How to Cite:
Mutlag, N. H., & Hatimi, I. A. R. A. (2022). Evaluation of some of chemical and physical properties and some nutrients in the soils and water of Bahr al-Najaf Depression-Iraq. *International Journal of Health Sciences*, *6*(S4), 5533–5547.
https://doi.org/10.53730/ijhs.v6nS4.9387

Evaluation of some of chemical and physical properties and some nutrients in the soils and water of Bahr al-Najaf Depression-Iraq

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***Abstract*---**This study was conducted in the laboratories of the Department of Environmental Sciences - College of Science - University of Kufa, with the aim of measuring the chemical and physical properties of soil and water in the Bahr Al-Najaf depression. Samples were collected in October 2021 from three different sites with three replicates for each site. The results showed that the water in all sites were alkaline, with the highest value for site 2 of third replicate which pH reach 10.5, while the lowest value was for site 1 ,pH was 9.6.The electrical conductivity was the highest in the first and third site that reach 9.76 ms/cm,while the lower in site 2 which was 8.68 ms/cm. .The temperature was within the average (28_25) Celsius. The results also showed an increasing in salinity in sites 1 and 3 by 7.3 mg / l, and decreasing in the concentration of salts that was observed at site 2 of 5.5 mg / l. This study found a decrease in the nutrient concentrations in the water samples of Bahr Al-Najaf, where the highest concentration of NO_3 was 0.86 US/l, and the highest concentration of PO_4 was 0.248 mg/l. It was noted that SO_4 concentrations increased in all sites, where the highest concentration was in the first site.The highest concentration of COD was in site 2 with 234 mg/l, while the highest concentration of DOM was in site 3. The results showed the pH values of soil samples in all sites within the normal limits (7-7.4), while the conductivity and TDS were very high, its value was higher in site 3 that was 45 ds.m-1, and TDS was 20000ppm .Also the organic matter in the soil , the highest value was in Site 2 and the lowest in Site1. The texture also showed a discrepancy in the types of tissues as a result of the nature of the sedimentary condition in the soil of the study area.

***Keywords*---**chemical, physical properties, nutrients, soils, water.

Introduction

The Bahr al-Najaf depression is located in the west and southwest of the Holy Al-Najaf Governorate in Iraq. It is a water body, with a length and width of about (75-45) km, and an area of about 435 km. It is surrounded by desert and some groves of land, and the waters are seasonally stagnant according to rainfall levels (Mizhir et al., 2020).

Soil is the surface layer of the earth's crust that contains the roots of plants that grow in them, and also contains animals and other living organisms such as bacteria and fungi. Soil is the basis of ecosystems on the earth's surface and is the natural medium for plant growth. Soil, besides being a source of water, nutrients for plants and mechanical support, is also a refuge for a wide number of organisms in ecosystems on Earth (Al Mansouri, 2018).

The study of the physical properties of soils gives an understanding of soil mechanisms, by which the water-conducting properties are estimated and their ability to provide nutrients stored in their organic and mineral molecule is evaluated. The chemical properties of soil vary according to the different controlled substances such as the substance of origin, climate, terrain, and time. The importance of studying soil chemistry in order to determine the number of nutrients, the chemical images that they take, and the factors that affect this quantity (Awwad,1987). Water is the basis of life, and it has unique, interesting, and diverse properties. Where the nature and behavior of water necessitate knowing certain basic facts about its chemical and natural properties. Many of these characteristics play a major role in determining the quality of water, either through a natural phenomenon or as a result of activities resulting from man (Naseem,2007). Freshwater constitutes about 5.2% of the total water on the globe in the form of rivers, lakes, ice, and groundwater, and groundwater constitutes about 13%. of which, more than 50% of the world's population depends on groundwater for drinking (Mohammed; elt,2004). Water has many physical properties that make it of great value, whether in life, agriculture, industry, and other fields, and among its most important properties (pH, temperature, total dissolved salts)

Materials And Methods

Description of Study area

The study area was conducted in the Bahr al-Najaf depression, which is located in the west and southwest of Najaf governorate. It contains a water body where three sites from the Najaf sea were allocated for the purpose of the study. The geographical coordinates of the studied sites were taken using a GPS device (Fig. 1) as follows: The first site Second site, third site. Three replicates were taken for each site and three samples were taken for each replicate.

Fig 1. Sampling sites of the Bahr al-Najaf depression

The physical and chemical properties of the soil

The chemical properties of the soil

1- pH: An indication of the acidity and basicity of the soil, and it is known as the negative logarithm of the concentration of active hydrogen ions in the solution. Soils with values greater than 7 are considered alkaline soils, while soils with values less than 7 are considered acidic, while soils with values 7 are considered neutral, (Al-Khatib 2004). Soils with of pH less than 6 are more prone to nutrient deficiencies. There is a shortage of potassium and magnesium in acidic ground, and in highly acidic and very acidic ground, aluminum and manganese may be present in toxic quantities due to the dissolution of the compounds of these elements. It reacts with phosphates to form insoluble phosphates. In alkaline soils, pH is greater than 7, iron, manganese, copper and zinc become unsuitable for uptake by the plant (Naseem 2003).
2- EC Electrical conductivity: The electrical conductivity (EC) of a soil solution can be used to classify the amount of soluble salts present, or the soil solution can be examined for its elemental content. As the quantity of soluble salts rises, the first technique becomes more common, with the normal result being reduced plant growth due to reverse osmosis. As a result, soluble salt determination is critical in agriculture, particularly in plant nutrition and plant sciences in general. It is also difficult to manage soils affected by high levels of dissolved salt, especially when Na+ is the dominant cation that contributes to the high level of salt, which is also called alkalization (Shaw; 1999, Richards,1969). Temperature causes an increase in EC (specific carrier). At 25°C, the conductivity is best determined. However, using proper temperature factors, EC can be measured at other known temperatures and corrected to a reference temperature of 25 °C (usually based on the conductivity of NaCl).
3- Organic matter (OM): It expresses the extent of the biological activity that refers to the existence of living things, whether they are plants or animals, whether they are water or living, and it is one of the important characteristics of the lands and has a major role in the processes of land formation. The correlation between them was strong and intrinsic, as the

earth's content of organic matter increases with the increase in humidity or the rate of rainfall, assuming the stability of temperature and the rest of the other factors. (Goekel 2000).

The physical properties of the soil

Soil Texture

It is the relative volume distribution of soil particles that have an equivalent diameter of less than 2 mm, and their diameter is determined by the size of the soil particles. It is one of its most important morphological properties; It is easy to notice and identify in the field. Soil particles consist of a mixture of Sand, Silt, and Clay. The texture of the soil is determined by many of its other physical properties such as the rate of water infiltration in the soil, the extent of its retention, and the amount of soil aeration and cohesion. (Zamili, 2014)

The physical and chemical properties of water

The physical properties of the water

Water Temperature (WT) C °The water temperature was measured directly by the thermometer 0-100C;

The chemical properties of water

Hydrogen Ion Concentration (pH)

Hydrogen ion concentration is a vital environmental characteristic that determines the survival of aquatic organisms, metabolism, and physiology, and growth of aquatic organisms (Lokhande et al., 2011).It affected bottom sediments and biological activities. It may result in high pH for the high rate of the process of photosynthesis by phytoplankton flowering dense. PH is higher than 7 but less than 8.5 according to Abowei's (2010) is ideal for biological productivity, but the pH is less than 4 affects aquatic life. total acidity may be affected, the surface of the surrounding rocks and runoff, and drainage. have water acidity values (8.5-6) between what is natural 8, which is the same amount as what was determined by the World Food Organization (FAO) about the pH of natural water (Table1)

Property	The maximum allowed
pH No.	8.5-6.5

Table (1) WHO drinking standards FAO

From the researcher's work, based on Abdel Karim Mahmoud Abdel Qader Al-Samry, assessing the quality of groundwater and its suitability for irrigation purposes for some wells in the two regions of (Al-Wasita, 2014)

Electrical Conductivity (EC) µS/cm

Electrical conductivity is a measure of a substance's ability to deliver an electric current. It varies from one body of water to another because it essentially depends

on molecules ionized to connect the power supply. So it can be described as a measure of the conductivity of the concentration of dissolved substances in the body of water ionizing *(Akoto et al.,* 2008). Conductivity is measured in units (µScm-1/µS/cm) and in aquatic ecosystems.The salt and minerals that came salinity in aqueous medium are therefore divided into cations and anions that are available in water such Mg^{+2}, Ca^{+2}, Na^{+1} ,K^{+1}, and bio carbonate such as HCO_3^-, SO^{-2},Cl^- Mostly affected by the work of metal ions such as the disintegration of ions, temperature, and ionic mobility. Most of the freshwater systems with low conductivity but contaminated water bodies may have a very high conductivity due to the presence of pollutants (CWT, 2004). Pollutants contribute in this way dramatically through the introduction of more ionic species dissolved solids. And can therefore assess the level of contamination by using the conductivity. According to Table (2) we can know the variety of Water according to the percentage of electrical conductivity according to the classification (TOOD).

Electron conductivity	micromose/cm Water type
100-250	saline
250-750	medium salinity
750-2250	high salinity
2250-5000	very high salinity

(Table 2) Classify water according to the percentage of electrical conductivity According to the rating (TOOD**).**

Total Dissolved Solid (TDS) :

TDS can be defined as the sum of organic and inorganic substances present in water TDS, and also known as the sum of cations and anions found in water. They are represented by ionic compounds, including soluble solids such as carbonates, bicarbonates, chlorides, fluorides, Ca, Mg, Na, K, etc., measured in units (mg/l) *(EPA, 2000).* we can classify water on the basis of the percentage of dissolved salts into several types according to (Klementov) (table 3).

Water class	ppm
Super fresh	200
Fresh	200-1000
Slightly	1000-2000
Brackish	2000-3000
Strongly Brackish	3000-10000
Saline	10000-35000
Brine	More than 35000

Table (3) Classification of water according to its TDS content at Klimentove ., 1983.

Nutrient

Sulfate ions So_4

The main source of sulfate in water is solutions of sulfate minerals present in sedimentary rocks such as gypsum and anhydrite as well as from the oxidation of

barite minerals *(Jowaihel, a previous source).* As it is assumed that the sulfate concentration does not exceed (250) mg / liter because the taste of water is changed to bitter water *(Bouwer, 1978).*

Nitrate ions NO_3

Nitrogen gas constitutes 78% of the air volume and enters the All animal and plant tissues, and many plants, such as legumes, can convert it into nitrate (NO_3). Most of the nitrogen is released when they die in the form of ammonia gas through the activity of bacteria. Bacteria through the oxidation of nitrogen and ammonia to nitrite and then converted by the oxidation process again to nitrate and this process is called nitration. *(Jowaihel, a previous source).*

Results and Discussion

Water samples were examined for three replicates and for three locations and measurement was taken of the physicochemical properties of water (pH, EC, TDS, salinity, nutrient, T.P, T.N, COD, temperature, dissolved organic matter) where the values were found as follows:

Water physicochemical properties:

pH

The pH values of the three sites of Bahr al-Najaf depression were observed to increase in the second site and the third site of the third repeater and gradually decrease in the second site and the first site, where the lowest value was recorded in the second site of the second repeater .(Fig. 1)

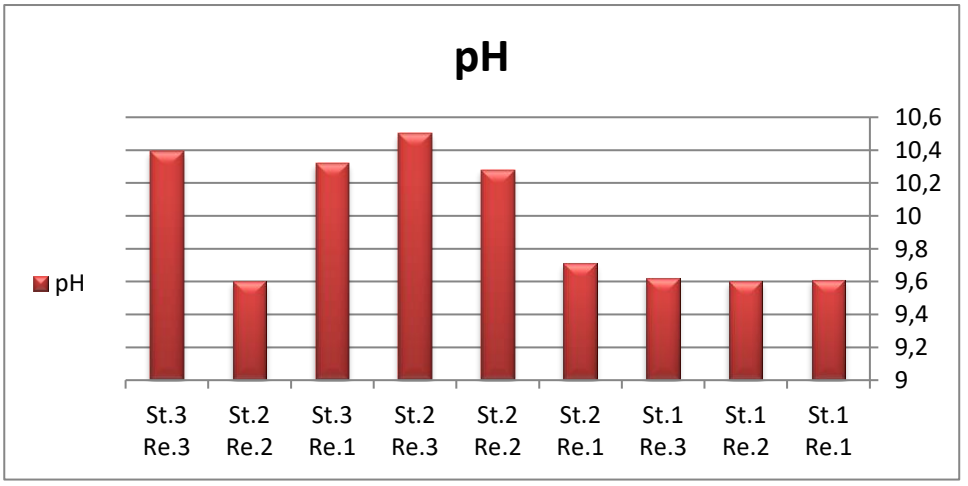

Fig. (1) pH values in the three locations.

Electrical Conductivity EC

The electrical conductivity values of the three sites of the Bahr al-Najaf depression were observed to increase in the first site and the second site of the three

repeaters, where the highest value was recorded in the first site of the first and second repeater (68.8), and it decreased by a large difference in the second site, where the lowest value was recorded in the second site of the second repeater (9.76) ,Fig. (2)

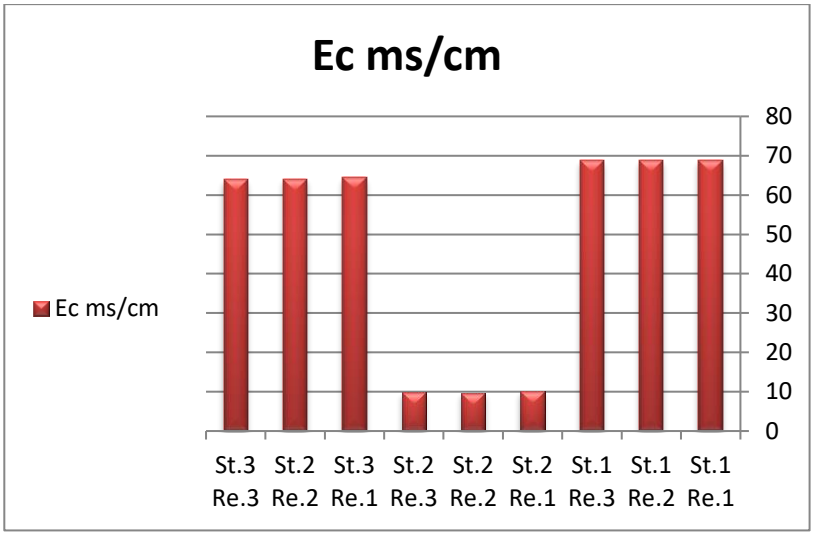

Fig. (2) EC values in the three locations.

Water Temperature W.T

It was noticed that the water temperature values for the three sites of the Bahr al-Najaf depression increased in the second site of the three replicates, where the highest value was recorded (28), and decreased in the first and third site, where the lowest value was recorded in the first and second replicate site (25.8) Fig. (3)

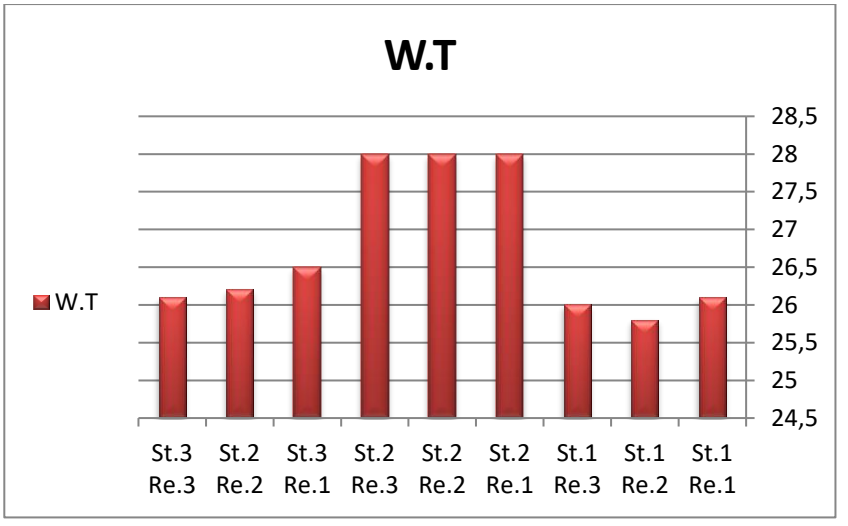

Fig. (3) Water temperature values in the three locations.

Salinity

It was noticed that the water salinity values for the three sites of the Bahr al-Najaf depression increased in the first site at high rates and then decreased dramatically in the second site to rise in the third site of the three replicates, where the highest value was recorded (47.3) in the first site, and the lowest value (5.5). In the second position, Figure (4).

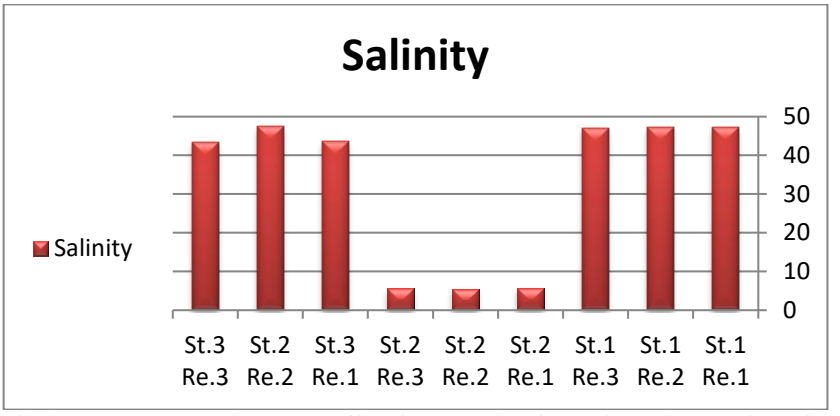

Fig. (4) salinity concentrations (mg/l) of water in three locations of Bahr al-Najaf

TDS

It was observed that the values of total dissolved salts were constant for all three locations of the depression with a value of ($0.88 * 10^3$).

nitrate NO_3

The percentage of nitrate was measured in the three sites of the depression and its presence was observed in a high percentage in the site while it decreases in the second site and then increases in the third site and its percentage was as shown in Figure (5).

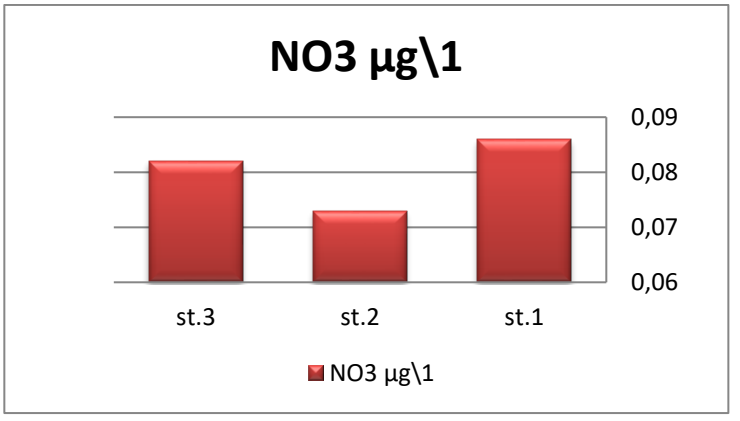

Fig. (5) NO_3 concentrations (mg/l) of three locations in the Bahr al-Najaf.

phosphatePO_4

The percentage of phosphate was measured in the three sites of the depression, and its presence was observed in a small percentage in the first site, while it was high in the second site and the third site, and its percentage was as shown in Figure (6).

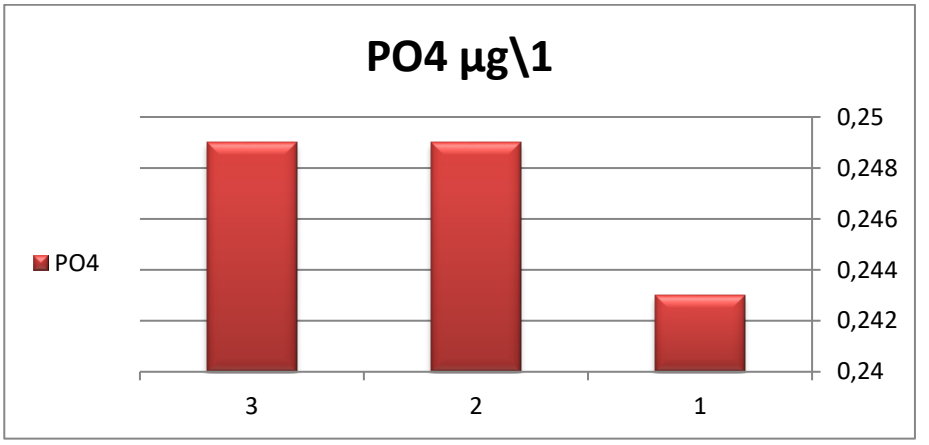

Fig. (6) PO_4 concentrations (mg/l) of three locations in the Bahr al-Najaf.

SO_4

The percentage of sulfate was measured in the three sites of the depression, and it was observed that it was high in the first and third sites, while it was low in the second site, and its percentage was as shown in Figure (7).

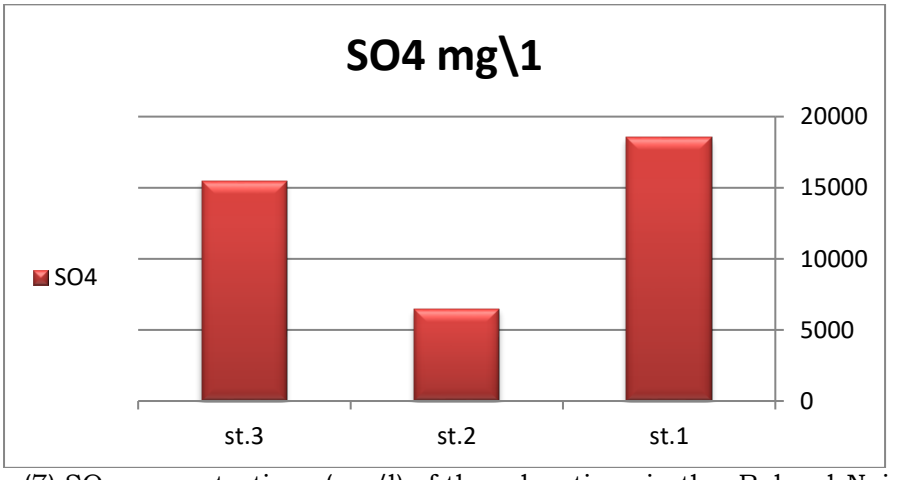

Fig. (7) SO_4 concentrations (mg/l) of three locations in the Bahr al-Najaf.

Total Nitrogen

The percentage of total nitrogen was measured in the three sites of the depression, and its presence was observed in a small percentage in the first and

second sites, while its percentage was high in the third site, as shown in Figure (8).

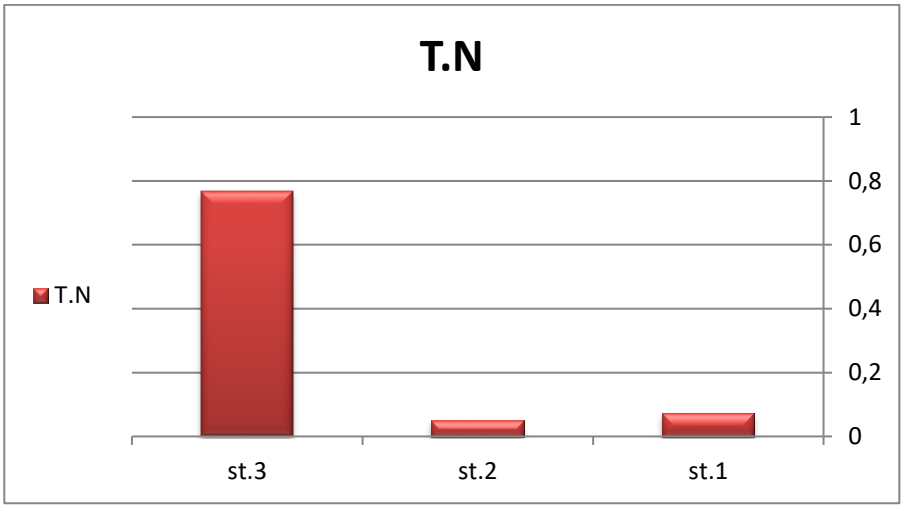

Fig. (8) T.N concentrations (mg/l) of three locations in the Bahr al-Najaf.

Total Phosphorous

The percentage of total phosphorous was measured in the three sites of the depression, and its presence was observed in close proportions in each of the first and third sites, while its percentage was lower in the second site, as shown in Figure (9).

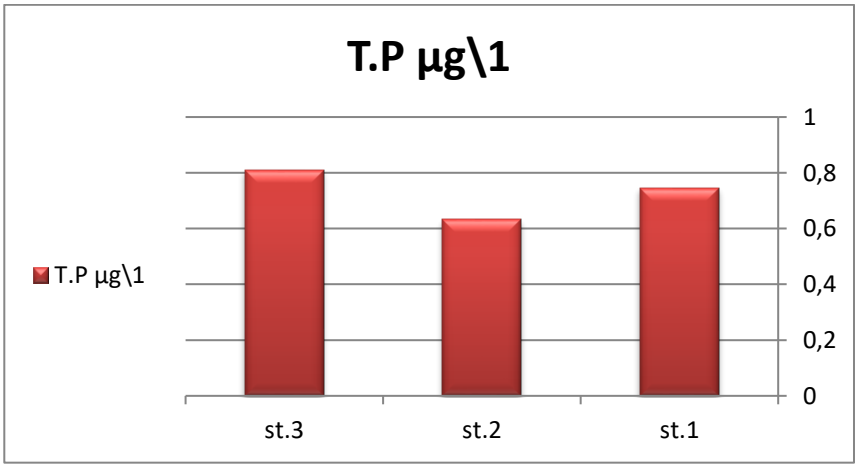

Fig. (9) T.P concentrations (µg/l) of three locations in the Bahr al-Najaf.

Dissolved Organic Carbon DOC:

When measuring the percentage of dissolved organic carbon in the three sites of the depression, it was observed that it was found in low proportions in each of the

first and third sites, while its percentage was high in the second site, as shown in Fig. (10).

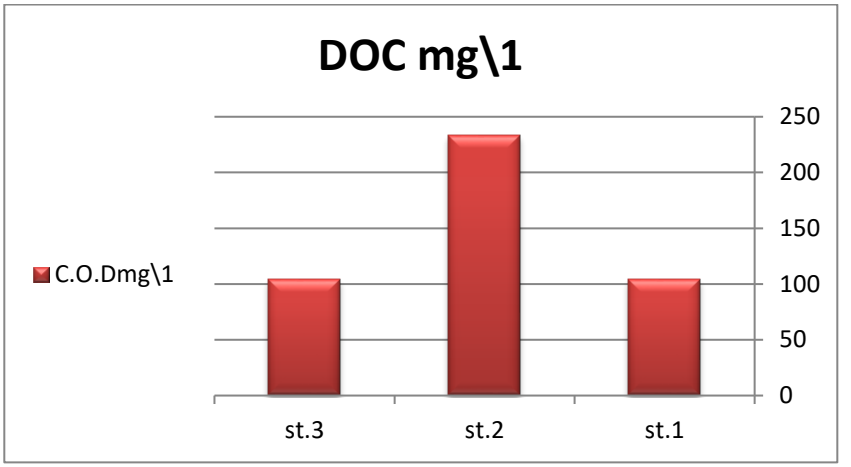

Fig. (10) DOC concentrations (mg/l) of three locations in the Bahr al-Najaf.

Dissolved Organic Matter DOM

When measuring the percentage of dissolved organic matter in the three depression sites, a low percentage was found in the second site, while its percentage was high in the first and third sites as shown in Fig. (11).

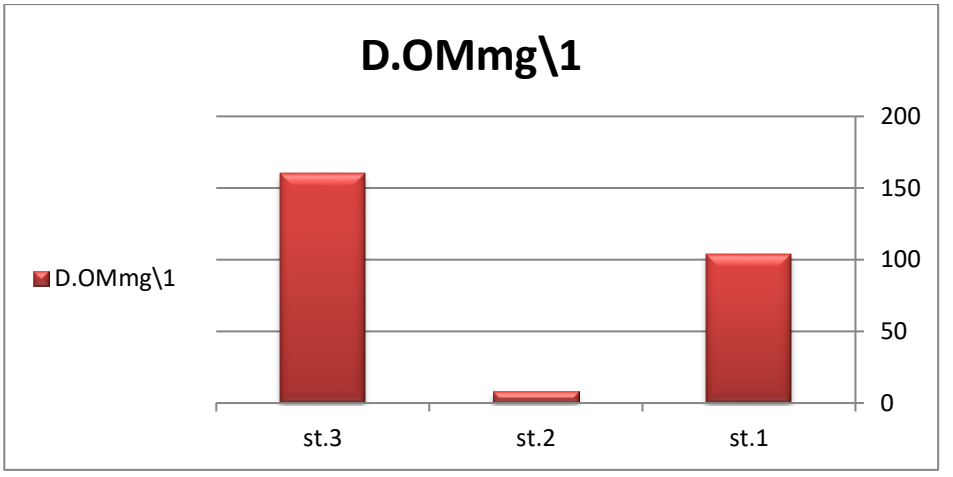

Fig. (11) DOM concentrations (mg/l) of three locations in the Bahr al-Najaf.

Soil physicochemical properties:

The physicochemical properties of Bahr al-Najaf depression were measured and were as follows:

pH

The pH value of the Bahr al-Najaf depression was measured for the three sites and its three replicates, and its values were increasing in the first site and decreasing in each of the second and third sites, as follows: Fig. (12)

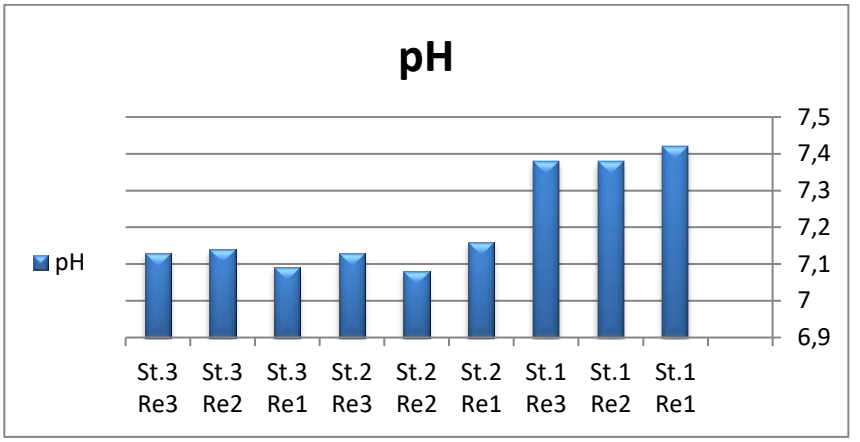

Fig. (12) Values of pH values of three locations in soil of the Bahr al-Najaf

electrical conductivity EC

The electrical conductivity of Bahr al-Najaf depression soil was measured for the three sites and for its three replicates, and their values varied in small percentages in the three sites as follows: Fig. (13)

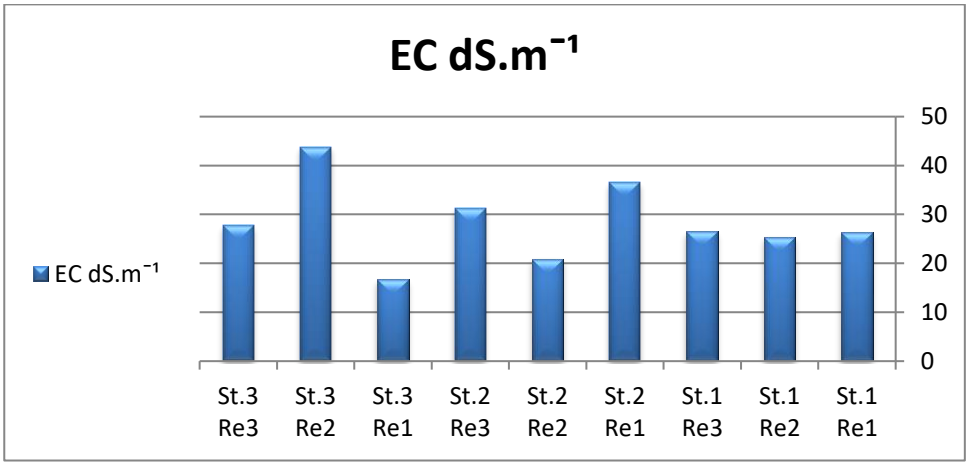

Fig. (13) Values of EC values of three locations in soil of the Bahr al-Najaf.

Total Dissolved Solids T.D.S

The total Dissolved solids values were measured for the study sites, where the values appeared in the first site close to each other, while increasing in the third and second repeated site**,**(fig.14)**:**

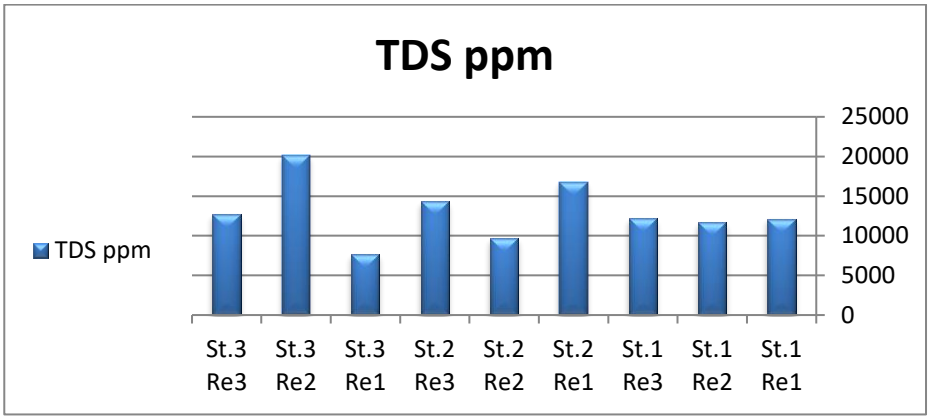

Fig. (14) Values of TDS values of three locations in soil of the Bahr al-Najaf.

Soil O.M

The percentage of soil organic matter was measured in the three depression sites, and it was found to be low in the first site, while it was high in the second and third sites, as shown in Figure (15).

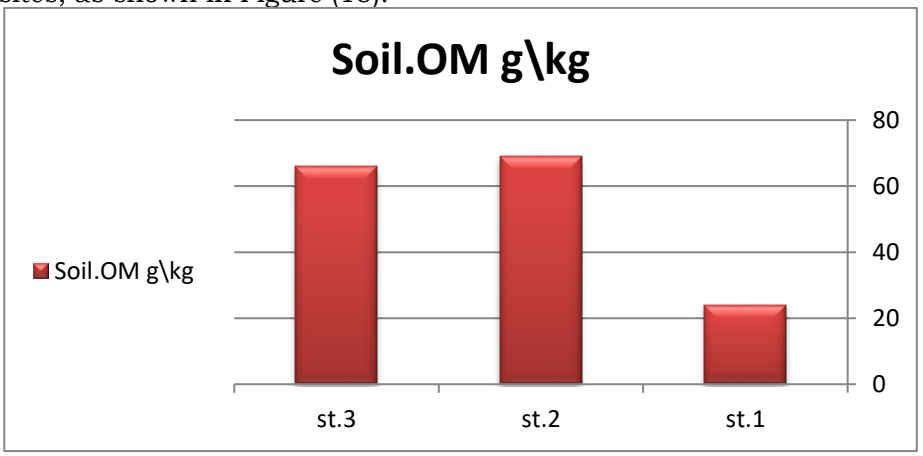

Fig. (15) Soil.OM values in the three locations.

soil texture

The results of the analysis of soil particles and the morphological description of the soil texture show that there is a variance in the tissue types as a result of the nature of the sedimentary condition in the soil of the study area. The soil of the study area is characterized as having a sandy mixture texture according to the texture triangle as in the fig.(16). The sand separations in the three sites reached (672,592,692,352,552,372,552,572,572), where the highest percentage was in the first site and the lowest in the second site.

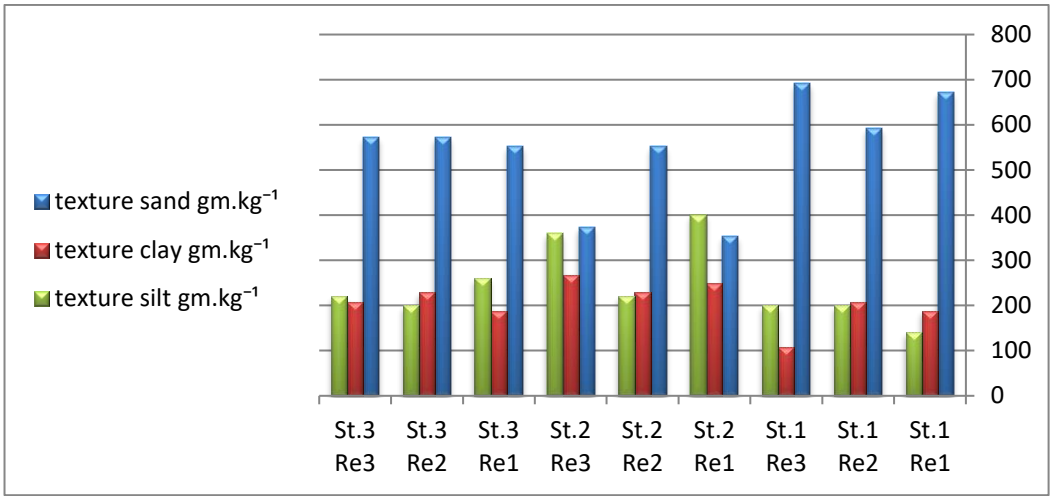

Fig. (16) soil texture values of three locations in soil of the Bahr al-Najaf.

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