Global warming increases the surface temperature of earth, increasing the level of greenhouse gas are enhancing the greenhouse effect which cause global warming.

Wetlands are saturated with water which is the most productive ecosystems in the world that provides transitions between terrestrial and aquatic ecosystems. Wetlands are ecosystems composed of physical, chemical and biological elements such as soil, water, plants, animals and nutrients. These areas have many important biological and chemical properties such as sediment storage, removal from nitrogen and phosphorus system and conversion of nutrients from inorganic form into organic form. The functions of wetlands, as water quality are influenced by factors such as climate, geomorphology and water resources in the wetlands (Korkanç 2004). Soil and water pollution particularly, have previously impacted on food safety which represents a significant risk to human health. The increase in the use of vehicles for transportation in most developing countries, has contributed a great deal of concern over vehicular pollution.

The introduction of pollutants from human activity in many parts of the world has seriously degraded our environment (Soylak 1999). The main sources of soil pollution may be from domestic, agricultural or industrial. An industrial waste is often conducted without regard to the deter environmental impact upon the receiving soil body (Soylak et al. 2000; Ghaedi 2006). Pollution of the natural environment by heavy metals is a worldwide problem because these metals are not destroyed and most of them have toxic effects on living organisms. Heavy metals are enters into soil through, dumping wastes, effluents leading to heavy metal runoff of terrestrial system (industrial and domestic effluents) and geological weathering (Ghaedi 2006). Some heavy metals attached to the soil particles can be removed from the soil surfaces and get translocated in another place by the action of water and wind (Harrison et al. 1981; Ndiokwere 1984; Ghrefat and Yusuf 2006).

In aquatic systems metal pollution can result from direct atmospheric deposition, geologic weathering or across the release of agricultural, municipal, or industrial waste yield. Soils become contaminated by the accumulation of heavy metals through emissions from the expanding industrial areas, land application of fertilizers, disposal of high metal wastes and paints, animal manures, pesticides, sewage sludge, wastewater coal combustion residues, irrigating and atmospheric deposition (Khan et al. 2008; Zhang et al. 2010). Bioaccumulation of metals in sediments has significant environmental impacts for local communities, as well as for river water quality. The resultant effect of continuous discharge of wastes in aquatic environments is a buildup of pollutants, including heavy metals in sediments or wastewaters. Naturally in the aquatic environments metals are moving independent of human activities, usually without any damaging effects, sewage irrigation, sludge reuse and fertilizer application are the main sources of heavy metals in cultivated ground (Chen et al. 1999).

Some of metals essential in the water are necessary to the metabolism process in all living organisms yet toxic when they occur in high concentration, other are non essential but are toxic even at relatively low concentrations. The accumulation of some of these metals in aquatic environment has direct effect to humans and to the ecosystem. Metals like Zn and Cu which are required for metabolic activity in organisms (Skidmore 1964; Spear 1981). Water is a necessary material to realize the vital activities such as nutrition, respiration, excretion, reproduction in every period of human life cycle. On the other hand, water is one of the basic elements in the formation of the living environment, and at the same time it is a living environment itself. Water being one of the basic conditions for life which include surface and ground water, so the quality of water is very important, because the rapid increase of population in the country, the most important parameter that affect on the activity of elements in water is pH. The pH of water determine the chemistry of many metals that alters the availability and toxicity in the aquatic environment, Metals like Al, Cu, Cd and Zn are most likely to increases harmful environmental impacts as a result of lowered pH. (Department of Water Affairs and Forestry 1996). The growth of industrialization, the spread of fertilizer and drug use in agriculture are causes water pollution. The chief sources of water pollution are Point and Non-point sources. Point source is the pollutants that belong to a single source like the emissions from factories into the water, Non-point include pollutants that emitted from multiple sources like Contaminated water after rains that has traveled through several regions like wastewater.

Wastewater is water whose chemical, physical, or biological properties have been changed as a result of the preface of certain substances which make it unsafe for some purposes such as drinking. Everyday activities of man are mainly water dependent and therefore discharging waste into the water. Some of the substances comprise body wastes (feces and urine), hair, hair shampoo, food scraps, laundry powder, fat, fabric conditioners, toilet paper, detergent, chemicals, household cleaners, dirt, micro-organisms (germs) which can make people ill and damage the environment. It is recognized that much of water supplied ends up as wastewater which makes its treatment very important (Bani 2011).

Also hospitals produce relatively large quantities of wastewater that may contain various potentially hazardous materials.The generation of waste in hospitals has been increasing due to development in medical services and products. Nowadays several thousands of ingredients are used for drugs in even more products. Besides the active substances, formulation adjutants, dyes and pigments are also drug components. Hospital wastewater has similar quality to municipal wastewater, but may also contain a variety of potentially hazardous components including mainly microbiological pathogens, hazardous chemical compounds, radioactive isotopes, disinfectants, and pharmaceuticals. Indeed hospital wastewater may have an adverse impact on environmental and human health (Mesdaghinia et al. 2009). The effectual management of any wastewater flow requires a logically accurate knowledge of its characteristics. This is principally true for wastewater flows from rural residential dwellings, viable establishments and other facilities where individual water-using activities create an alternating flow of wastewater that can vary widely in volume and degree of pollution. Mainly communities produce wastewater from both residential and nonresidential sources. Residential wastewater actually is used to describe all types of wastewater generated from every room in a house. Sewage varies regionally and from home to home based on such factors as the number and sort of water-using fixtures and appliances, the numeral of persons, their ages, and even their habits, for instance the types of foods they eat. However, when compared to the assortment of wastewater flows generated by diverse nonresidential sources, household wastewater shares a lot of related characteristics overall. Nonresidential wastewater in petite communities is generated by such diverse sources as offices, businesses, department stores, schools, restaurants, farms, hospitals, industrial, manufacturers, and other commercial and institutional entities (Sheet 2004).

The main physical characteristics of wastewater are its solids content, color, odor and temperature. The total solids in a wastewater comprise of the insoluble or suspended solids and the soluble compounds dissolved in water. The suspended solids substances are found by drying and weighing the residue detached by the filtering of the sample. When these remains are ignited the volatile solids are burned off. Volatile solids are supposed to be organic matter, even though some organic matter will not burn and some inorganic salts break down at high temperatures. The organic matter comprise mostly of proteins, carbohydrates and fats. In the range of 40 and 65% of the solids in an average wastewater are suspended. Settleable solids, uttered as milliliters per liter, are those that can be detached by sedimentation. Typically about 60% of the suspended solids in a municipal wastewater are settleable. Solids possibly classified in another way as well: those that are volatilized at a high temperature (600 °C) and those are not. The previous are known as volatile solids, the latter as fixed solids. Generally, volatile solids are organic. Color is a qualitative characteristic that can be used to evaluate the general condition of wastewater. Wastewater which has light brown in color is less than 6 h old, while a light-to- medium grey color is feature of wastewaters that have undergone some degree of decomposition or that have been in the compilation system for some time. Finally, if the color is dark grey or black, the wastewater is characteristically septic, having undergone general bacterial decomposition under anaerobic conditions. The blackening of wastewater is frequently caused by the formation of various sulfides, particularly, ferrous sulfide. This results when hydrogen sulfide formed under anaerobic conditions combines with divalent metal, like iron, which may be present. Color is considered by comparison with standards. The determination of odor has become gradually more important, as the general public has become more apprehensive with the proper operation of wastewater treatment conveniences. Fresh wastewater odor is usually not disgusting, but a multiplicity of odorous compounds is discharged when wastewater is decomposed biologically under anaerobic conditions. The primary odorous compound is hydrogen sulfide (rotten eggs smell). Other compounds, such as: skatol, indol, cadaverin and mercaptan produced under anaerobic conditions or present in the effluents of pulp and paper mills (hydrogen sulfide, dimethylsulfide, mercaptan, etc.), may also origin a rather offensive odor. Odor is precise by successive dilutions of the sample with odor-free water until the odor is no longer detectable. The temperature of wastewater is frequently higher than that of the water supply because warm municipal water has been added. The measurement of temperature is essential because most wastewater treatment schemes contain biological processes that are temperature dependent. The temperature of wastewater will change from season to season and also with geographic location. In cold regions the temperature will change from about 7 to 18°C, while in warmer regions the temperatures change from 13 to 24°C. The chemical characteristics of wastewater consist of: oxygen demand, pH, dissolved oxygen, nutrients and toxicmaterials.

Wastewater is called strong or weak depending upon the amount of oxygen that is necessary to oxidize and stabilize it. Chemical characteristics of wastewater are also alienated into two classes, inorganic and organic. Bacause of their special importance, volatile organic compounds (VOCs) and priority pollutants are typically considered separately (Munter 2003). Viruses, bacteria, and parasites make up the biological characteristics of wastewater. Wastewater contains huge quantities ofbacteria and other organisms that instigatein discharged wastes. The feeding activities of these organisms support in decomposing wastewater. Aerobicbacteria decayorganic matter in the attendance of free oxygen. Anaerobic bacteria decay organicmatter that is Shut off from freeoxygen, such as in the internal of amass of feces oradead body. The yield of has an extremely unlikable odor. Matter in which this circumstance exists is assumed to be septic. A great number of the bacteria in wastewater are coliform bacteria those found in the digestive tract of normal humans.While most of these bacteria are non harmful, pathogens will usually beoccurin wastewater containing the discharges of many persons. It is these comparatively few pathogenic organisms that create the most public health hazard. Wastewater thatis not suitably treated may ultimately find its way into a community water source and extend water borne diseases. The composition of wastewater changes fromhour to hour, day to day, and season to season, butits average composition can beindomitable for a given period. In general, wastewater is 99.9% water by weight. The lasting 0.1 percent (1,000 ppm) is mineraland organicmatter (organic, dissolved, suspended, and inorganic solids). Mainly of the mineral matter comprise of salts from the water supply, meat, urine, vegetable extracts, permissible acids and alkalies from industries. The organic matter, primarily from human or food origin, isunsteady and enthusiastically decomposed and oxidized by biological or chemical agents to produce more stable substances. The total mineral and organic matter in waste water containabout 0.1% by weight. This matter is more classified as filterable and nonfilterble excess (West 1993).

Huge volume of wastewater is being produced in cities because of ever-increasing population, this water and town wastes contain valuable nutrients (Olsen 1977) which is used for irrigation to certain crops may lead to increased agricultural production. However, systematic studies on the effect of irrigation with wastewater on soil properties and plant growth are practically lacking (Essington et al. 1991). Also, the cost of scientifically treated wastewater for recycling is too elevated; to be commonly feasible in developing countries like Turkey. In agricultural land the use of wastewater for irrigation is a worldwide practice especially common in developing countries, where water treatment costs cannot yet be afforded (Kuzyakovet al. 2000). Soil irrigation by municipal wastewater may change soil properties that include physical, chemical, or biological properties. These properties play an important role for transforming nutrients present in the applied wastewater (Sparling et al. 1999). Also Irrigation with wastewater can increase available water supply that have an economic benefits and use of wastewater for agricultural sites provides an economical alternative to surface water disposal, which enhances the nutrient cycle, although contaminants may accumulate in soil and pose a potential risk to soil quality and long-term productivity (Friedel et al. 2000). The effect of applying wastewater on the environment varies depending on the type of soil, the characteristics of the wastewater and the vegetation in the irrigated soil. Irrigation of municipal wastewater into the soil may change the properties of the soil, whether natural, chemical or biological. Soil properties play an important role in the conversion of nutrients into wastewater (Sparling et al. 1999).

Some of developing countries are using treated wastewater for irrigation which is treated by biological, chemical and/or physical treatment processes. Biological treatment processes are most used technology for treating wastewater because it’s friendly to environment and more effective(Sheng et al. 2010). The biological processes include nitrification and denitrification. Nitrification under aerobic condition oxidize ammonium to nitrite or nitrate but denitrification under anaerobic condition convert nitrite and nitrate to N_2 gas (Ji et al. 2010). Pollution in the environment by heavy metals is a common problem because these minerals are indestructible and most have toxic effects on living organisms, when allowed levels of concentration are exceeded. Heavy metals usually occur in literature with regard to potential hazards and falling into contaminated soil are Cd, Cr, Pb, Zn, Fe and Cu (Akoto et al. 2008). Automobile exhausts, as well as several industrial activities, are emitted from these heavy metals, so that the soil, plants and even the population along the roads with heavy traffic loads are exposed to increasing levels of heavy metal pollution (Ghrefat et al. 2006).

Untreated or ineffectively treated heavy metal contaminated wastewater effluents reason a variety of health and environmental impacts, when unrestricted into receiving water bodies. In aquatic ecosystems, heavy metals importantly depress the number of living organisms. Heavy metals have negative influence on the growth of aquatic organisms and can source serious upsets in biological wastewater treatment plants. The presence of heavy metal pollutants serve as huge threats to soil and plants growing on such soils, with the consumption of such plants by animals and humans because of their entry into the food chain through bioaccumulation and biomagnification, prominent to severe detrimental effects (Sa'idi 2010).

Each pollution problem requires skilled processing to avoid exceeding expected costs. Decisions should therefore be made, for example, on optimal sampling of hot spots to estimate the average concentration or amount of contaminated soil, But also to balance the selection of new technologies in the site cleaned up against the traditional. Based on the data and experience collected, a treatment plan with a list of options for different strategies is developed (Okx et al. 2000). Metals in the Capakcur river are derived from both natural and artificial sources that are naturally introduced into the river from sources such as rock weathering, soil erosion and wastewater from human activities.The aim of the study were to identify the sources of potential toxic elements and organic pollutants in wastewater and soil around it, to conduct a qualitative and quantitative measurement of pollutants in wastewater and runoff water based on data available in literature. Analysis of elements is To assess the percentage of Cl, Ca, organic matter, and other tests in Capakcur river and the percentage of pollutants discharged into the environment and The objective of this work was, therefore, to determine pollutant elements, determine the amount of micro nutrient distribution in wastewater of Capakcur river and the soil around it, determining the quality of water and the effects of wastewater on the soil around the Capakcur river.

2. LITERATURE REVIEW

Morselli and Olivieri were studied the brunt of heavy metal pollution on a Mediterranean natural ecosystem, outcome from heavy metal monitoring are obtainable in different environmental matrixes (suspended particulate matter-SPM and stem flow of forest trees, atmospheric dry depositions) in Castelporziano Presidential Estate /Rome. One inside and one near the sea, selected to assess differences in pollutant load. The outcome showed that heavy metal contamination could result from local human activities, particularly road traffic, and long-term pollution, from industrial and craft activities near Rome (Morselli et al. 2004).

Al-Shammiri and Ahmed were determined micro filtration (MF) unit, It was tested at the (Kuwait Institute) for scientific research for the dealing of secondary wastewater from the sewage treatment plant in (Riqqa). This test shows that the MF unit is dependable and very effective in removing sewage impurities. Chemical analysis result showing that the MF system has radically improved the quality of the effluent. There was a reliable reduction in chemical oxygen demand (COD), biological oxygen demand (BOD), total suspended solid (TSS) and total bacterial count (TBC). This paper examines the appropriateness of filtration water from the MF unit for irrigation purposes, compare the quality of MF product water with the standards for irrigation in (Kuwait) and other organization. The comparison is founded on calculation sodium absorption ratio (SAR), adjusted SAR, residual sodium carbonate (RSC), sodium hazards (SSP), and measured parameters such as the electrical conductivity (EC), calcium, chloride and potassium concentration, total suspended solids, sodium, trace minerals analysis and other parameters of health importance. The results of the study showed that the quality of treated wastewater in the MF unit is appropriate for irrigation with low potential problems (Al-Shammiri and Ahmed 2005).

Angin et al. were determined the using of wastewater in irrigation that has been increasingly identified as a technical solution to reduce soil degradation and return soil nutrient content. This study describes changes in soil content and plant nutrients after long-term irrigation with wastewater. The use of wastewater has increased salinity and reduced pH. Several beneficial changes have been observed including an increase in organic matter, N, and concentrations of major cations and heavy metals from the soil.

Wastewater increased P, N, Fe, Mn, Zn, B, Cd, Mo and Cu contents of cabbage (Brassica olerecea var. Capitate cv. Yalova-1) and potato (Solanumtuberosum) plants. In order to avoidunwanted side effects due to salinity and toxic concentrations ofmetals from the use of wastewater to soil, it is basic to identify the effects of long-term wastewater concentration (Angin et al. 2005).

Irmak et al. were identified the effects of the town's waste on plant nutrient elements and the heavy metals content of the soil from three different soil chains (Urfa, Akabe, Yenice) in Harran basic were researched. It was observed that Şanlı- urfa town wastes have strongly affected both plant nutrient element levels and heavy metal contents of soils. In the same way, the amount of P_2O_5 available in the untreated soil of the Urfa chain was 49 kg ha^{-1}, while the P_2O_5 available from soil exposed to city waste (sewage) reached 168 kg ha^{-1} . The increase in P_2O_5 can be attributed to mixed domestic water wastes to the public waste in the city. The amount of P_2O_5 available to uninhabited soil was 39 kg ha^{-1}, while the soil exposed to waste in the city was 134 kg ha^{-1}. The same trend was shown in the Akabe series (46 kg ha^{-1} for undifferentiated soil and 114 kg ha^{-1} for treated soil). city waste has significantly affected the contents of heavy metals in the soil. While the Cu content of the clean soil of the Urfa chain was 65.4 mg kg^{-1}, the same chain of irrigated soils by wastewater increased to 179.8 mg kg^{-1}, Also, Zn content in 0-30 cm depths of the unexposed soils of Yenice series was 199.5 mg kg^{-1}, but 1496.1 mg kg^{-1} in the province waste-treated ones. The increase in Zn and Cu levels may be connected with Zn and Cu contents of domestic wastewaters. Town wastes have also affected the Cl- and SO_4^{-2} contents of soils (Irmak et al. 2007).

Huang et al were investigated concentrations of Hg, Cd, Pb, Zn, Cu, As, Ni, and Cr in soil samples, cereal, and vegetables from Yang zhong district, China. Compared to subsoil, the sampled top soils are enriched in Cd, Hg, Cu, Pb, Zn, and As. High levels of Hg and Cd are experiential in most agricultural soils. the Cr and Ni Concentrations prove little spatial differences, and high Pb, Cu, and Zn contents are well aligned with the areas of urban development. High as the contents are recorded primarily on both ends of the sample alopion. The contents of Cd, Hg, and total organic carbon (TOC) Gradually increase the maximum values in the upper parts of soil profiles, although Cr and Ni arise in low concentrations within sample profiles. As, lead, Cu, and Zn show slightly enriching patterns within the surface layer.Compared to the data obtained in 1990, Cd and Hg showed increasing concentrations in 2005, due to the long-term use of agrochemicals. The contents of Cr and Ni remained constant on this interval because they derived from the weathering of the mother material and subsequent generation. Measured As, Cu, Pb and Zn show slight increases over time due to the deposition of materials from human activity in urban areas. Low concentrations of heavy metals are recorded in vegetables and grains because the subalkaline environment of the soil limits their movement. Although the concentrations of heavy metals measured in this study do not pose a health hazard, they affect the quality of agricultural products (Huang et al 2007).

Begum and Veena were analyzed the evaluate the heavy metal content in litchens and soil samples from different localities of Hosur Road, Bangalore south was undertaken. Topsoil samples (0-10 cm) were taken at different locations, these metals Cr, Pb, Fe, Zn, Ni and Cu were analyzed. The geological accumulation of these minerals in the soil under the study areas indicates that they are not polluted with Ni, Zn, and Fe and moderately contaminated with Cr and Pb. the concentration of Fe, Pb and Ni was maximum in the Industrial areas and traffic junctions. The accumulation of heavy metals was analyzed in a few prominent lichens in some areas. Cr and Pb were most in Chrysothrixcandelaris L. Laundon, In the Madiwala Gardens and Silk Board Junction with 95.29 and 623.95 µg g^{-1} dry weight respectively. Fe and Cu were highest in BulbothrixisidizaNyl. Hale and PyxinepetricolaNyl at Central Prison campus and KendriyaSadan campus with 22721 and 338.12 µg g^{-1} dry weight respectively, LecanoraperplexaBrodo at Infosis and Wipro Campus, electronic city have 531.5 and 634 µg g^{-1} dry weight of Zn. While Ni and Fe were highest in Arthopyreniaceae at Shanti Niketan of MICO Limited with 1100 and 23200 µg g^{-1} dry weight respectively (Begum et al.2009).

Mleczek and Golinski were determined the efficiency of the absorption from the middle and accumulation by plant of ions of the heavy metals depends on many factors including plant age and its genotype. The heavy metals accumulation by 1-, 2- and 3-year-old plants was studied in the side of renovation and revitalization effectiveness of demoted areas. Results of this study answer the question relating to the accumulation of seven heavy metals (Cd, Co, Cr, Cu, Ni, Pb and Zn) by willow cuttings (Salix viminalis) in environments with different concentrations of these elements. Cuttings used were firstly grown on a substrate not contaminated with the metals and wealthy in nutrients. In order to eliminate the effect of soil physicochemical factors, the experimentation was carried out using a hydroponic system The results indicated that there were significant effects of the concentrations of the minerals obtained on the accumulation of willow. The extent of metal accumulation as an indicator of the remediation capacity of willow depended on the age of the cuttings used at planting (Mleczek et al.2009).

Ndukaand Orisakwewere determine lead (Pb) levels were calculated in roadside surface soils, dust particles and rain water samples from the urban cities of Enugu, Awka, Onitsha, Nnewi, Aba, Port Harcourt and Warri in Southern Nigeria in 2007 and 2008. Samples were collected during the dry season, While rainfall samples were collected during early rain (April–June), middle rain (July–August) and late rain seasons (September–October) for the two years. Soil samples were collected from traffic-laden roads. Dust was collected by connecting a 1.5-meter-wide plastic basin above ground and leaving it for 45 days. Rain samples were collected from three equal points. Samples were analyzed by AAS. The maximum soil Pb of 120.00 ±0.00 and 80.36 ±0.00 mg/kg were reported in Onitsha for 2007 and 2008, respectively. Nnewi showed 33.40 ±0.01 and 4,238.29 ±0.00 mg/kg for 2007 and 2008. Aba had 22.56 ±0.01 and 21.28 ±0.00 mg/kg for 2007 and 2008. Upper concentrations were recorded for Nnewi and Port Harcourt in 2008 than in 2007. Enugu had more in 2007 while Awka had more in 2008. Dust Pb ranged from 0.13–0.49 mg/kg and 0.15–0.47 mg/kg for 2007 and 2008, respectively. Rain samples had the least Pb concentration, ranging from 0.103 ±0.000 to

0.163 ±0.046 mg/L.We can conclude that Nigerians are exposed to environmental Pb (Ndukaet al. 2010).

Sharma and Prasad were determined environmental pollution of heavy metals from cars has gained considerable attention in the recent past. The current research was conducted to study Pb and Cd level Concentrations in soil and plants along the main highway with high traffic density. Soil and vegetable samples were collected along the highway from 10 sites in Agra district (India) and analyzed for two heavy metals (lead and cadmium) using flame atomic absorption spectrophotometer (AAS). Physical properties of soil were also determined. Generally decrease in the concentrations of these metals with the distance from the highway indicates their relationship to traffic. High accumulations of minerals on plants and soil samples have been observed near the highway (0-5 m) than on vegetation and soil samples from sites a little out of away (at 5-10 m & 10-15 m). This is mainly due to atmospheric deposition of metal particles from motor vehicles. The values of heavy metals were compared with those originate by other researchers in different countries around the world (Sharma and Prasad 2010).

Wuanaand Okieimenwere determined the background information of the sources, chemistry, and potential risks of toxic heavy metals in contaminated soils is needed for the selection of correct remedial options. Remediation of soil contaminated by heavy metals is essential in order to reduce the associated risks, make the land resource presented for agricultural production, enhance food security, and scale down land possession problems. Paralysis, soil washing and plant breeding are often classified as the best available technologies for cleaning soil contaminated with heavy metals, but they often appear in developed countries. These technologies are proposed for field application and commercialization in developing countries where agriculture, urbanization and industrialization are left with a mandate for environmental degradation (Wuanaand Okieimen 2011).

Taghinia et al. were determined the river Kabini in Karnataka, India that was carries natural and anthropogenic pollutants, mostly heavy metal concentrations of Cr, Cu, Fe, Mn, Ni, Pb and Zn which are released from industrial effluents, agricultural arrival flows and domestic sewage. Kabini, which is a stream of the Cauvery, drains through the industrial area at Nanjangud, Karnataka, India. Heavy metals were determined in waters and sediment (2 µm) of Kabini River. In this research, chemical division studies were conducted to determine the association of base metals with different sedimentary phases. Heavy metal concentrations are higher in a loosely bonded portion than other studied fractions. In addition, the degree of sediment contamination was assessed by a geochemical index. It should be noted that Cu and Cr show the highest pollution intensity. Cluster analysis was used to determine the interrelationship between the minerals studied. It is clear that higher concentrations of minerals are present in the vicinity of industrial effluents. The concentrations of Cr followed by Zn and Ni are relatively higher than the maximum background values in the Kabini River sediment. This is mainly true at the influx of paper mill effluents into the River (Taghinia et al. 2010).

Naser and Sultana were determined the levels of lead, cadmium, and nickel in wayside soils and vegetables beside a major main road in Gazipur, Bangladesh were investigated. Soil samples were composed at distances of 0, 50, 100, and 1000 m from the road. The concentrations of lead (Pb) and nickel (Ni) in soil and vegetables (bottle gourd and pumpkin) decreased with distance from the road, signifying their relation to traffic and automotive emissions. The concentration of cadmium (Cd) was found to be independent of the distance of the road. There were important differences in the concentrations of lead, cadmium, and nickel for different plant species and soils at various distances. The heavy metals inside both in the soils and vegetables for every distance from the road was found in the order nickel>lead>cadmium (Naser et al. 2012).

Radulescu and Chilianwere calculated the concentration of seven heavy metals including (Cd, Fe, Mn, Cu, Zn, Pb, and Ni) In soil and investigate the biological availability of heavy metals from soil to different parts of Brassica oleracea L. var. capitata. The transport of heavy metals from the soil to the food chain and its bioaccumulation in cabbage has increased from a safety point of view. The metal concentrations were determined by Flame Atomic Absorption Spectrometry technique. In this study the highest concentration of copper and iron was obtained in the soil. This can be a importance to the using excessively the fertilizers, pesticides and copper sulphate as treatment for cabbage protection. The manganese, nickel, zinc and Cadmium concentrations in soil do not exceed normal values according to Romanian Regulation. The bioaccumulation factor (BF) of seven heavy metals in cabbage discovered that this vegetable was a poor accumulators of Fe, Ni, Cu, Cd, and Pb (BF <1), and good accumulator of Mn (BF >1). Obviously, only with BF is no possible to determine whether the cabbage may be aware of the accumulation types of certain minerals, and for this reason translocation factor (TF) was calculated (Radulescu et at.2013).

Hanc et al. were explained the objective of this study was to assess the mobility of Cd, Cu, Pb and Zn through 3 different fertilizer aeration rates of domestic bio-waste, originate in urban settlement (U-bio-waste) and family house buildings (F-bio-waste). The first two weeks, when the thermophilic composting phase became, the maximum decline of transferable pleased was recorded. After 12 weeks of composting, lesser exchangeable content was originate in the case of U-bio-waste composts than F-bio-waste composts, even with high loss of fresh mass. The sort of fractions in both final composts was as follows: residual >oxidizable> reducible > exchangeable. The exchangeable fraction of total content in final composts decreased in this order: Zn (17%), Cd (11%), Pb (4%) and Cu (3%). About the low transferable content of heavy metals and high-quality organic matter, these sorts of composts could be used not only as fertilizer, but for remediation of metals polluted land (Hanc et al. 2014).

Cui and Ju were analyzed that heavy metal ions cruelly harm human health; it is significant to develop simple, responsive and precise methods for their detection in environment and food. Electrochemical detection emerged with short analytical time, low energy cost, high sensitivity and easy adjustment of the on-site measurement is one of the most advanced methods. This review briefly presents recent achievements in the field of electrochemical sensing of heavy metal ions with inorganic, organic and modified biological materials. In particular, the unique properties of inorganic nanoparticles, small organic molecules and polymers, enzymes and nucleic acids are detected to detect heavy metal ions. By employing some representative examples, the design and sensing mechanisms of these electrodes are discussed (Cui and Ju 2015).

Islam and Masunaga were determined soil pollution, affected by both natural and human factors, greatly reduces the quality of the environment. In this study, six hazardous elements (Cr, Ni, Cu, As, Cd and Pb) in 12 different land-use town soils from Bangladesh were assessed. The ranges of Cr, Ni, Cu, As, Cd and Pb in studied soils were 2.4–1258, 8.3– 1044, 9.7–823, 8.7–277, 1.8–80 and 13–842 mg/kg, respectively. More than 70% of soil samples exceeded the Dutch target value for Ni, Cu, As, Cd and Pb concentration in soil, indicating a possible risk to the environment. Some indicators, including the enrichment factor (EF), the pollutant load index (PLI), and contamination factor (CF) have been used to assess the ecological risks posed by hazardous elements in the soil. The mean range of PLI was 1.5–10, indicating progressive corrosion of soil due to metal contamination. However, the CF standards of Cd ranged from 3.7 to 35 revealed that the examined soils were strongly impacted by Cd. in view of the severity of latent ecological risk for single metal (ER), the sliding order of contaminants was Cd N As N Cu N Pb N Ni N Cr. In analysis of the potential ecological risk (PER), soils from all land uses showed considerable to very high potential ecological risk (Islam et al. 2015).

Gatta et al. were specified a relative study that was carried out to calculate the effects of two water irrigation sources on the quality and microbiological safety of tomato plants and fruit, and on the microbiological soil properties: irrigation with groundwater (GW) and with treated agro-industrial wastewater (TW). In a field experimentation in southern Italy (Apulia region), The physical and chemical properties of irrigation water and fruit quality standards were determined. Escherichia coli, fecal Enterococci and Salmonella spp. It was also spotted in irrigation water, tomato plant, fruit, root area soil. The bacteriological analysis of the total heterogeneity counts (THCs) that plant, fruit and soil samples was determined. The source of irrigation water did not significantly affect the quantitative characteristics of the crop. However, with GW, the marketable fruit yield was greater than with TW (~82 vs. ~79 Mg ha^{-1}, respectively). For each of the irrigation parameters, the most important qualitative criteria characterize the treated tomato fruit (i.e., dry matter content, pH, soluble solid content, color parameters) were in contract with reports in the literature. For the microbiological results, the mean levels of E. coli and fecal Enterococci were 4408 and 3804 CFU 100 ml^{-1}, respectively, for TW (above the Italian guidelines for TW re-use). For the tomato plant and fruit, no E. coli isolated in either, and fecal coliforms and THC were not subjective by the irrigation waters ($P > 0.05$). Total bacterial recorded by quantitative PCR was lower in soil irrigated with GW, than TW (3.69 vs. 4.02, ×106, respectively). Moreover, And microbial community soil patterns vary greatly between two water treatments,These data show that while fecal indicators are not affected, the composition of the community and the dynamics of the entire bacterial population in the soil is influenced by the different qualities of this water used in irrigation (Gatta et al.2015).

Meng and Wang were identified that because of the freshwater constraints of agricultural irrigation, wastewater has been used to irrigate agricultural land as an important complement and alternative water resource over the past three decades in China, especially in the northern regions. However, there is increasing concern about the risks of food safety and health, and a case study was then conducted to understand the long-term impact of sewage irrigation on concentrations of heavy metals in soil and plants. Sewage Sludge, soil and vegetation samples were collected and analyzed for heavy metal concentrations. Results showed that sewage irrigated soil contained much higher concentrations of Cd, Cu, Pb, Zn, Ni, Cr, As and Hg compared to clean water irrigated soil. Heavy metal content of surface soil (0-20 cm) was significantly higher than soil substrate. Significant heavy metal (Cd, Zn and Hg) pollution has occurred in soils of areas that had been using untreated waste water irrigation in Tianjin, China. There were heavy accumulations of heavy metals in wheat used for sewage water irrigation. Compared with other parts of wheat plants, the contents of the Cd, Cr, Pb and As in the roots show that the roots have physically powerful absorption potential and may have a clear effect on the fence. Based on the soil to plant move factor of heavy metals, there is a strong piling up effect of Cd in vegetables. Overall, the concentrations of Cd, Pb, Ni, Cr and As were lower than the national allowed safety limits in soil. Mean Cd, Pb and As concentrations in vegetables were higher than the national safety limits, While the average concentrations of Cu, Zn and Cr were lower than China's national safety limits. Therefore, in order to ensure food safety and the use of irrigation water for irrigation, continuous monitoring and pollution control are needed (Meng et al.2016).

Abegunrin et al. were analyzed the indiscriminate use of wastewater in irrigation as a result of lack of fresh water can weaken soil functions and cause environmental pollution. The aim of this study was to assess the physical and chemical properties of soils, growth parameters and water use pattern of the two irrigated indigenous vegetables with three types of wastewater in southwestern Nigeria. The study was a pot experiment (2 × 4) (wastewater versus vegetables), developed in a randomized full design (RBCD) with three replicates in the screen house. The vegetables that were tested were SM-eggplant (Solanummacrocarbon) and CA-spinach (Celusiaangentia) while wastewater treatment was abattoir wastewater (AW), bathroom, laundry wastewater (BW) cassava effluent (CE) and rainwater (RW) as control, The wastewaters were analyzed for physical, chemical and biological properties while the soil samples collected from the field at 0–20 cm soil layer and pots at 0–10 and 10–20 cm layer were analyzed for physico-chemical properties before and after the test respectively. Soil hydrophobicity was determined using the water-droplet penetration time (WDPT) method, plant growth parameters were monitored every 5 days while leaf area was determined shortly before harvest. Consumptive water use was determined using the soil water balance system. The wastewaters had sensible to very high degree of limitation for use in relation to salinity and sodicity. Except for CE treatment, wastewater irrigation increased the soil pH, Mg, K, Ca, TOC, TN and CEC at harvest. SAR surpassed the threshold value of 6 in the surface layer of CA soil irrigated with BW wastewater. Wastewater irrigation caused the amount of soil hydrophobicity, with the highest hydrophobic degree from CE treatment. Vegetative growth indicators showed that the SM vegetables performed better under AW treatment or while the CA vegetables performed better in the treatment of BW compared to the RW treatment. The vegetables differed in relation to water use and there was no marked trend among the different wastewater treatments as regards the temporal division of the consumptive water use. The CE wastewater had the most negative impact on both soil function and plant growth. The study showed that wastewater resources are valuable due to improved soil fertility and increased crop growth compared to rainwater, but need to be managed with caution, preferably before reuse, in soil function and crop quality (Abegunrin et al. 2016).

Gerić and Garaj-Vrhovac were determined the production of printed circuit boards (PCBs) generates wastewater polluted with heavy metals and organic matter, PCB factories signify potential pollution sites. The wastewater tested in this study was toxic and restricted several raw materials; the most were copper and iron. At two insinuation times tested (4 and 24 h) PCB wastewater (PCBW) proved to be cytotoxic (decreased cell viability) and genotoxic (increased comet assay tail intensity and tail moment) to human blood peripheral lymphocytes in vitro, and the oxidative pressure parameter (malondialdehyde concentration) was also found to be higher. After the joint treatment function by waste base, ozone and waste sludge methods, concentrations of metals in purified PCBW were below the upper permitted levels and all parameters did not differ compared to the negative control. Similar methods have been applied together in PCB factories before discharging potentially toxic wastewater into the environment because pure PCBW does not mean a threat by aspect of cytotoxicity and genetic toxicity (Gerić et al.2017).

Zanin and Dal Magro were used for printing in the graphic industry include traces of heavy metals that are dissolved and passed in the effluent, and the hazard posed by these contaminants in the environmentis connected with toxicity and bioaccumulation in living beings. The mean of this study was to calculate the use of natural clinoptilolite-zeolite (CL) as adsorbent for removal of heavy metals in wastewater from the graphic industry. Adsorption experiments were performed with the CL zeolite for copper(II), chromium(III) and iron(III) so as to decide stability constants and kinetic models. Kinetic assays performed for every metal resulted in removal up to 95.4% iron, 96.0% copper and 85.1% chromium, at 25.0 ˚C and pH 4.0. The zeolite selectivity followed the order Fe >Cr >Cu and the adsorption system followed pseudo-first order kinetic form for copper and chromium and pseudo-second categorize for iron. The Langmuir model provided the top fit of adsorption isotherms for chromium and copper while Freundlich form was the best for iron. Toxicity and genotoxicity assays in Allium cepa showed the effectiveness of the use of CL zeolite as an adsorbent for treating printing industry effluent, viewing no toxic and genotoxic potential, contrary to untreated effluent which showed a reduce in germination and increase in total cells with alterations (toxic and genotoxic effect) (Zanin et al.2017).

Ramsundar and Bux were determined wastewater employment for microalgae biomass creation is potentially the most economical way for its fuel and feed applications. In this study, the suitability of different wastewater streams within the local wastewater treatment plant was evaluated for microalgae cultivation.

Pre-treatment methods were evaluated to minimize bacterial load. Biomass, cell physiology, nutrient removal efficiencies and biochemical constituents of Chlorella sorokiniana were investigated in influent (INF) and anaerobic tank centrate (AC) under mixotrophic (Mixo) and heterotrophic (Hetero) cultivation. Promising biomass (77.14 mg L^{-1} d^{-1}), lipid (24.91 mg L^{-1} d^{-1}), protein (22.36 mg L^{-1} d^{-1}) and carbohydrate (20.10 mg L^{-1} d^{-1}) productivities were observed in Mixo AC with efficient ammonium (94.29%) and phosphate (83.30%) removal. Urea supplement in concentration of 1500 mg L^{-1} further enhanced biomass (162.50 mg L^{-1} d^{-1}), lipid (24.91 mg L^{-1} d^{-1}), protein (22.36 mg L^{-1} d^{-1}) and carbohydrate (20.10 mg L^{-1} d^{-1}) productivities in Mixo AC. Urea supplemented mixotrophic cultivation of microalgae in AC is developed as a biomass creation strategy (Ramsundar et al. 2017).

Lin and Li were analyzed a new chemically enhanced primary sedimentation (CEPS) and Sludge fermentation is developed to improve nutrient removal, energy saving and resource recovery in municipal wastewater treatment. The $FeCl_3$-based CEPS with a dosage of 20 mg-Fe/L can remove 75.6% of organic pollutants and 99.3% of PO_4-P on standard from wastewater. Under natural fermentation situation, the CEPS sludge undergoes effective hydrolysis and acidogenesis to produce volatile fatty acids (VFAs) and release phosphate as valuable resources. By using CEPS, around 27% of the Organic carbon can be recovered in wastewater by sludge fermentation, mainly in the form of VFAs, and about 23% of phosphorus recovered for making vivianite fertilizer. In comparison, the recovery rates for organic and phosphorus from wastewater are under 10% with conventional primary sedimentation and sludge fermentation. CEPS combined with side-stream sludge fermentation can be readily applied in new treatment plants or in a retrofit of existing treatment systems (Lin and Li 2017).

3. MATERIALS AND METHODS

3.1. Material

In this research the analyzing of parameters were determined the quality of water and the soil around it. The Capakcur river was divided into six points to collect six samples in two different seasons' winter and spring as follows in Figure 3.1. The first water sample was obtained from the beginning of the river entering the province, the second water sample in the center of the river, the third water sample from the point before mixing the Capakcur river with Gayt river, the forth water sample after mixing both of two rivers as mentioned, the fifth water sample was collected before mixing the Goynuk and Capakcur river, and the final sixth sample was taken after mixing all three rivers Capakcur, Goynuk and Gayt, then samples were carried in to the laboratory for analyzing their parameter.

3.1.1. Description of The Study Area

The area that has been worked on was named as Capakcur river, which is smaller than the river and is located in the middle of Bingol province that has become the source of wastewater in this city; also it mixes with two other rivers the Goynuk and Gayt River. The name of Bingol has been came from Bingol Mountain which is located in the Varto governorate on the border of Erzurum-Muş, Capakcur was officially used as a name. Because Capakcur Castle is in a mountainous area, the city center has been moved to Çevlig or Çolig in the creek bed in an uncertain history. Bingol located between 41°20' and 39°54' North latitudes with 38°27'and 40°27' Eastern meridians in the Upper Euphrates region of East Anatolia, Mus from the east, Elazig in the west, Erzurum in the north and Diyarbakir in the south. 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 are according to data from the (General Directorate of Meteorology Affairs 2015).

Figure 3.1. Work location map

3.1.2. Meteorological Conditions

The Bingol province displays significant differences in terms of climatic characteristics according to the topographic structure and the locations of the provinces. It is noted that there is a terrestrial with a dry and hot, hot and cold winters on the eastern border. Rainfall is seen in the form of rain in spring and autumn, and winter snow. The highest temperature in the study area with annual precipitation of 936.9 mm and the total annual evaporation of 1202.5 mm is the lowest in July and August (34.5^{o}C) (-6,1^{o}C). The evaporation increases with summer temperatures and reaches the highest level in July with 262.7 mm.When climate data are analyzed, the temperature system is Xeric (Soil Survey Staff 2014) (Table 3.1) because the average temperature of Bingol is 12^{o}C and the temperature difference between summer and winter seasons is 5^{o}C. Winters are arid and wet summers are rainy.

Table 3.1. The average climate data for long years of Bingöl province (1965-2015) (Meteorology Bingöl Station Directorate 2015)

Months	**Temperature ^{o}C**			**Cover. Precipitation (mm)**	**Relative humidity (%)**	**Wind Speed (m/s)**	**Evaporation (mm)**	**Soil Temperature ^{o}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

Biçimlendirilmiş: Yazı tipi: (Varsayılan) Times New Roman, Kalın Değil, Yazı tipi rengi: Otomatik

Biçimlendirilmiş: Yazı tipi: (Varsayılan) Times New Roman, Kalın Değil, Yazı tipi rengi: Otomatik

Biçimlendirilmiş: Yazı tipi: (Varsayılan) Times New Roman, Kalın Değil, Yazı tipi rengi: Otomatik

3.2. Method

3.2.1. Water Quality Analysis

a) pH: pH analysis was done using standard potansiometric method described by (Richard 1954)

b) Electrical Conductivity (EC): EC analysis was done using standard potansiometric method described by (Richard 1954)

c) Bicarbonate and Carbonate: Bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) were analyzed by titrimetric method using 0.01N H_2SO_4 solution described by (Richard 1954)

d) Chlorine: Chlorine (Cl-) was measured by titration with 0.05N $AgNO_3$ solution described by (Richard 1954)

e) Calcium and Magnesium: Calcium and magnesium were prepared by titrimetric method described by (Richard 1954)

f) Potassium: Potassium analysis was done using flamephotometric method described by (Richard 1954)

g) Sodium: Sodium analysis was done using flamephotometric method described by (Richard 1954)

h) Sediment: Sediment concentration were determined using grawimetric methods described by (Richard 1954)

i) Organic matter: Organic matter were prepared by walkley-black method described by (Richard 1954)

j) Micro and heavy metal elements: (Mn, Zn, Fe, Cu, Ni, Cd, and Pb): Micro and heavy metal elements concetrations were analyzed spectrophotometric described by (Richard 1954).

3.2.2. Soil Analysis

a) pH and Soluble salts (conductivity-EC): pH and EC were determined by standard procedure water suspensions at 1:2.5 described by (Richard 1954) and (Tüzüner 1990).

b) Soil lime ($CaCO_3$): $CaCO_3$ was determined using the Calcimeter method (Tüzüner 1990).

c) Organic matter (OM): OM content was determined using the Walkley-Black wet digestion method (Tüzüner 1990).

d) Soil available phosphorus was determined with or Olsen Method (Olsen et al. 1954).

e) 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 (Kaçar 1990).

4. RESULT AND DISCUSSION

4.1. Results of Water Samples

In order to determine the physical and chemical properties of the Capakcur River in Bingol province according to four months (December, January, April and May) Water samples and water analysis results were carried out below

4.1.1 pH

The pH values of water samples taken from the observation site are given in Table 4.1, the pH values of the waters ranged from 7.7 to 8.9 in the November sample, from 7.76 to 9.24 in the December sample, from 7.83 to 8.1 in the April sample and 8.06 to 8.33 in the last May sample. pH affects many biological and chemical phenomena in water, indicating the severity of the solution's ability to be acid or base, and is defined as the expression of H^+ ion concentration present in the solution. The pH of the water depends on the amount of dissolved CO_2, HCO_3^- and free CO_2. Industrial wastes, drainage waters and phytoplankton are factors that cause pH change in the water. Chemical reactions in the water and pH for biological life are important factors (Alemdar 2009).

Table 4.1. pH values of water sample

Water parameters		21.11.2016	28.12.2016	24.4.2017	9.5.2017	Mean
pH	Min.	7.7	7.76	7.83	8.06	
	Max.	8.9	9.24	8.1	8.33	
	Average	8.31	8.24	8.01	8.21	8.19

4.1.2. Electrical Conductivity (EC)

The EC values of water samples taken from the observation site are given in Table 4.2, EC values of water are between 244-438 µS/cm in November sampling, 328-543 µS/cm in December sampling, 92-217.8 µS/cm in April sampling and in the May sample ranged from 100-231.2 to 223 µS/cm . Electrical conductivity is known as the ability of water to conduct electricity. The EC is affected by the temperature, the EC value increases as the temperature increases. There is usually a linear relationship between the total amount of ions dissolved in the well and in the EC. Water conductivity is influenced by inorganic dissolved solids such as chloride, nitrate, sulfate, phosphate anions and sodium, magnesium, calcium, potassium, iron, aluminum cations (Demiralay 1993). Conductivity varies depending on geological structure and precipitation. It has been reported that surface waters are generally less salty due to the continuous washing of the soil in high rainfall areas (Akyurt 1993).

Table 4.2. EC values of water samples

Water parameters		21.11.2016	28.12.2016	24.4.2017	9.5.2017	Mean
EC µS/cm	Min.	244	328	97	100	
	Max.	438	543	217.8	231.2	
	Average	347.44	464.28	178.56	181.7	292.99

4.1.3. Bicarbonate Analysis

Descriptive statistics of the bicarbonate values of the water sample at the observation site Table 4.3, the concentrations of bicarbonate in the water ranged from 1.9 to 4.4 mg/L in the November, from 8.2 to 13 mg/L in the December sample and from 0.2 to 0.4 in the April and 0.1 to 0.4 mg/L from May sampling. The alkalinity of bicarbonate to groundwater mainly consists of the atmospheric and CO_2 absorption of carbonate rocks (Varol et al. 2008). Allows detection of bicarbonate and carbonate alkalinity in natural waters (Tanyolaç 2000).

Table 4.3. Bicarbonate values of the water sample

Water parameters		21.11.2016	28.12.2016	24.4.2017	9.5.2017	Mean
Bicarbonat mg/L	Min.	1.9	8.2	0.2	0.1	
	Max.	4.4	13	0.4	0.4	
	Average	3.28	10.44	0.26	0.27	3.56

4.1.4. Chloride Analysis

Descriptive statistics of water sample chlorine values from observation site Table 4.4, According to the results of the analysis, chlorine concentrations were 0.2-0.5 mg/L in the November sample, 0.4-0.8 mg/L in the December sample, 0.2-0.8 mg/L in the April sample and 0.2-1 from May sampling. Chloride is an element found in natural waters, urban wastewater and soil drainage. The sources of chlorine is from the Soil structure, artificial fertilizers, industrial wastewater, animal wastes, sewage and some food processing. Industry wastes affect Cl level of water. The increase in water $CaCl_2$ increases the susceptibility to contamination by sewage waters. Waters with high chlorine levels are not suitable for cleanness at home and for industrial use (Alemdar et al. 2009).

Table 4.4. Chlorine values from observation site

Water parameters		21.11.2016	28.12.2016	24.4.2017	9.5.2017	Mean
Chloriede mg/L	Min.	0.2	0.4	0.2	0.2	
	Max.	0.5	0.8	0.8	1	
	Average	0.34	0.53	0.34	0.39	0.40

4.1.5. Hardness

Descriptive statistics of the water sample hardness values taken from the observation site Table 4.5, Water hardness values ranged from 3.4 to 5.8 mg/L in the November sample, 1 to 6 mg/L in the December sample, 1.2-1.8 mg/L in the April sample and 1-3 mg/L in the May sample. The Ca^{+2} and Mg^{+2} ions give rise to most of the hardness of the natural waters. This hardness is considered as total hardness with very few errors. Generally, the degree of hardness of the water is related to the geological structure in which it straddles along the road it tracks through the rainwater. The waters found in the thick regions of the earth layer and in the calcareous land are harder. As a rule, surface waters are softer than underground waters.

Table 4.5. Hardness values taken from the observation site

Water parameters		21.11.2016	28.12.2016	24.4.2017	9.5.2017	Mean
Ca+Mg mg/L	Min.	3.4	1	1.2	1	
	Max.	5.8	6	1.8	3	
	Average	4.47	3.39	1.47	1.63	2.73

4.1.6. Calcium Analysis (Ca)

Descriptive statistics of water sample calcium values taken from the observation site Table 4.6, and the calcium concentrations of the water ranged from 1.2 to 3.8 mg/L in the November sample, from 1 to 2 mg/L in the December sample, from 0.6 to 1.6 mg/L in the April sample and from 0.6 to 1.4 mg/L in the May sample. The sources of Calcium in water are from rain, underground and surface waters are dissolved in limestone and water is washed away from the soil. Larger amounts of Ca-containing waters are not suitable for drinking and industrial use (Alemdar et al. 2009). Water that has high mineral content is called hard water (in contrast with "soft water"). Hard water is formed when water percolates through deposits of limestone and chalk which are largely made up of calcium andmagnesium carbonates. Hard water is defined as hard water if Ca^{++} is less than 10 mg L to1 in soft water, soft water in 20 to 25 mg L-1, medium hard water in 25 mg L to 1 (Tanyolaç 2004).

Table 4.6. Calcium values taken from the observationsite

Water parameters		21.11.2016	28.12.2016	24.4.2017	9.5.2017	Mean
Ca mg/L	Min.	1.2	1	0.6	0.6	
	Max.	3.8	2	1.6	1.4	
	Average	2.43	1.54	1.12	0.89	1.49

4.1.7. Sodium Analysis

Descriptive statistics of water samples taken from the observation site Table 4.7, the results of analysis show that the sodium concentrations of water are between 6.78 and 21.25 mg/L in the December sample, between 5.37 and 14.55 mg/L in the January sample and between 1.96 and 6.42 mg/L in the April samples and in the May ranged from 2.47 to 5.17 mg/L. Samples in monthly adjusted, samples are seen to have increased in December and January. This is thought to be due to the increase in concentration resulting from excessive evaporation. Some points sampled during the winter period were later found to be dried due to temperature (creeks, wells, etc.). Sodium is the most common alkali metal found in nature. All sodium compounds are readily soluble in water. Natural waters all contain some sodium. The presence of sodium underground depends on factors such as type and amount of mineral, pH, decay time, groundwater flow rate, calcium ion exchange in the environment, artificial and natural pollution (Koçak 2017).

Table 4.7. Sodium values taken from the observation site

Water parameters		1.12.2016	10.1.2017	24.4.2017	9.5.2017	Mean
Na mg/L	Min.	6.781	5.375	1.965	2.476	
	Max.	21.25	14.55	6.423	5.179	
	Average	10.47	10.20	4.26	3.89	7.20

4.1.8. Potassium Analysis

Descriptive statistics of the potassium values of the water sample taken from the observation site Table 4.8, the results of analysis show that the potassium concentrations of water are between 2.24-5.93 mg/L in the December sample, 3.006-5.26 mg/L in the January sample, 10.69-1.57 mg/L in the April sample and in the May sample ranged from 0.63 to 1.46 mg/L. Potassium forms 2.5% of the earth's crust and it is found mainly in feldspars (orthoclase, microcline), mica, feldspatoids and clay minerals. It belongs to plants (Koçak 2017). The amount of potassium in groundwater depends on the degradation of potassium minerals (such as potassium feldspars. Although it is relatively common in nature, it is usually found at a few mg/L in natural waters. The moderate concentration of potassium in the water does not adversely affect the use of water. Low and high concentrations in drinking water have no direct impact on human health. Potassium is one of the main nutrients for plant and animal life. The amount of K in the main rocks forming the soil base is more than Na. On the other hand, Na ions in the water are more than K ions (Koçak 2017) because of the absorption of K ions in the ground due to plants and killer.

Table 4.8. Potassium values of the water sample taken from the observation site

Water parameters		1.12.2016	10.1.2017	24.4.2017	9.5.2017	Mean
K mg/L	Min.	2.24	3.006	0.692	0.639	
	Max.	5.931	5.26	1.572	1.461	
	Average	3.11	3.57	1.02	1.06	2.19

4.1.9. Heavy Metal Contents of Water Samples

Current research displayed results between (Mn^{++}, Zn^{++}, Fe^{++}, Cu^{++}, Ni^{++}, Cd^{++}, and Pb^{++})

4.1.9.1. Manganese (Mn)

Descriptive statistics of the Manganese values of the water sample taken from the observation site Table 4.9, the results of analysis show that the Mn concentrations of water are between 0.203-0.277 mg/L in the November sample, 0.203-0.299 mg/L in the January sample, 0.011-0.058 mg/L in the April sample and in the May sample ranged from 0.016 to 0.074 mg/L. Manganese is one of the most common metals on the surface of the earth. About 0.1% of the earth's crust. Manganese is not naturally present (elemental) form, but more than 100 mineral compounds (Windham at el 2006).

Table 4.9. Manganese values of the water sample taken from the observation site

Water parameters		24.11.2016	12.1.2017	24.4.2017	9.5.2017	Mean
Mn mg/L	Min.	0.203	0.205	0.011	0.016	
	Max.	0.277	0.299	0.058	0.074	
	Average	0.24	0.26	0.03	0.06	0.148

4.1.9.2. Zinc (Zn)

Descriptive statistics of Zn values of the water sample taken from the observation site Table 4.10, the results of analysis show that the Zn concentrations of water are between 0.021-0.043 mg/L in the November sample, 0.02-0.061 mg/L in the January sample, 0.02-0.036 mg/L in the April sample and in the May sample ranged from 0.025 to 0.07 mg/L. Zinc (Zn) It is an important and beneficial element of the human body and plants. Full exclusion of Zn is not possible due to its double role, an essential micro element on the one hand and a toxic environmental factor on the other (Brune et al. 1994). However, Zinc can cause non-fatal smoke fever, pneumonia, and potential danger as environmental pollutants (Hampp et al. 1976).

Table 4.10. Zinc values of the water sample taken from the observation site

Water Parameters		24.11.2016	12.1.2017	24.4.2017	9.5.2017	Mean
Zn mg/L	Min.	0.021	0.02	0.02	0.025	
	Max.	0.043	0.061	0.036	0.07	
	Average	0.03	0.04	0.03	0.04	0.03

4.1.9.3. Iron Fe

Descriptive statistics of Fe values of the water sample taken from the observation site Table 4.11, the results of analysis show that the Fe concentrations of water are between 0.187-0.409 mg/L in the November sample, 0-0.152 mg/L in the January sample, 0.089-0.548 mg/L in the April sample and in the May sample ranged from 0.007 to 0.638 mg/L. The Environmental Protection Agency considers iron in well water to be a secondary contaminant, which means it has no direct impact on health. The maximum level of secondary pollutants identified by the EPA is 0.3 milligrams per liter, but this is just a guideline rather than a federal standard.

Table 4.11. Iron values of the water sample taken from the observation site

Water parameters		24.11.2016	12.1.2017	24.4.2017	9.5.2017	Mean
Fe mg/L	Min.	0.187	0	0.089	0.007	
	Max.	0.409	0.152	0.548	0.638	
	Average	0.28	0.05	0.28	0.26	0.22

4.1.9.4. Copper Cu

Descriptive statistics of Copper (Cu) values of the water sample taken from the observation site Table 4.12, the results of analysis show that the Cu concentrations of water are between 0.01-0.058 mg/L in the November sample, 0.002-0.061 mg/L in the January sample, 0-0.044 mg/L in the April sample and in the May sample ranged from 0.026 to 0.098 mg/L. Copper is a reddish metal that found naturally in soil, water, sediment, and air. It is an essential element for living organisms, in small amounts-necessary to ensure good health but too much copper cause health effects, including vomiting and diarrhea also it damage liver and kidney disease (Salavati-Niasari et al. 2008).

Table 4.12. Copper values of the water sample taken from the observation site

Water parameters		24.11.2016	12.1.2017	24.4.2017	9.5.2017	Mean
Cu mg/L	Min.	0.01	0.002	0	0.026	
	Max.	0.058	0.061	0.044	0.098	
	Average	0.03	0.02	0.02	0.07	0.04

4.1.9.5. Nickel Ni

Descriptive statistics of nickel (Ni) values of the water sample taken from the observation site Table 4.13, the results of analysis show that the Ni concentrations of water are between 0.037-0.186 mg/L in the November sample, 0.101-0.269 mg/L in the January sample, 0.068-0.142 mg/L in the April sample and in the May sample ranged from 0.12 to 0.19 mg/L. Ni is the element that is accumulate in sediments and a part of the several biological cycles. Ni is emitted directly from numerous industries through discharge to surface water. The common source of nickel in drinking water is from leaching pipes it become toxic in a larger doses.

Table 4.13. Nickel values of the water sample taken from the observation site

Water parameters		24.11.2016	12.1.2017	24.4.2017	9.5.2017	Mean
Ni mg/L	Min.	0.037	0.101	0.068	0.12	
	Max.	0.186	0.269	0.142	0.19	
	Average	0.11	0.16	0.10	0.15	0.13

4.1.9.6. Cadmium Cd

Descriptive statistics of cadmium (Cd) values of the water sample taken from the observation site Table 4.14, the results of analysis show that the Cd concentrations of water are between 0.008-0.021 mg/L in the November sample, 0.007-0.1 mg/L in the January sample, 0.013-0.045 mg/L in the April sample and in the May sample ranged from 0.041 to 0.06 mg/L. A low level of cadmium is found naturally in surface and groundwater higher levels of cadmium in water can result from the use and dispose of elements containing cadmium. Cadmium is toxic to fish and other aquatic life, Cadmium is a natural element that is sometimes found in drinking water. Public water systems are monitored for cadmium.

Table 4.14. Cadmium values of the water sample taken from the observation site

Water parameters		24.11.2016	12.1.2017	24.4.2017	9.5.2017	Mean
Cd mg/L	Min.	0.008	0.007	0.013	0.041	
	Max.	0.021	0.1	0.045	0.06	
	Average	0.01	0.02	0.03	0.05	0.029

4.1.9.7. Lead Pb

Descriptive statistics of Lead (Pb) values of the water sample taken from the observation site Table 4.15, the results of analysis show that the Pb concentrations of water are minus in the November and May samples, 0-6.426 mg/L in the January sample, 0.259-0.503 mg/L in the April sample . Lead is usually toxic, in wastewater often stems from streets and roofs. The human body contains about 120 mg of lead. Organic lead cause necrosis of neurons but inorganic lead cause axonal degeneration and removal of myelin. Both types of lead may cause edema and congestion.

Table 4.15. Lead values of the water sample taken from the observation site

Water parameters		24.11.2016	12.1.2017	24.4.2017	9.5.2017	Mean
Pb mg/L	Min.		0	0.259		
	Max.		6.426	0.503		
	Average		0.87	0.42		0.65

4.1.10. Water Organic Matter

Descriptive statistics of the water sample Organic matter values taken from the observation field Table 4.16, And Organic matter values ranged from 22.01 to 29.17 mg/L in the December sample, 18.37 to 22.62 mg/L in the January sample, 18.23-20.56 mg/L in the April sample and 18.33-21.37 mg/L in the May sample. Organic matter is something that contains carbon compounds formed by living organisms. It covers a wide range of things such as leaves, branches, and algae, any parts of animals, manure, sediment, and sewage sludge.

Table 4.16. Water organic matter values taken from the observation site

Water parameters		2.12.2016	3.1.2017	24.4.2017	9.5.2017	Mean
Organic matter mg/L	Min.	22.01	18.37	18.23	18.33	
	Max.	29.17	22.62	20.56	21.37	
	Average	24.78	20.50	19.62	19.74	21.16

4.1.11. Water Sediment

The results of water sediment were on 29.11.2016 the most dense sediment was measured at the point P5 (0.2 gr/L). The minimum sediment concentration was measured at P6 (0.07 gr/L). On 02.01.2017 the densest sediment was measured at the point P3 (0.04 gr/L). The minimum sediment concentration was measured at P2 (0 gr/L). On 24.04.2017 the most dense sediment was measured at the points P1, 2, 4, 5 (0.04 gr/L). The minimum sediment concentration was measured at P6 (0.02 gr/L). On 09.05.2017the most dense sediment was measured at the points P3 (0.06 gr/L). The minimum sediment concentration was measured at P6 (0.01 gr/L). That showed in table 4.17. Sediment is the amount of clay, sand, silt and other soil particles that settle at the bottom of a water body. The source of Sediment can come from soil erosion or from the decaying of plants and animals. Also Wind, water and ice carrys these particles to rivers, lakes and streams (Wauchope et al. 1992).

Table 4.17. Water sediment from the observation side

Sample	Sediment (gr/L)			
	29.11.2016	02.01.2017	24.04.2017	09.05.2017
p1	0.14	0.02	0.04	0.02
p2	0.09	0	0.04	0.05
p3	0.10	0.04	0.03	0.06
p4	0.08	0.02	0.04	0.02
p5	0.20	0.02	0.04	0.02
p6	0.07	0.02	0.02	0.01

4.1.12. Statistical Water Analysis

4.1.12.1. Descriptive statistics

The descriptive statistics of physical and chemical parameters under Capakcur river studied are given in Table 4.18, they provide a summary of the mean, standard deviation, variance values of fifteen measured parameters for four months data.

Table 4.18. Descriptive

		N	Mean	Std. Deviation	Std. Error
pH	1.0	12	8.2242	.13426	.03876
	2.0	12	8.3517	.28749	.08299
	3.0	12	8.2050	.23888	.06896
	4.0	12	8.5025	.53095	.15327
	5.0	12	7.9358	.19797	.05715
	6.0	12	7.9208	.13548	.03911
	Total	72	8.1900	.34836	.04105
EC	1.0	12	317.708	117.7936	34.0041
	2.0	12	316.642	116.5094	33.6334
	3.0	12	315.475	109.0149	31.4699
	4.0	12	204.750	112.2045	32.3906
	5.0	12	285.708	141.8107	40.9372
	6.0	12	317.692	171.1773	49.4146
	Total	72	292.996	131.9517	15.5507
Bicarbonate	1.0	12	3.475	4.3687	1.2611
	2.0	12	3.683	4.4210	1.2762
	3.0	12	3.317	3.8312	1.1060
	4.0	12	3.167	3.6001	1.0393
	5.0	12	3.683	4.7899	1.3827
	6.0	12	4.058	5.2321	1.5104
	Total	72	3.564	4.2600	.5020
Chlorine	1.0	12	.467	.2741	.0791
	2.0	12	.333	.1303	.0376
	3.0	12	.375	.1215	.0351
	4.0	12	.442	.1782	.0514
	5.0	12	.350	.1168	.0337
	6.0	12	.450	.2067	.0597
	Total	72	.403	.1815	.0214
Ca+Mg	1.0	12	2.467	1.0765	.3108
	2.0	12	2.433	1.0165	.2934
	3.0	12	3.108	1.2206	.3524
	4.0	12	2.033	1.3694	.3953
	5.0	12	3.000	1.7352	.5009
	6.0	12	3.392	2.0891	.6031
	Total	72	2.739	1.4909	.1757
Ca	1.0	12	1.383	.6576	.1898
	2.0	12	1.500	.6060	.1749
	3.0	12	1.367	.6651	.1920
	4.0	12	1.367	.5314	.1534
	5.0	12	1.617	.6686	.1930
	6.0	12	1.750	1.0553	.3046
	Total	72	1.497	.7065	.0833

Table 4.18. (Continue) Descriptive

Mn	1.0	12	.13592	.112286	.032414
	2.0	12	.14292	.111036	.032053
	3.0	12	.14792	.110525	.031906
	4.0	12	.14733	.102442	.029573
	5.0	12	.15692	.103890	.029991
	6.0	12	.15733	.106940	.030871
	Total	72	.14806	.104323	.012295
Zn	1.0	12	.02883	.006250	.001804
	2.0	12	.02858	.008544	.002466
	3.0	12	.03392	.005282	.001525
	4.0	12	.03650	.014988	.004327
	5.0	12	.03250	.008533	.002463
	6.0	12	.04367	.015210	.004391
	Total	72	.03400	.011415	.001345
Fe	1.0	12	.117083	.0709692	.0204870
	2.0	12	.110250	.1098049	.0316979
	3.0	12	.154167	.0938479	.0270915
	4.0	12	.368917	.2382300	.0687711
	5.0	12	.342000	.1853684	.0535113
	6.0	12	.220250	.1069410	.0308712
	Total	72	.218778	.1752762	.0206565
Cu	1.0	12	.025250	.0158924	.0045877
	2.0	12	.041750	.0195221	.0056356
	3.0	12	.035250	.0317522	.0091661
	4.0	12	.034667	.0235925	.0068106
	5.0	12	.040583	.0257133	.0074228
	6.0	12	.036833	.0253586	.0073204
	Total	72	.035722	.0239119	.0028180
Ni	1.0	12	.14358	.046740	.013493
	2.0	12	.12025	.017274	.004987
	3.0	12	.12967	.027665	.007986
	4.0	12	.14392	.039383	.011369
	5.0	12	.11200	.036534	.010546
	6.0	12	.13508	.074004	.021363
	Total	72	.13075	.044016	.005187
Cd	1.0	12	.020167	.0158506	.0045757
	2.0	12	.029083	.0194677	.0056198
	3.0	12	.027583	.0174848	.0050474
	4.0	12	.029583	.0175834	.0050759
	5.0	12	.032417	.0168548	.0048656
	6.0	12	.032250	.0203431	.0058725
	Total	72	.028514	.0178365	.0021021
Na	1.0	12	7.65692	3.103940	.896030
	2.0	12	7.75908	2.602233	.751200
	3.0	12	7.56217	2.747827	.793229
	4.0	12	4.76975	2.659181	.767639
	5.0	12	4.95267	1.942262	.560683
	6.0	12	10.51325	7.660214	2.211313
	Total	72	7.20231	4.277868	.504152

Table 4.18. (Continue) Descriptive

K	1.0	12	1.90267	1.023259	.295389
	2.0	12	1.91408	.827966	.239013
	3.0	12	1.80258	1.012765	.292360
	4.0	12	2.05858	1.058297	.305504
	5.0	12	2.10800	1.219364	.352000
	6.0	12	3.35717	2.336204	.674404
	Total	72	2.19051	1.401173	.165130
Organic matter	1.0	12	21.7833	1.95169	.56340
	2.0	12	21.5933	2.73236	.78876
	3.0	12	21.2233	3.00901	.86863
	4.0	12	21.0758	3.11962	.90056
	5.0	12	20.3583	3.18306	.91887
	6.0	12	20.9217	1.47210	.42496
	Total	72	21.1593	2.60390	.30687

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

The result of ANOVA one-way (sites), provided in table 4.19, the objective of data (bold color) is the significance of discriminate function and to determine significance variable that result in water quality variation in four months, pH and Fe parameters was significantly affected according to the station of Capakcur river. There was no significant difference between the EC, Bicarbonate, Chloride, Ca+Mg, Ca, Mn, Zn, Cu, Ni, Cd, Na, K and Organic matter of various station.

Table 4.19. 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
pH	8.22±.039	8.35±.083	8.21±.069	8.50±.153	7.94±.057	7.9±.039	7.60	**.001**
EC (µs/cm)	317.7±34	316.6±33.6	315.4±31.47	204.75±32.39	285.71±40.94	317.69± 49.41	1.44	.222
Bicarbonat	3.48±1.26	3.68±1.28	3.32±1.11	3.17±1.04	3.69±1.38	4.06±1.51	.062	.997
Chlor	.47±.080	.33±.038	.38±.035	.44±.051	.35±.034	.45±.060	1.20	.321
Ca+Mg	2.47±.31	2.43±.29	3.11±.35	2.03±.39	3.00±.501	3.39±.60	1.44	.221
Ca	1.38±.19	1.50±.17	1.37±.19	1.37±.15	1.61±.19	1.75±.30	.59	.712
Mn	.14±.032	.14±.032	.15±.032	.15±.030	.16±.30	.16±.03	.070	.996
Zn	.029±.02	.03±.002	.03±.002	.04±.004	.032±.002	.043±.004	3.40	.009
Fe	.12±.02	.11±.032	.15±.03	.37±.07	.34±.05	.22±.031	7.18	**.001**
Cu	.03±.005	.04±.01	.04±.01	.034±.01	.041±.01	.037±.007	.71	.620
Ni	.14±.013	.12±.004	.13±.008	.14±.01	.11±.010	.14±.02	1.02	.415
Cd	.02±.004	.03±.01	.03±.01	.03±.01	.03±.005	.032±.006	.75	.589
Na	7.65±.89	7.76±.75	7.56±.79	4.77±.76	4.10±.56	10.5±2.2	3.47	.007
K	1.9±.30	1.9±.23	1.8±.29	2.06±.31	2.1±.35	3.3±.67	2.25	.059
Organic matter	21.9±.56	21.6±.79	21.22±.87	21.07±.90	20.3±.92	20.9±.43	.44	.821

Different superscript letters in a row show significant differences ($P < 0.05$) indicated by Tukey Honest significant difference tests.

* indicates significantly calculated F-value.

*p values if it is red color it is significant ($P < 0.05$, and $P < 0.01$).

4.1.12.3. The Descriptive Groups of Stations According to Physicochemical parameters of water by Tukey Test

The descriptive groups of stations according to the physicochemical parameters of water by Tukey tests, these statistical analyses showed that there are different station group from most of the parameter and were given in tables below.

Table 4.20. pH Tukey B[a]

Sits	N	Subset for alpha = 0.05	
		1	2
6.0	12	7.9208	
5.0	12	7.9358	
3.0	12	8.2050	8.2050
1.0	12	8.2242	8.2242
2.0	12		8.3517
4.0	12		8.5025

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.21. EC Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
4.0	12	204.750
5.0	12	285.708
3.0	12	315.475
2.0	12	316.642
6.0	12	317.692
1.0	12	317.708

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.22. Bicarbonate Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
4.0	12	3.167
3.0	12	3.317
1.0	12	3.475
5.0	12	3.683
2.0	12	3.683
6.0	12	4.058

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.23. Chloride Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
2.0	12	.333
5.0	12	.350
3.0	12	.375
4.0	12	.442
6.0	12	.450
1.0	12	.467

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.24. Ca + Mg Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
4.0	12	2.033
2.0	12	2.433
1.0	12	2.467
5.0	12	3.000
3.0	12	3.108
6.0	12	3.392

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.25. Ca Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
4.0	12	1.367
3.0	12	1.367
1.0	12	1.383
2.0	12	1.500
5.0	12	1.617
6.0	12	1.750

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.26. Mn Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
1.0	12	.13592
2.0	12	.14292
4.0	12	.14733
3.0	12	.14792
5.0	1k2	.15692
6.0	12	.15733

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.27. Zn Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
2.0	12	.02858
1.0	12	.02883
5.0	12	.03250
3.0	12	.03392
4.0	12	.03650
6.0	12	

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4. 28. Fe Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
2.0	12	.110250
1.0	12	.117083
3.0	12	.154167
6.0	12	.220250
5.0	12	
4.0	12	

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.29. Cu Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
1.0	12	.025250
4.0	12	.034667
3.0	12	.035250
6.0	12	.036833
5.0	12	.040583
2.0	12	.041750

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.30. Ni Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
5.0	12	.11200
2.0	12	.12025
3.0	12	.12967
6.0	12	.13508
1.0	12	.14358
4.0	12	.14392

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.31. Cd Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
1.0	12	.020167
3.0	12	.027583
2.0	12	.029083
4.0	12	.029583
6.0	12	.032250
5.0	12	.032417

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.32. Na Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
4.0	12	4.76975
5.0	12	4.95267
3.0	12	7.56217
1.0	12	7.65692
2.0	12	7.75908
6.0	12	

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.33. K Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
3.0	12	1.80258
1.0	12	1.90267
2.0	12	1.91408
4.0	12	2.05858
5.0	12	2.10800
6.0	12	3.35717

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

Table 4.34. Organic matter Tukey B[a]

Sites	N	Subset for alpha = 0.05
		1
5.0	12	20.3583
6.0	12	20.9217
4.0	12	21.0758
3.0	12	21.2233
2.0	12	21.5933
1.0	12	21.7833

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 12.000.

4.1.12.4. The Descriptive of Means Plots

The descriptive of means plots according to the physicochemical parameters of water were identified between sites and parameters shown in figures below.

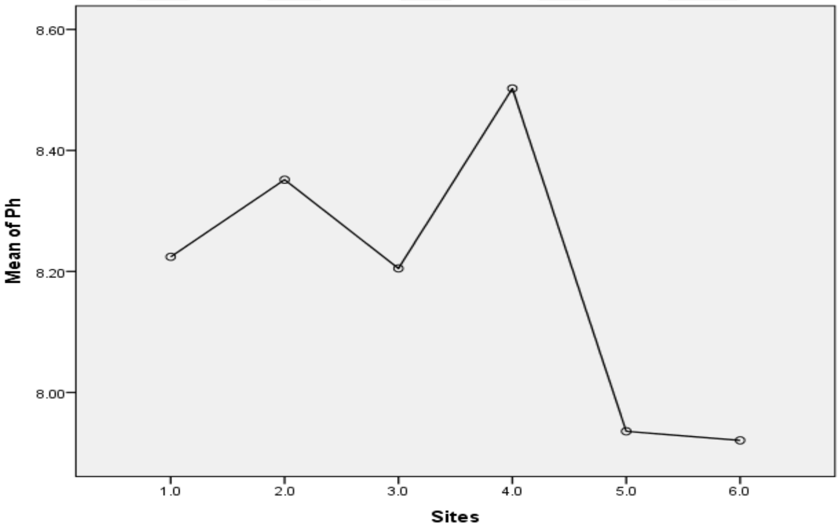

Figure 4.1. Mean of pH

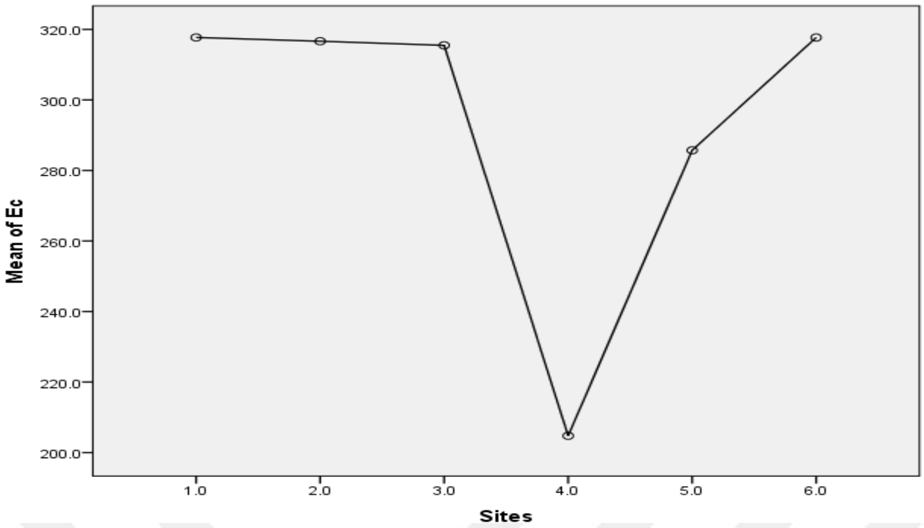

Figure 4.2. Mean of EC

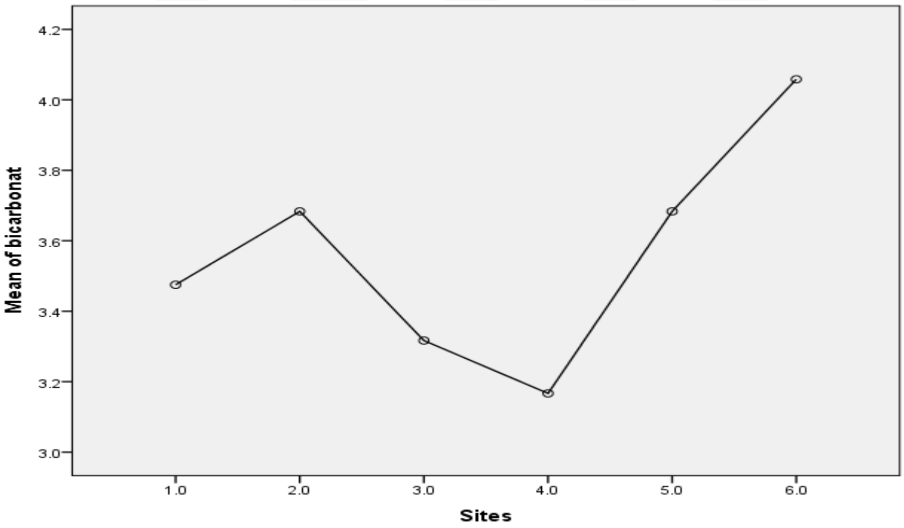

Figure 4.3. Mean of bicarbonate

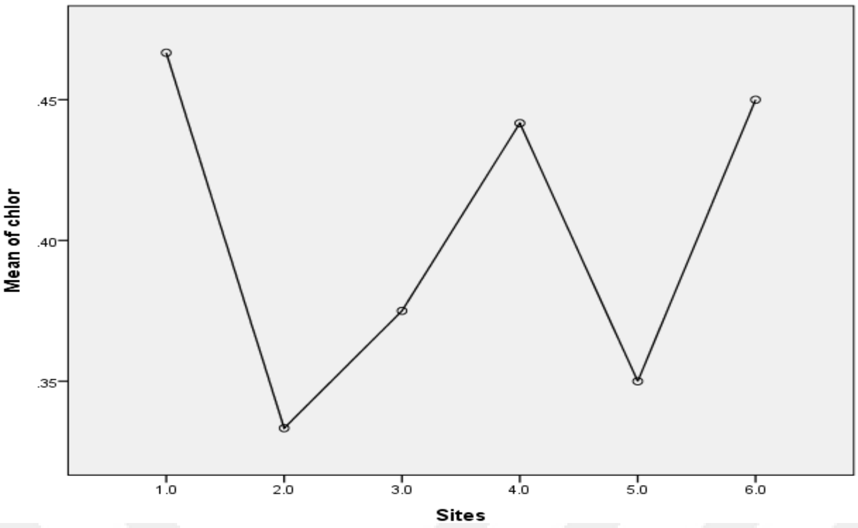

Figure 4.4. Mean of chloride

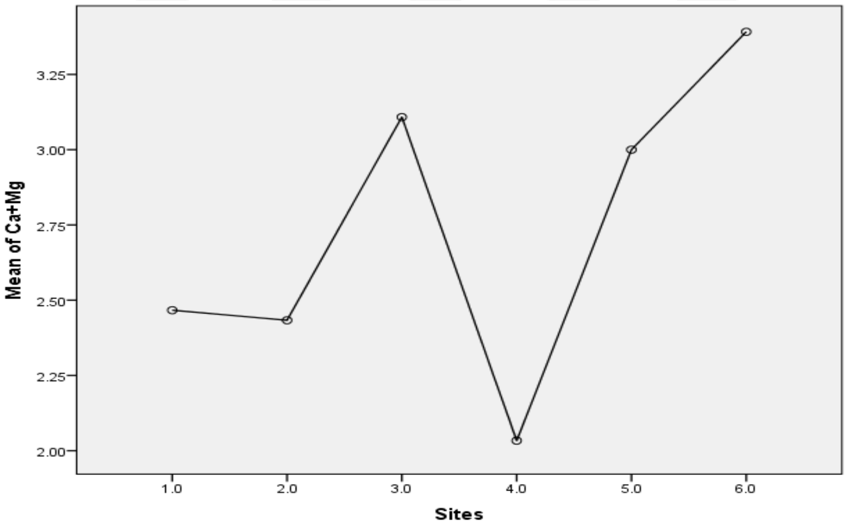

Figure 4.5. Mean of Ca + Mg

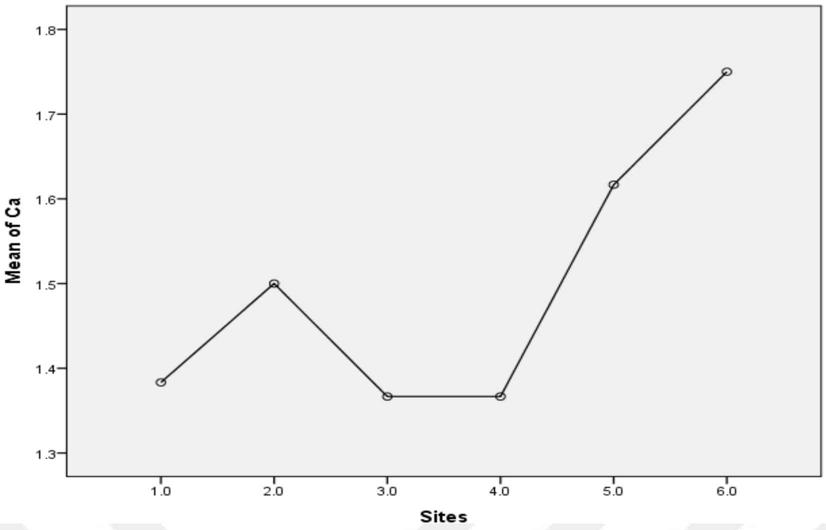

Figure 4.6. Mean of Ca

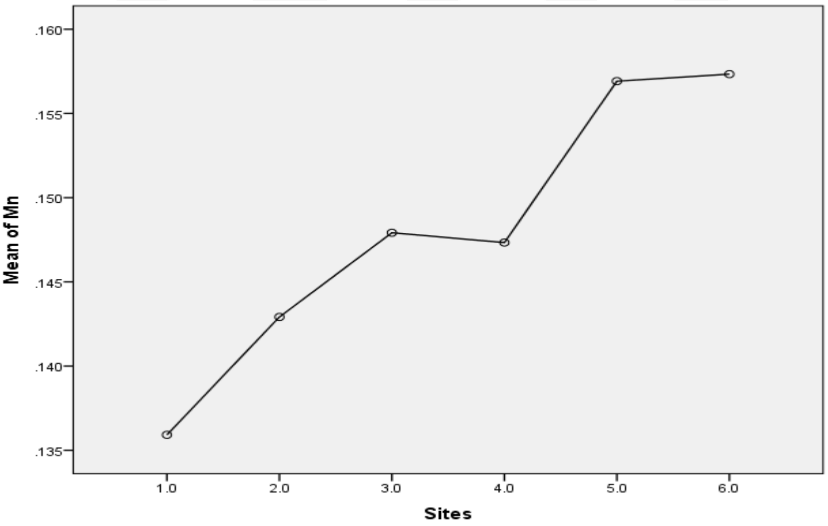

Figure 4.7. Mean of M

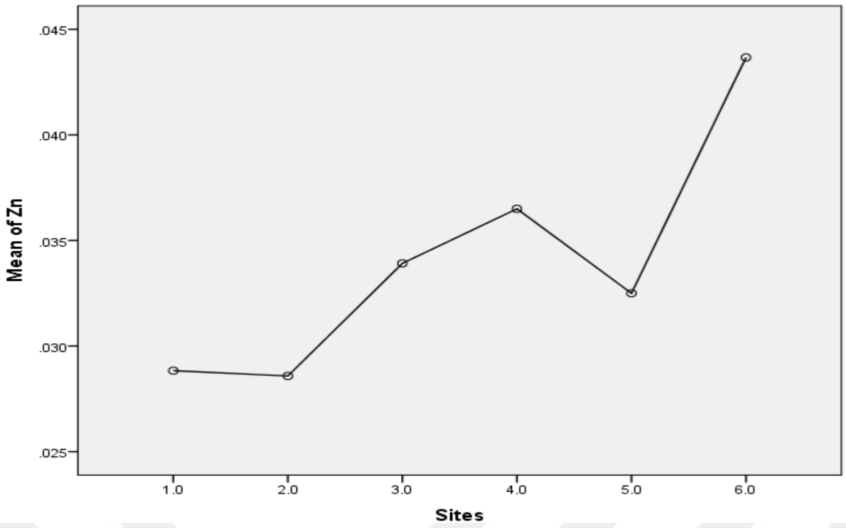

Figure 4.8. Mean of Z

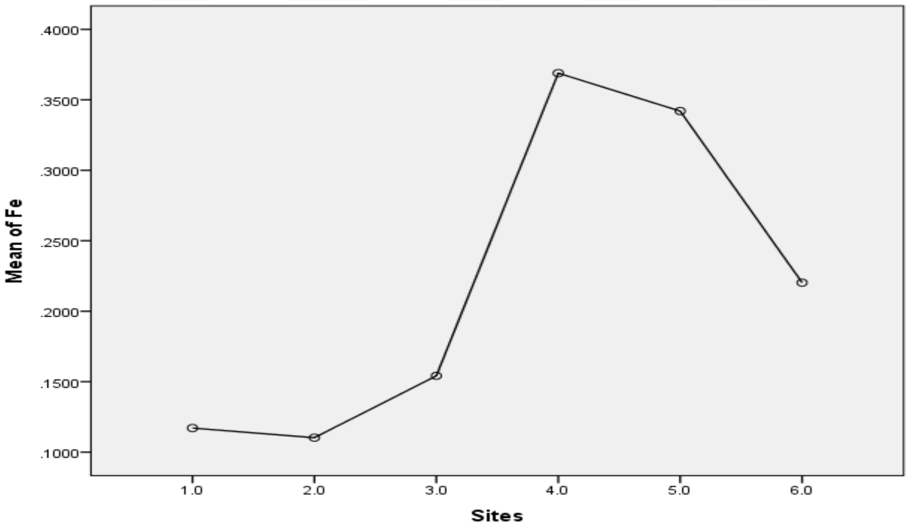

Figure 4.9. Mean of Fe

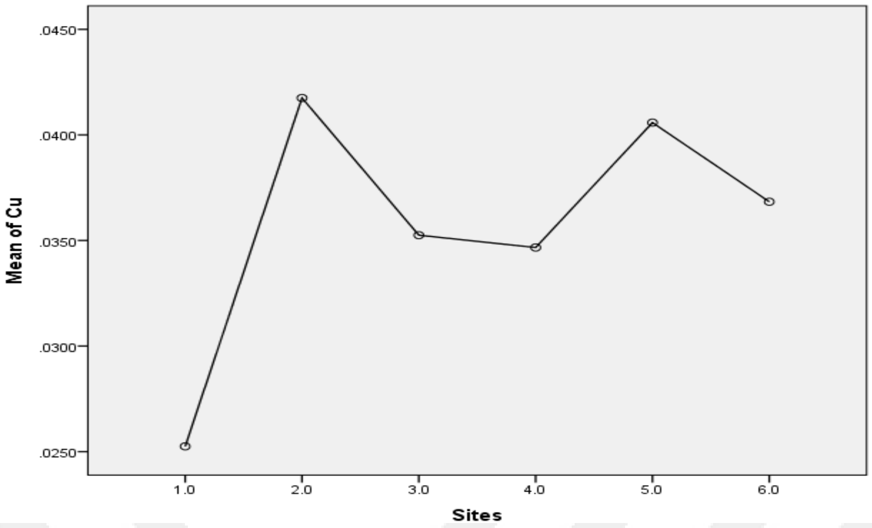

Figure 4.10. Mean of Cu

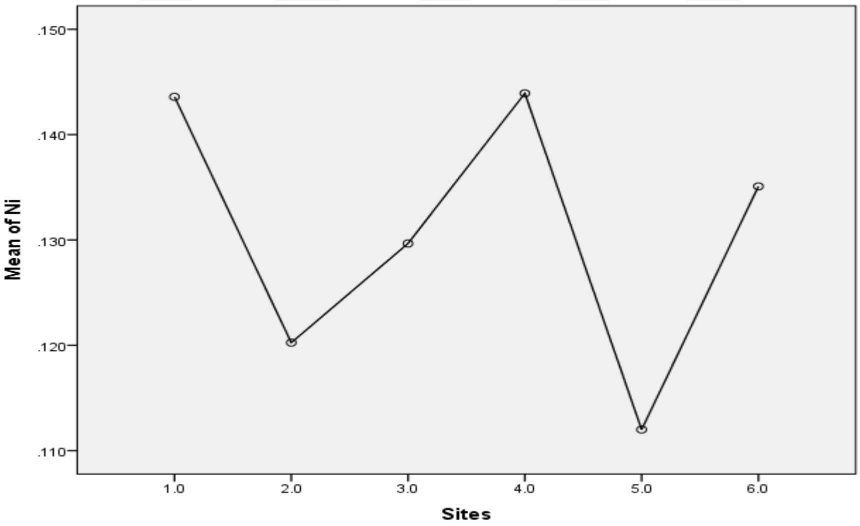

Figure 4.11. Mean of Ni

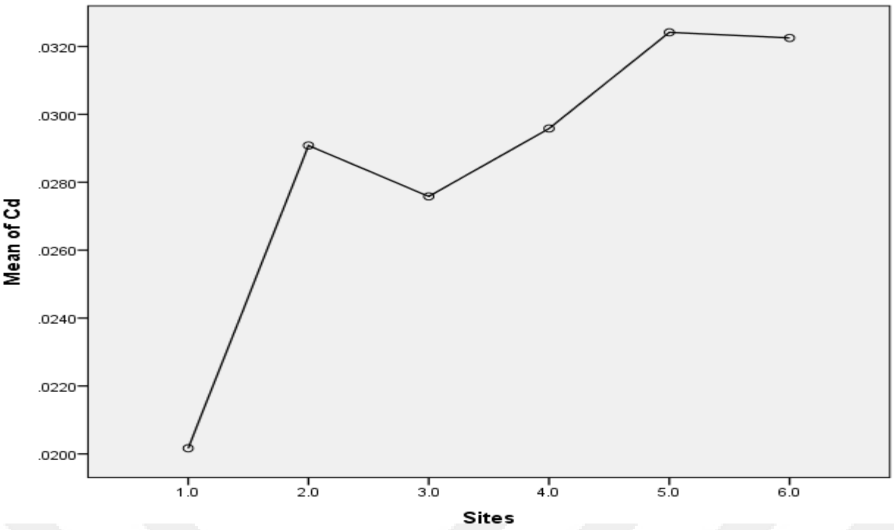

Figure 4.12. Mean of Cd

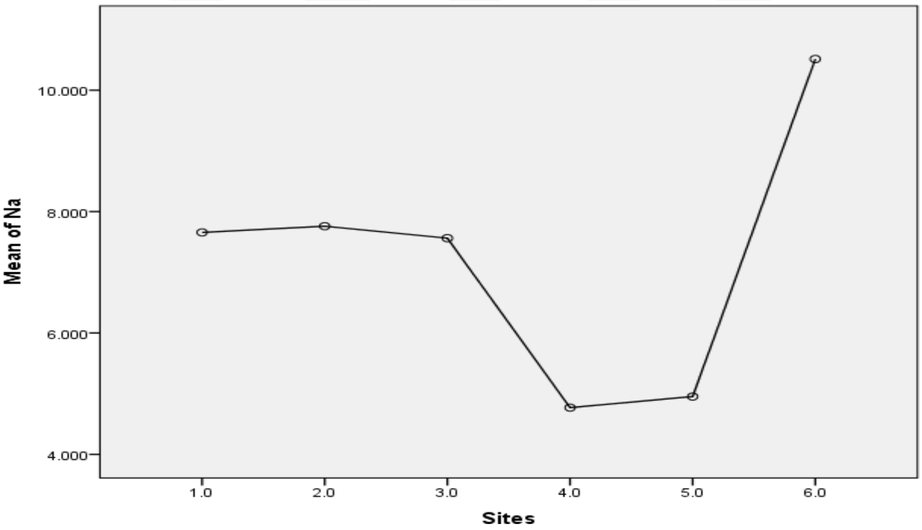

Figure 4.13. Mean of Na

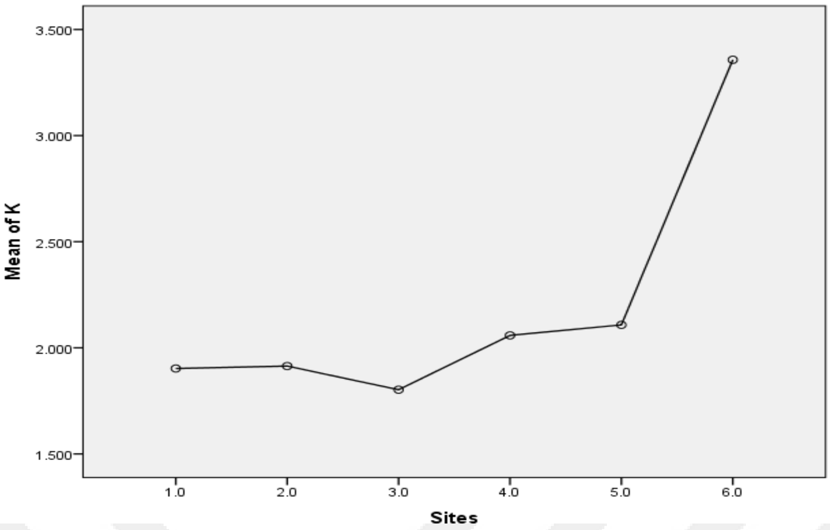

Figure 4.14. Mean of K

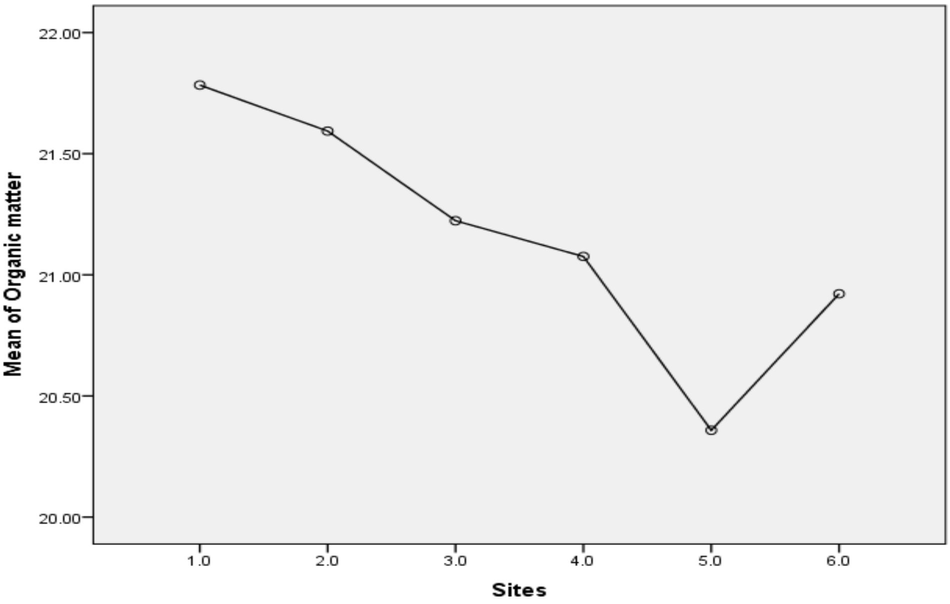

Figure 4.15. Mean of Organic matter

4.2. Results of Soil Samples

Soil samples were collected in Right and Left side of Capakcur river, Soil samples and soil analysis results were carried out below.

4.2.1. Soil pH

Descriptive statistics of pH values of the Right and Left side soil sample taken from the observation site Table 4.35, the results of analysis show that the pH concentrations of Right side between 7.46-8.3, left side between 7.19-8.09, and the $CaCO_3$ in the Right side between 3-40.4 Left side between 1.8-35.2. The pH of the soil is one of the most important chemical properties. The pH range of the highest availability of nutrients is reported to be 6.5-7.0 (Akıncı 2011). The model and parameters obtained for the pH of the soil in the study area are shown below.

Table 4.35. 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

4.2.2. Soil EC

Descriptive statistics of EC values of the Right and Left side soil sample taken from the observation site Table 4.36, the results of analysis show that the. EC concentration of Right side between 109.9-298 and left side between 232.2-425. Electrical conductivity (EC) is the most important indicator of salinity in the soil. Soil EC is a measure of the amount of salts in the soil. The level of Salt increase as aresult of cropping, irrigation, and land management. Management that leads to low organic matter, Poor infiltration, and saturated soil Pressure can increase soil EC (Adviento-Borbe et al. 2006).

Table 4.36. 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

4.2.3. Soil $CaCO_3$

Descriptive statistics of $CaCo_3$ values of the Right and Left side soil sample taken from the observation site Table 4.37, the results of analysis show that the $CaCO_3$ concentration of Right side between 3-40.4 and left side between 1.8-35.2.The amount and distribution of carbonates effects on soil fertility, increase of calcium carbonate in soil causes many problem associated to fertilization and nutrient availability. The amount and rate of carbonates in soil are affecting by the chemical and physical property of the soil (e.g., particle size and mineralogy). (Hamid2009) (Del Campilloet al. 1992). The increase in soil pH with increasing soil $CaCO_3$ content (Bockheim et al. 2014).

Table 4.37. 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

4.2.4. Soil Organic Matter

Descriptive statistics of organic matter values of the Right and Left side soil sample taken from the observation site Table 4.38, the results of analysis show that the, organic matter concentration of Right side between 10.03-19.38 and left side between 12.53-18.57. Soil organic matter is the most effective parameters to the agricultural soil, it’s important for soil fertility (Pitts et al. 1986). It effects on physical, chemical and biological properties of soils like cation exchange capacity, soil structure, water holding capacity, and pesticide adsorption (Ding et al. 2002). There are several methods to determine Soil organic matter each method with some advantages and disadvantages like wet oxidation procedure and Walkley-Black (WB) method (Nelson et al. 1982).

Table 4.38. 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

4.2.5. Soil Phosphorus

Descriptive statistics of phosphorus (P) values of the Right and Left side soil sample taken from the observation site Table 4.39, the results of analysis show that the (P) concentration of Right side between 0-0.48 and left side between 0-0.23. Phosphorus is one of the major controlling nutrients for plant growth because it added to soil as fertilizer for agricultural soils to improve crop production and it has the main role in transfer of energy in living organisms. Phosphates’ fertilizer is essential to support agricultural production. Although soil has two forms of (P) organic and inorganic, plants can only utilize inorganic (P) so Mineralization of organic (P) used by plants to convert organic into inorganic (P) for growth (Raghothama 2005).

Table 4.39. 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

4.2.6. Soil Total Element

Descriptive statistics of soil total element include (Fe, Mn, Cu, Zn, Pb, Cd, Ni, Na, K).

4.2.6.1. Iron Fe

Fe values of the Right and Left side soil sample taken from the observation site Table 4.40, the results of analysis show that the Fe concentration of Right side between 0.494-4.413 and left side between 2.597-4.108. In the Earth's crust the second most abundant metal is Fe after aluminum (Al) and it has an average level of 40 g kg-1 (Sparks 2003). Iron (Fe) is also a necessary micronutrient for plants, it is a factor for several enzymes involved in photosynthesis, respiration and is necessary for the synthesis of chlorophyll (Gattullo et al. 2017).

Table 4.40. 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

4.2.6.2. Manganese Mn

Mn Values of the Right and Left side soil sample taken from the observation site Table 4.41, the results of analysis show that the Mn concentration of Right side between 0.053-0.173 and left side between 0.098-0.152. Mn is capable to be replaced by other metal ions generally acts as an activator of enzymes. In biochemical function Manganese resembles as Mn and is involved in the activation of enzyme-stimulating reactions including phosphorylations, decarboxylations, reductions and hydrolysis reactions as a result affects processes such as respiration, amino acid synthesis, and the level of hormones in plants, the main role of Mn in nature is its association in oxygen evolution in photosynthesis in green plants (Burnell 1988).

Table 4.41. 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

4.2.6.3. Copper Cu

Cu Values of the Right and Left side soil sample taken from the observation site Table 4.42, the results of analysis show that the Cu concentration of Right side between 0.361-1.927 and left side between 0.536-1.242. Cu is a necessary micronutrient for all organisms but above a certain threshold exposure becomes toxic (Adriano 2001). Cu is mainly derived from paternal rocks, but in some soils it may be derived from the anthropogenic sources. The mobility of Cu in contaminated soils is mainly controlled by physicochemical soil properties (e.g. pH), copper distribution between the different soil elements, erosion, and agricultural practices (Brunetto et al. 2014). For example Cu is more easily mobilized in acidic soil Such as granite rocks compared to calcareous rocks (Brun et al. 1998).

Table 4.42. 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

4.2.6.4. Zinc Zn

Zn Values of the Right and Left side soil sample taken from the observation site Table 4.43, the results of analysis show that the Zn concentration of Right side between 0.005-0.043 and left side between 0.003-0.682 . Zinc (Zn) is a necessary micronutrient with great biological impact, it plays a central role as a regulatory co-factor in enzymes intricate in several cellular functions (Hofmann 2012). It lasts in the soil for long times and can easily bio-accumulate in the food chain (Frey et al. 2000). Soil Organic matter plays a complex role in the zinc division in the soil, in an additional process it can effect on the solubility of Zn. Zn may be leached into the soil during litter decomposition of organic matter in the soil surface (Scheid et al. 2009), solid organic matter decreases Zn solubility by absorbing Zinc in to surface functional groups while dissolved organic matter increases Zn solubility and mobility (Opfergelt et al. 2017).

Table 4.43. 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

4.2.6.5. Lead Pb

Pb Values of the Right and Left side soil sample taken from the observation site Table 4.44, the results of analysis show that the Pb concentration of Right side between 0.069-0.15 and left side between 0.004-0.097. Lead (Pb) is a potentially toxic element (PTE) common in anthropogenic polluted soils (McCann et al. 2015), it has been developed by humans through history it is non-essential heavy metal (Bermudez et al. 2011). Pb can be Unloaded easily into agricultural ecosystem by human activities, causing adverse impacts on environments and human health (Broos et al. 2005; Liu et al. 2014) So, contaminated soils by Pb must be treated directly .

Table 4.44. 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

4.2.6.6. Cadmium Cd

Cd Values of the Right and Left side soil sample taken from the observation site Table 4.45, the results of analysis show that the Cd concentration of Right side between 0.003-0.028 and left side between 0.002-0.019. Cadmium (Cd) is non-essential element that can cause many harmful health effects at high concentrations (Kabata et al. 2007). As a pollutant in all phosphate rocks It occurs naturally, although the concentrations depending on the source of the parental material. Igneous rock mostly has Cd concentrations of 0.7e30 mg/kg P from originated Rock phosphate. (Oosterhuis et al. 2000). Cd contamination in agricultural soils caused by major sources like sludge application and sewage irrigation, that are lead to inhibition of crop growth, it like other toxic elements, that is affects negatively on rice growth, mainly in the roots, because of the Induction of oxidative leading to damage plant cells (Fasahat 2015).

Table 4.45. 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

4.2.6.7. Nickel Ni

Ni Values of the Right and Left side soil sample taken from the observation site Table 4.46, the results of analysis show that the Ni concentration of Right side between 0.247-2.677 and left side between 1.013-3.128. Nickel is an essential nutrient for microbes where it contributes in a variety of cellular processes. Nickel first isolated from the mineral niccolite by a Swedish Chemist Axel Cronstedt in 1751. The name “Nickel” is means Old Nick"s Copper that is derived from the term „Kupfernickel, it naturally occurs generally in the environment, being allowed through both natural and anthropogenic sources (Iyaka 2011). Many microbes are able to identifying cellular nickel ion concentrations and taking up this nutrient thru ATP-binding transport systems (Sokhadze et al. 2017).

Table 4.46. 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

4.2.6.8. Sodium Na

Na Values of the Right and Left side soil sample taken from the observation site Table 4.47, the results of analysis show that the Na concentration of Right side between 3.053-10.16 and left side between 1.575-6.506. Irrigation of wastewater can effect in the addition of large amounts of salt exactly of sodium (Na) to the soil leading to adverse effect on soil properties like Swelling and dispersion, affecting on plant growth (Victoria 2003). Sodium (Na) is an essential nutrients for healthy functioning of human body. A soil with high range of sodium is known as a “sodic” soil, is one in which sodium inhabits an extra amount of space on soil exchange sites. Soluble calcium levels decrease by increasing in soil sodium levels, soluble calcium gives soil its friable, loamy and permeable structure. Also the soil with high amount of salt is known as “saline” soil (Clancy 2009).

Table 4.47. 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

4.2.6.9. Potassium K

K Values of the Right and Left side soil sample taken from the observation site Table 4.48, the results of analysis show that the K concentration of Right side between 6.013-13.84 and left side between 10.19-27.02. Potassium (K) is a mobile ion in soils and significantly amounts can be lost by leaching (Quemener 1986). K is the most abundant element in soils. In the Earth's crust Igneous rocks have higher K contents than sedimentary rocks, K in soil is present in four forms: solution, exchangeable, nonexchangeable, and structural or mineral (Sparks 2001). In the order of their availability to plantsthe forms of soil K are solution > exchangeable > non exchangeable > mineral (Sparks et al. 1985).

Table 4.48. 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

4.2.7. Statistical Soil Analysis Right Side

4.2.7.1. Descriptive statistics

The descriptive statistics of physical and chemical parameters of right side soil samples under Capakcur River studied are given in Table 4.49, they provide a summary of the mean, standard deviation, variance values of nine measured parameters for one times data.

Table 4.49. 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

Table 4.49. (Continue): Descriptive

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

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

The result of ANOVA one-way (sites), provided in table 4.50, the objective of data (bold color) is the significance of discriminate function and to determine significance variable that result in right side soil quality variation in one times, Fe, Cu, Pb, Cd, Ni, Na, and K parameters was significantly affected according to the station of Capakcur river. There was no significant difference between the Mn and Zn matter of various station.

Table 4.50. 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	4.30±.12	3.82±.28	.71±.14	.58±.04	1.05±.10	1.06±.08	128.105	**.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

4.2.7.3. The Descriptive Groups of Stations According to Physicochemical parameters of right side soil by Tukey Test

The descriptive groups of stations according to the physicochemical parameters of right side soil sample by Tukey tests are provided in tables below, these statistical analyses showed that there are different station group from most of the parameter and were given in tables below.

Table 4.51. Fe Tukey HSD[a]

Site	N	Subset for alpha = 0.05	
		1	2
4.0	3	.58033	
3.0	3	.71133	
5.0	3	1.05000	
6.0	3	1.06333	
2.0	3		3.81900
1.0	3		4.29700
Sig.		.262	.271

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000.

Table 4.52. Cu Tukey HSD[a]

Site	N	Subset for alpha = 0.05		
		1	2	3
1.0	3	.37800		
2.0	3	.66167	.66167	
4.0	3	.68733	.68733	
3.0	3	.71467	.71467	
6.0	3		1.15633	1.15633
5.0	3			1.34433
Sig.		.471	.141	.897

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000.

Table 4.53. Zn Tukey HSD[a]

Site	N	Subset for alpha = 0.05
		1
2.0	3	.017000
6.0	3	.024000
3.0	3	.026667
4.0	3	.027000
1.0	3	.027333
5.0	3	.027333
Sig.		.639

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000.

Table 4.54. Pb Tukey HSD[a]

Site	N	Subset for alpha = 0.05		
		1	2	3
2.0	3	.08433		
1.0	3	.09267	.09267	
4.0	3	.11833	.11833	.11833
5.0	3		.12733	.12733
3.0	3		.13033	.13033
6.0	3			.13367
Sig.		.107	.064	.777

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000.

Table 4.55. Cd Tukey HSD[a]

Site	N	Subset for alpha = 0.05		
		1	2	3
1.0	3	.007667		
2.0	3	.008667	.008667	
6.0	3	.009333	.009333	
3.0	3	.015667	.015667	.015667
5.0	3		.019667	.019667
4.0	3			.022667
Sig.		.278	.075	.403

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000.

Table 4.56. Ni Tukey HSD[a]

Site	N	Subset for alpha = 0.05				
		1	2	3	4	5
1.0	3	.28833				
4.0	3		.88167			
5.0	3			1.48067		
3.0	3				1.99933	
2.0	3				2.11100	
6.0	3					2.55333
Sig.		1.000	1.000	1.000	.944	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000.

Table 4.57. Na Tukey HSD[a]

Site	N	Subset for alpha = 0.05	
		1	2
1.0	3	3.26033	
6.0	3	5.28933	5.28933
2.0	3		6.39833
3.0	3		7.07333
4.0	3		7.34933
5.0	3		7.99433
Sig.		.227	.064

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000.

Table 4.58. K Tukey HSD[a]

Site	N	Subset for alpha = 0.05		
		1	2	3
1.0	3	6.61567		
4.0	3	7.19800	7.19800	
5.0	3	7.71900	7.71900	
3.0	3	8.83200	8.83200	
2.0	3		9.18700	
6.0	3			13.24667
Sig.		.073	.124	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000.

4.2.7.4. The Descriptive of means plots

The descriptive of means plots according to the physicochemical parameters of right side soil samples were identified between sites and parameters shown in figures below.

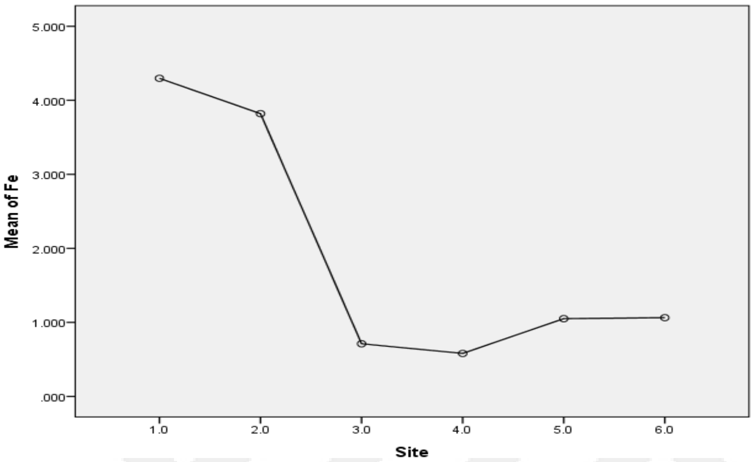

Figure 4.16. Mean of Fe

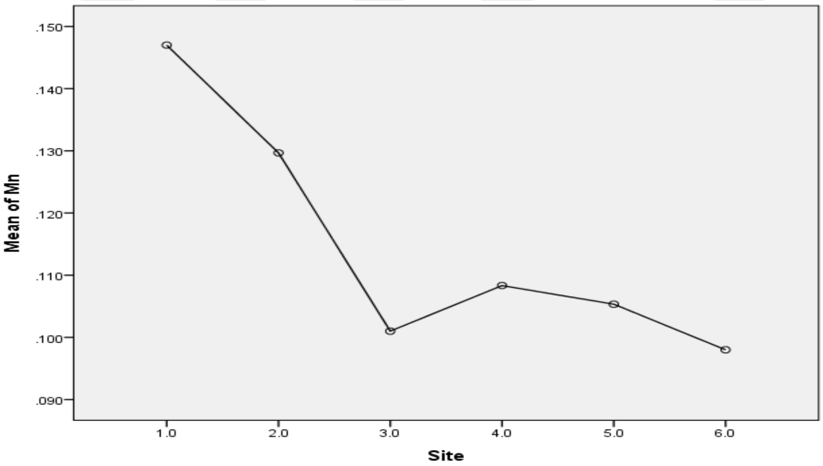

Figure 4.17. Mean of Mn

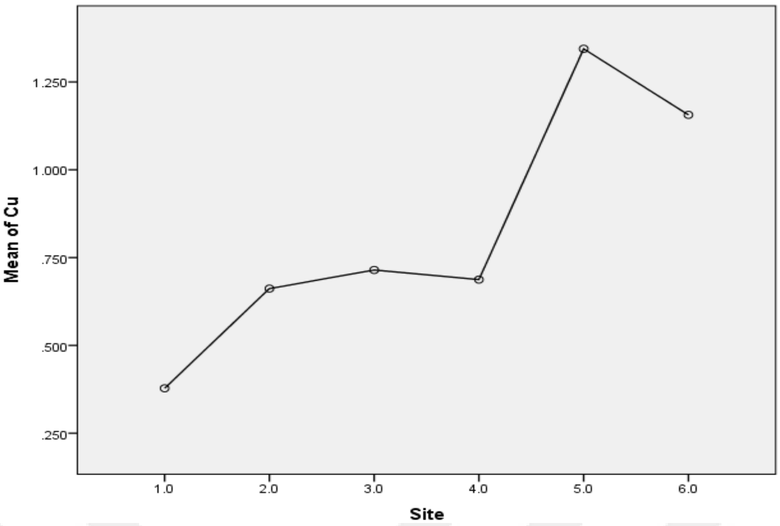

Figure 4.18. Mean of Cu

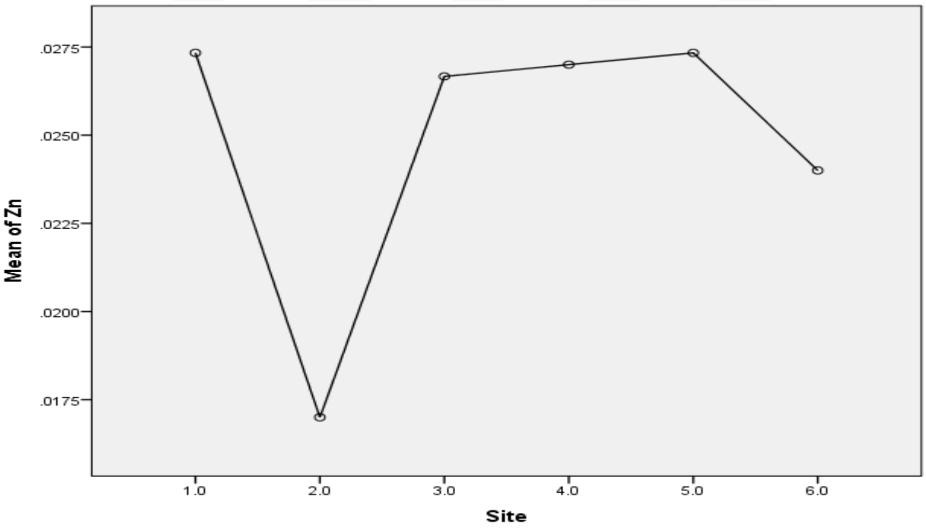

Figure 4.19. Mean of Zn

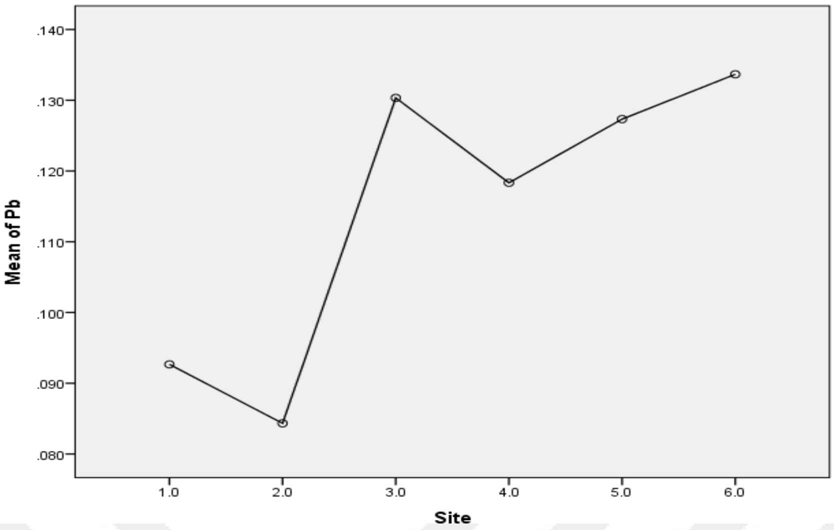

Figure 4.20. Mean of Pb

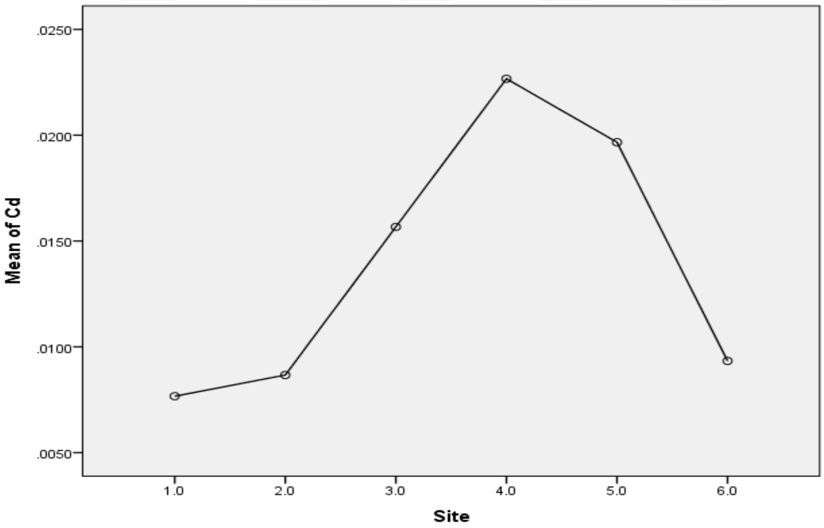

Figure 4.21. Mean of C

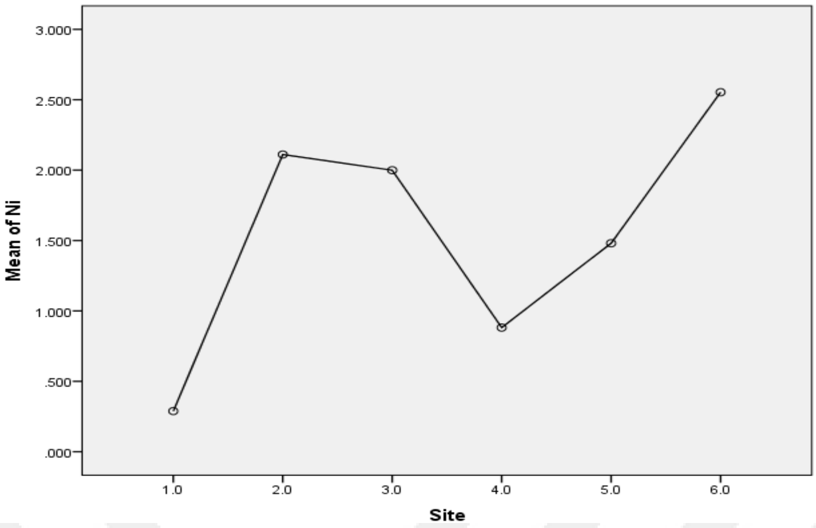

Figure 4.22. Mean of Ni

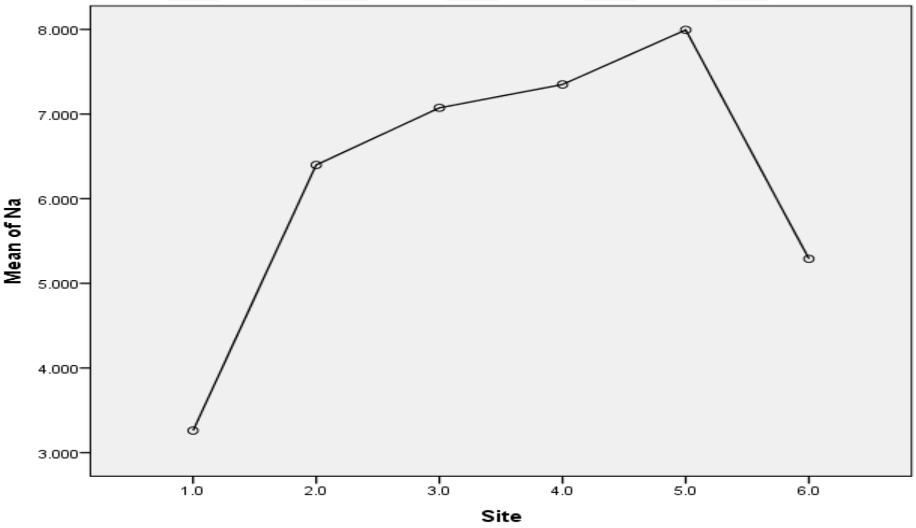

Figure 4.23. Mean of Na

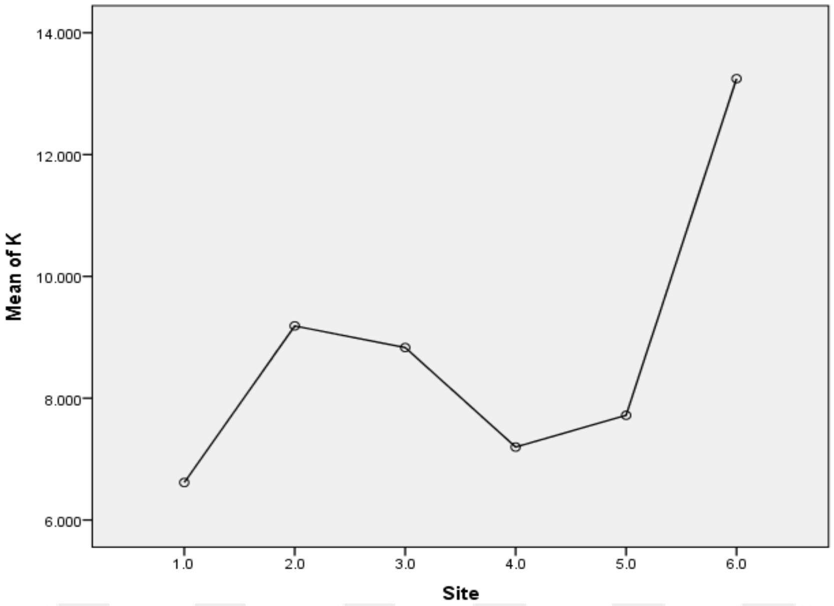

Figure 4.24. Mean of K

4.2.8. Statistical Soil Analysis Left Side

4.2.8.1. Descriptive statistics

The descriptive statistics of physical and chemical parameters of left side soil samples under Capakcur river studied are given in Table 4.59, they provide a summary of the mean, standard deviation, variance values of nine measured parameters for one times data.

Table 4.59. 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

Table 4.59. (Continue): Descriptive

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

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

The result of ANOVA one-way (sites), provided in table 4.60, the objective of data (bold color) is the significance of discriminate function and to determine significance variable that result in left side soil quality variation in one times, Mn, Cu, Pb, Cd, Ni, Na, and K parameters was significantly affected according to the station of Capakcur river. There was no significant difference between Fe and Zn matter of various station.

Table 4.60. 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.

4.2.8.3. The Descriptive Groups of Stations According to Physicochemical Parameters of Left Side Soil By Tukey Test

Table 4.61. FeTukey HSD[a]

Site	N	Subset for alpha = 0.05	
		1	2
4.0	3	2.74300	
1.0	3	2.74467	
2.0	3	2.90233	2.90233
3.0	3	3.41067	3.41067
5.0	3	3.64300	3.64300
6.0	3		3.86333
Sig.		.074	.052

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000

Table 4.62. MnTukey HSD[a]

Site	N	Subset for alpha = 0.05	
		1	2
1.0	3	.11300	
2.0	3	.12633	.12633
6.0	3	.12700	.12700
4.0	3	.12900	.12900
5.0	3	.13800	.13800
3.0	3		.14500
Sig.		.107	.320

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000

Table 4.63. CuTukey HSD[a]

Site	N	Subset for alpha = 0.05		
		1	2	3
4.0	3	.55200		
1.0	3	.70767	.70767	
5.0	3	.73167	.73167	
2.0	3		.93367	.93367
6.0	3		1.02267	1.02267
3.0	3			1.08633
Sig.		.545	.088	.693

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000

Table 4.64. ZnTukey HSD[a]

Site	N	Subset for alpha = 0.05
		1
2.0	3	.017667
3.0	3	.023000
1.0	3	.031000
4.0	3	.033667
6.0	3	.076333
5.0	3	.295333
Sig.		.274

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000

Table 4.65. PbTukey HSD[a]

Site	N	Subset for alpha = 0.05		
		1	2	3
5.0	3	.012667		
6.0	3	.021333	.021333	
4.0	3		.056333	.056333
3.0	3			.058667
2.0	3			.066000
1.0	3			.092000
Sig.		.965	.070	.063

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000

Table 4.66. CdTukey HSD[a]

Site	N	Subset for alpha = 0.05	
		1	2
2.0	3	.004667	
1.0	3	.005333	
3.0	3	.005333	
5.0	3	.007333	
6.0	3	.010000	.010000
4.0	3		.016333
Sig.		.160	.072

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000

Table 4.67. NiTukey HSD[a]

Site	N	Subset for alpha = 0.05		
		1	2	3
4.0	3	1.09300		
5.0	3	1.27333	1.27333	
2.0	3	1.38733	1.38733	
1.0	3	1.54000	1.54000	
3.0	3		2.16633	2.16633
6.0	3			2.53133
Sig.		.594	.059	.762

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000

Table 4.68. NaTukey HSD[a]

Site	N	Subset for alpha = 0.05	
		1	2
4.0	3	1.90700	
3.0	3	2.47000	
6.0	3	2.88167	
5.0	3	2.96000	
2.0	3		5.60667
1.0	3		5.97700
Sig.		.114	.908

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000

Table 4.69. K Tukey HSD[a]

Site	N	Subset for alpha = 0.05	
		1	2
2.0	3	10.4233	
1.0	3	11.0833	
4.0	3	11.3400	
5.0	3	12.1533	
3.0	3	13.9167	
6.0	3		22.0567
Sig.		.628	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 3.000

4.2.8.4. The Descriptive of means plots

The descriptive of means plots according to the physicochemical parameters of left side soil samples were identified between sites and parameters shown in figures below.

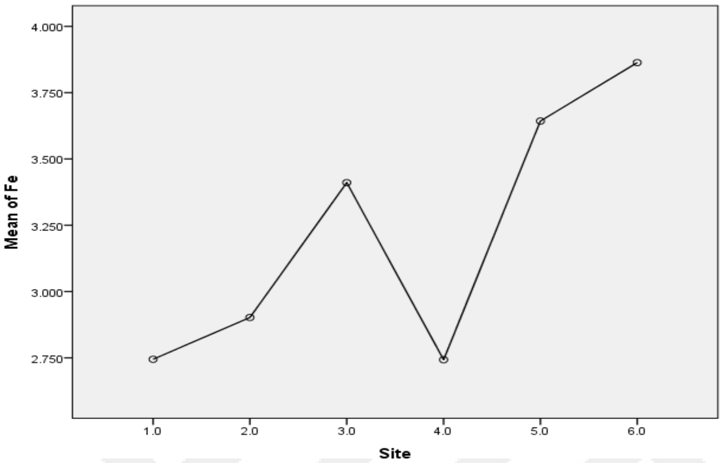

Figure 4.25. Mean of Fe

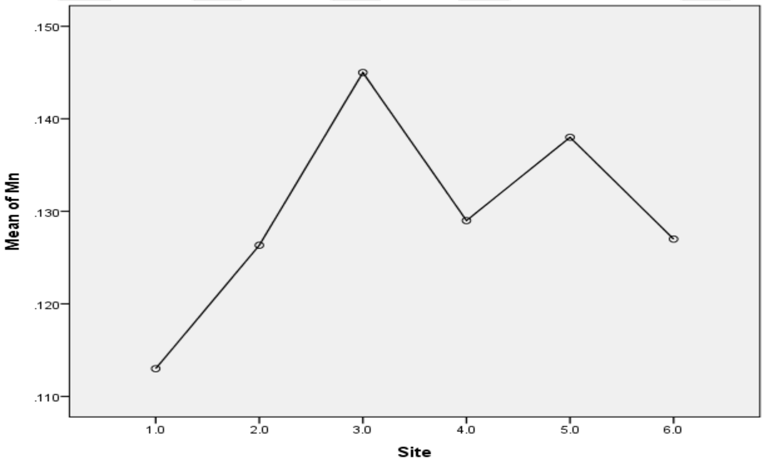

Figure 4.26. Mean of Mn

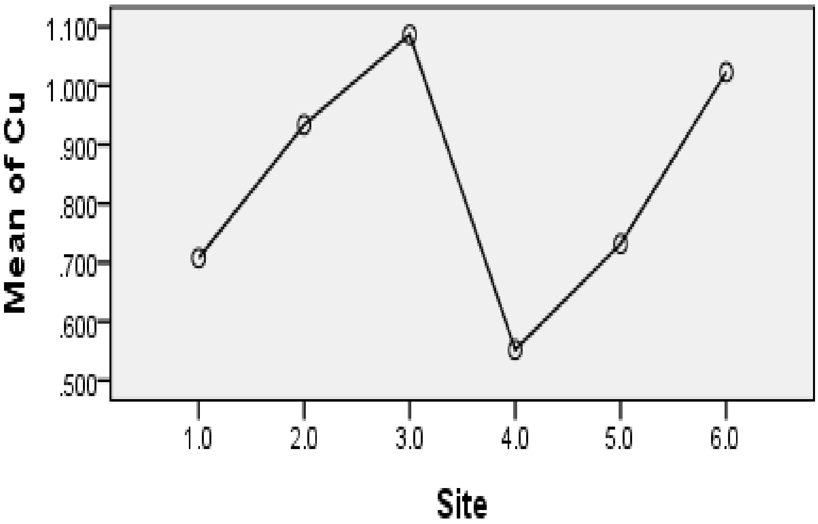

Figure 4.27. Mean of Cu

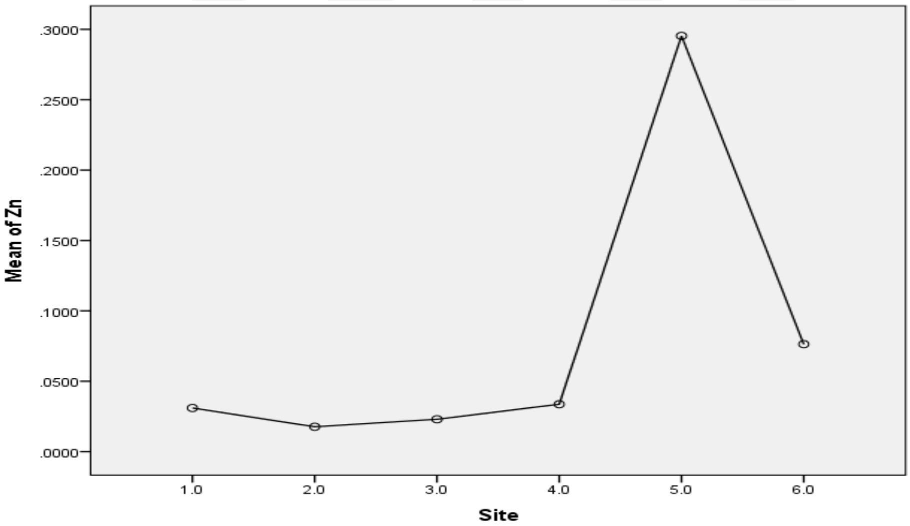

Figure 4.28. Mean of Zn

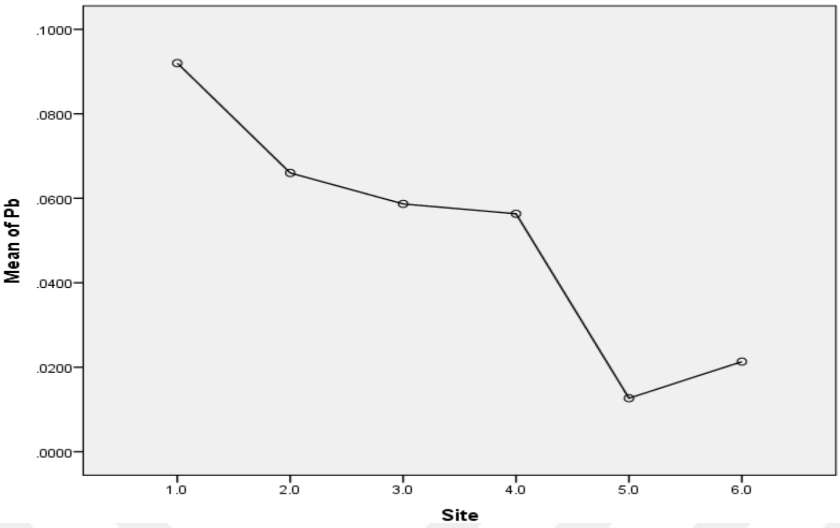

Figure 4.29. Mean of Pb

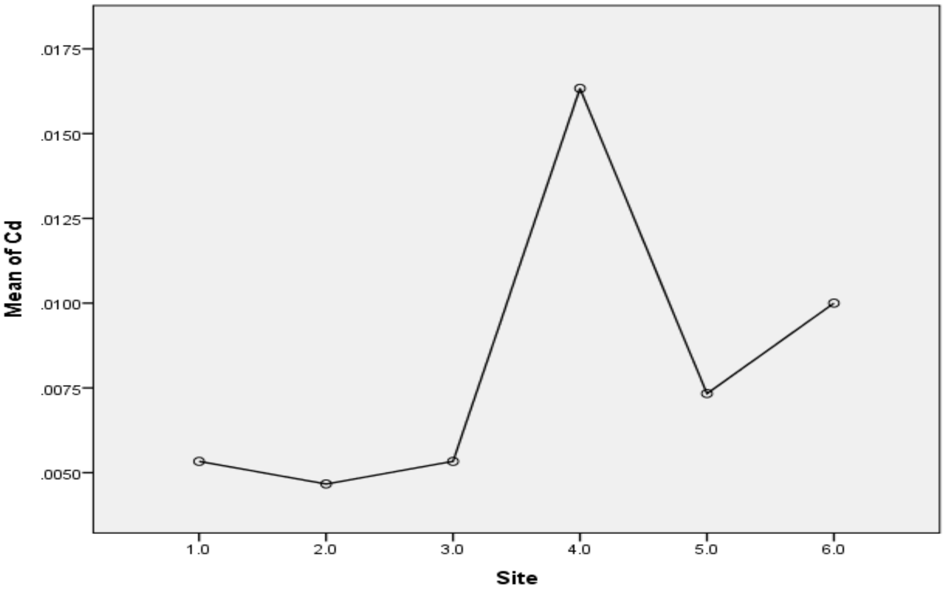

Figure 4.30. Mean of Cd

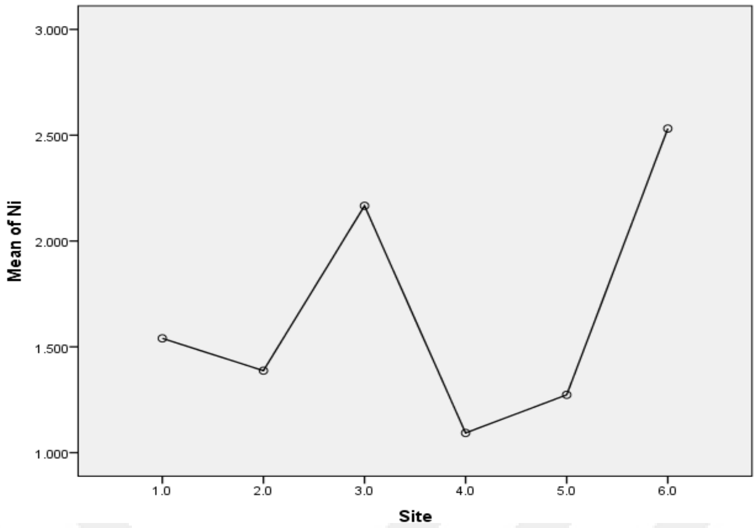

Figure 4.31. Mean of Ni

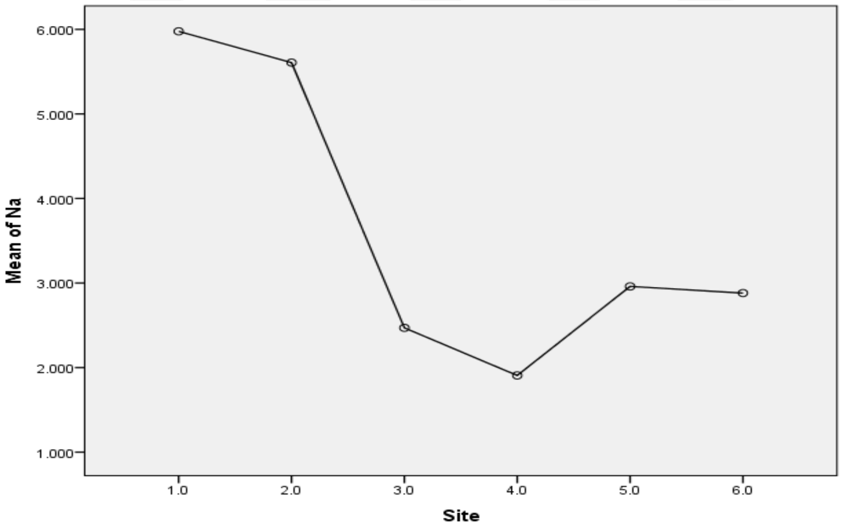

Figure 4.32. Mean of Na

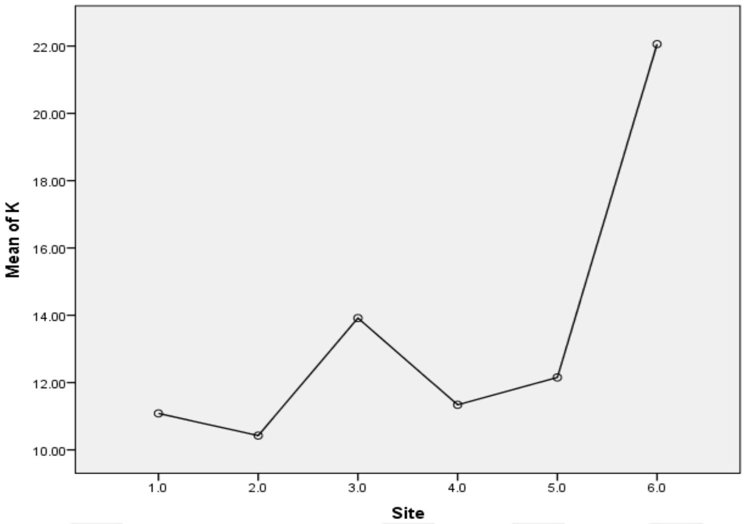

Figure 4.33. Mean of K

5. CONCLUSION

The study showed that water pH levels ranged from 7,7 to 9,24 and increased in the winter season. The EC values of water samples were determined between 97-543 µS/cm and the values became maximum in the winter season. The bicarbonate values of water samples were observed between 0,1-13 mg/L with maximum values in the winter months. The sodium and potassium analysis of waters showed that Na and K contents ranged from 1,96 to 21,25 mg/L and 0,64 to 5,93 mg/L with maximum levels in the winter seasons, respectively.

Total hardness of water samples were ranged from 1 to 6 mg/L with maximum levels in the winter season as like EC, pH, bicarbonate, Na and K levels. The increasing of pH, EC, bicarbonate and Na levels of water samples is that because the Ca, Mg, Na, K elements etc. enter into the water from the soil surface.

The Mn, Zn, Fe, Cu, Ni, Cd, and Pb contents of water samples in the study area were observed in the low concentrations because of lack of the heavy metal source in this area. And the maximum valus of sediment in winter season was 0.2 and the minimum value was 0.01in spring season.

The soil pH, EC, $CaCO_3$, organic matter and P levels in the study area ranged from 7,19 to 8,3, from 109,9 to 425 µS/cm, from 1,8 to 40,4%, from 10,03 to 19,38, from 0 to 0,48 respectively.

The Mn, Zn, Fe, Cu, Ni, Cd, and Pb contents of soil samples in the area were observed in the non-toxic level because of lack of the heavy metal source in this area.

The high content of heavy metals in soil associated with soil parent material, industrial, and factories. Generally the heavy metal inouts into area which was studied can be say from fertilizer and parent material. This investigation of soil and water samples around Capakcur in Bingol revealed and clear low content of heavy metals. All of the samples had low concetration on soil and water quality standard (Facchinelli et al. 2001).

The result of this research indicated that the water of this river can be used for irrigation water in plant production. To protect of this quality of the water, known pollutants around the river should be controlled or prohibited to enterance to the river.

REFERENCE

Abegunrin TP, Awe GO, Idowu DO, Adejumobi MA (2016) Impact of wastewater irrigation on soil physico-chemical properties, growth and water use pattern of two indigenous vegetables in southwest Nigeria. Catena 139: 167-178

Adriano DC (2001) Arsenic In Trace elements in terrestrial environments. Springer New York pp: 219-261

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

Akıncı Ş (2011) Hümik asitler, bitki büyümesi ve besleyici alımı

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)

Akyurt İ (1993) Balık Yetiştiriciliğinde Su Kalitesi Yönetimi Atatürk Üniv Yayınları p: 144

Alemdar S, Kahraman T, Ağaoğlu S, Alişarlı M (2009) Bitlis ili içme sularının bazı mikrobiyolojik ve fizikokimyasal özellikleri. Ekoloji 19(73): 29-38

Al-Shammiri M, Al-Saffar A, Bohamad S, Ahmed M (2005) Waste water quality and reuse in irrigation in Kuwait using microfiltration technology in treatment. Desalination 185(1-3): 213-225

Angin I, Yaganoglu AV, Turan M (2005) Effects of long-term wastewater irrigation on soil properties. Journal of Sustainable Agriculture 26(3): 31-42

Bani R (2011) Wastewater Management In Waste Water-Evaluation and Management. InTech

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

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

Bockheim JG, Gennadiyev AN, Hartemink AE, Brevik EC (2014) Soil-forming factors and Soil Taxonomy. Geoderma 226: 231-237

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

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

Brune A, Urbach W, Dietz KJ (1994) Compartmentation and transport of zinc in barley primary leaves as basic mechanisms involved in zinc tolerance. Plant, Cell & Environment 17(2): 153-162

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

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

Chen S, Duckworth K, Chaiken S (1999) Motivated heuristic and systematic processing. Psychological Inquiry 10(1): 44-49

Clancy K (2009) Sodium affected soils. Enderby: Fusion Turf Nutrition. Turf Line News

Cui L, Wu J, Ju H (2015) Electrochemical sensing of heavy metal ions with inorganic, organic and bio-materials. Biosensors and Bioelectronics 63: 276-286

Del Campillo MC, Torrent J, Loeppert RH (1992) The reactivity of carbonates in selected soils of southern Spain. Geoderma 52(1-2): 149-160

Demiralay İ, Analizleri TF (1993) Atatürk Üniversitesi Ziraat fakültesi Yayınları No: 143

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

Essington ME, Mattigod SV (1991) Trace element solid-phase associations in sewage sludge and sludge-amended soil. Soil Science Society of America Journal 55(2): 350-356

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

Fasahat P (2015) Recent progress in understanding cadmium toxicity and tolerance in rice. Emirates Journal of Food and Agriculture 27(1): 94

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

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

Gatta G, Libutti A, Gagliardi A, Beneduce L, Brusetti L, Borruso L, Tarantino, E (2015) Treated agro-industrial wastewater irrigation of tomato crop: Effects on qualitative/quantitative characteristics of production and microbiological properties of the soil. Agricultural Water Management 149: 33-43

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

Gerić M, Gajski G, Oreščanin V, Domijan AM, Kollar R, Garaj-Vrhovac V (2017) Environmental risk assessment of wastewaters from printed circuit board production: A multibiomarker approach using human cells. Chemosphere 168: 1075-1081

Ghaedi M (2006) Pyrimidine-2-thiol as selective and sensitive ligand for preconcentration and determination of Pb2+. Chemia analityczna 51(4): 593-602

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

Hamid YS (2009) Dissolution kinetics of carbonates in soil. Szent Istvan University, Hungary

Hampp R., Beulich K, Ziegler, H (1976) Effects of zinc and cadmium on photosynthetic CO2-fixation and Hill activity of isolated spinach chloroplasts. Zeitschrift für Pflanzenphysiologie 77(4): 336-344

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

Harrison JM, Pliska SR (1981) Martingales and stochastic integrals in the theory of continuous trading. Stochastic processes and their applications 11(3): 215-260

Hofmann NR (2012) Nicotianamine in zinc and iron homeostasis

Huang SS, Liao QL, Hua M, Wu XM, Bi KS, Yan CY, Zhang XY (2007) Survey of heavy metal pollution and assessment of agricultural soil in Yangzhong district, Jiangsu Province, China. Chemosphere 67(11): 2148-2155

Irmak S, Kasap Y, Surucu A (2007) Effects of town waste on the heavy metal contents and plant nutrient element contents of soils in Harran Plain, Turkey. Fresenius Environmental Bulletin 16(3): 285-289

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

Iyaka YA (2011) Nickel in soils A review of its distribution and impacts. Scientific Research and Essays 6(33): 6774-6777

Ji Z, Chen Y (2010) Using sludge fermentation liquid to improve wastewater short-cut nitrification-denitrification and denitrifying phosphorus removal via nitrite. Environmental science & technology 44(23): 8957-8963

Kabata-Pendias A, Mukherjee AB (2007) Trace elements from soil to human. Springer Science & Business Media

Kacar DJ, Kacar CR (1990) US Patent No 4,943,105 Washington, DC: US Patent and Trademark Office

Khan S, Cao Q, Zheng YM, Huang YZ, Zhu YG (2008) Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China. Environmental pollution 152(3): 686-692

Koçak İ (2017) Şeyhler Yöresi Borat Yatağının Jeokimyasal Özellikleri, Emet, Türkiye

Korkanç M, Tuğrul A (2004) Evaluation of selected basalts from Niğde, Turkey, as source of concrete aggregate. Engineering Geology 75(3): 291-307

Kuzyakov Y, Friedel JK, Stahr K (2000) Review of mechanisms and quantification of priming effects. Soil Biology and Biochemistry 32(11): 1485-1498

Lin L, Li RH, Li Y, Xu J, Li XY (2017) Recovery of organic carbon and phosphorus from wastewater by Fe-enhanced primary sedimentation and sludge fermentation. Process Biochemistry 54: 135-139

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

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

Meng W, Wang Z, Hu B, Wang Z, Li H, Goodman RC (2016) Heavy metals in soil and plants after long-term sewage irrigation at Tianjin China: A case study assessment. Agricultural Water Management 171: 153-161

Mesdaghinia AR, Naddafi K, Nabizadeh R, Saeedi R, Zamanzadeh M (2009) Wastewater characteristics and appropriate method for wastewater management in the hospitals.Iranian Journal of Public Health 38(1): 34-40

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

Morselli L, Brusori B, Passarini F, Bernardi E, Francaviglia R, Gataleta L, Olivieri P (2004) Heavy metals monitoring at a Mediterranean natural ecosystem of Central Italy. Trends in different environmental matrixes Environment International 30(2): 173-181

Munter R (2003) Industrial wastewater characteristics. The Baltic University Programme (BUP), Sweden

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

Ndiokwere CL (1984) A study of heavy metal pollution from motor vehicle emissions and its effect on roadside soil, vegetation and crops in Nigeria. Environmental Pollution Series B, Chemical and Physical 7(1): 35-42

Nduka JK, Orisakwe OE (2010) Assessment of environmental distribution of lead in some municipalities of South-Eastern Nigeria. International journal of environmental research and public health 7(6): 2501-2513

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

Okx JP, Stein A (2000) An expert support model for in situ soil remediation. Water, Air, & Soil Pollution 118(3): 357-376

Olsen PE (1977) A new aquatic eosuchian from the Newark supergroup (Late Triassic-Early Jurassic) of North Carolina and Virginia

Olsen SR (1954) Estimation of available phosphorus in soils by extraction with sodium bicarbonate. United States Department Of Agriculture; Washington

Oosterhuis FH, Brouwer FM, Wijnants HJ (2000) A possible EU wide charge on cadmium in phosphate fertilisers: Economic and environmental implications

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

Pitts MJ, Hummel JW, Butler BJ (1986) Sensors utilizing light reflection to measure soil organic matter. Transactions of the ASAE 29(2): 422-0428

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

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

Raghothama KG (2005) Phosphorus and plant nutrition: an overview Phosphorus: agriculture and the environment, (phosphorusagric) p: 355-378

Ramsundar P, Guldhe A, Singh P, Bux F (2017) Assessment of municipal wastewaters at various stages of treatment process as potential growth media for Chlorella sorokiniana under different modes of cultivation. Bioresource technology 227: 82-92

Richards LA (1954) Diagnosis and improvement of saline and alkali soils Washington: United States Department of Agriculture. Agriculture handbook p: 60

Sa'idi M (2010) Experimental studies on effect of Heavy Metals presence in Industrial Wastewater on Biological Treatment. International journal of environmental sciences 1(4): 666

Salavati-Niasari M, Davar F, Mir N (2008) Synthesis and characterization of metallic copper nanoparticles via thermal decomposition. Polyhedron 27(17): 3514-3518

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

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

Sheet F (2004) The Disinfection Question–Answers for Onsite Systems

Sheng GP, Yu HQ, Li XY (2010) Extracellular polymeric substances (EPS) of microbial aggregates in biological wastewater treatment systems: a review. Biotechnology advances 28(6): 882-894

Skidmore JF (1964) Toxicity of zinc compounds to aquatic animals, with special reference to fish. The quarterly review of Biology 39(3): 227-248

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

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

Soylak M, Elci L, Dogan M (2000) Lead concentrations of dust samples from Nigde City-Turkey. Fresenius Environmental Bulletin 9(1-2): 036-039

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

Sparks DL (2003) Environmental soil chemistry. Academic press

Sparks DL, Huang PM (1985) Physical chemistry of soil potassium. Potassium in agriculture, (potassiuminagri) p: 201-276

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

Spear FS (1981) An experimental study of hornblende stability and compositional variability in amphibolite. American Journal of Science 281(6): 697-734

Taghinia Hejabi A, Basavarajappa HT, Qaid Saeed AM (2010) Heavy metal pollution in Kabini River sediments. International Journal of Environmental Research 4(4): 629-636

Tanyolaç J (2000) Limnoloji (3 Baskı) Hatipoğlu Yayınevi, Ankara, 237s

Tanyolaç J (2004) Limnoloji: tatlısu bilimi Hatiboğlu Yayınevi

Tüzüner A (1990) Toprak ve su analiz laboratuvarları el kitabı. Tarım Orman ve Köy İşleri Bakanlığı, Köy Hizmetleri Genel Müdürlüğü, Ankara

Varol S, Davraz A, Varol E (2008) Yeraltı suyu Kimyası ve Sağlığa Etkisinin Tıbbi Jeoloji Açısından Değerlendirilmesi. TAF Preventive Medicine Bulletin 7(4): 351-356

Victoria EPA (2003) State environment protection policy (Waters of Victoria) Victorian Government Gazette S 107: 1-52

Wauchope RD, Buttlez TM, Hornsby AG, Augustijn-Beckers PWM, Burt JP (1992) The SCS/ARS/CES pesticide properties database for environmental decision-making. In Reviews of environmental contamination and toxicology, Springer New York pp. 1-155

West DX (1993) Struct. Bonding, 76, 1 (1991); DX West, AE Liberta, SB Padhye, RC Chikate, PB Sonawane, AS Kumbhar and RG Yerande. Coord. Chem. Rev 123: 49

Windham GC, Zhang L, Gunier R, Croen LA, Grether JK (2006) Autism spectrum disorders in relation to distribution of hazardous air pollutants in the San Francisco Bay area. Environmental health perspectives 114(9): 1438

Wuana RA, Okieimen FE (2011) Heavy metals in contaminated soils: a review of sources, chemistry, risks and best available strategies for remediation. Isrn Ecology

Zanin E, Scapinello J, de Oliveira M, Rambo CL, Franscescon F, Freitas L, Dal Magro J (2017) Adsorption of heavy metals from wastewater graphic industry using clinoptilolite zeolite as adsorbent. Process Safety and Environmental Protection, 105: 194-200

Zhang MK, Liu ZY, Wang H (2010) Use of single extraction methods to predict bioavailability of heavy metals in polluted soils to rice. Communications in Soil Science and Plant Analysis 41(7): 820-831

CURRICULUM VITAE

Date of birth: 1988-12-19
Place of birth: Erbil, Iraq.
Nationality: Iraqi
Phone number: (+964) 7507094143
E-mail: parez.agha@gmail.com

Education

B.Sc. in Environmental Sciences Department, University of Salahaddin, Erbil, Iraq, 2012.

Certificates

English Language certificate-from Hiwa center /American center.
English Language proficiency certificate-from British Council/Salahaddin University-Erbil.
Teaching Method certificate- from Balla. Associating Academy for Education & Training.

Research Skill

2012: Determination of fluoride concentration in bottled drinking water brands in Erbil City, Iraqi Kurdistan.

Work Experience

I have worked one year at High Food Pack Company as accountant/ sales management.
I was working as a Science Teacher at Balla. Associating Academy about two years.
I have a good background about Field work.

Research interests

Water pollution & management.
Water and solid wastes water analysis.
Biological and chemical analysis.

Computer skill

Windows
Word
Excel
PowerPoint

Languages

Kurdish: Mother language
English: Very good
Turkish: İntermediate
Arabic: Very good

Master study

I have started post graduate study in September 2015 at Bingol University/ Turkey and awarded the master’s degree from Environmental Pollution (Wastewater and Soil) at Soil and Plant Nutrition Department in December 2017.