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Evaluation of phosphorus concentration in soil by using spectrophotometer (UV)

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ABSTRACT

This study was carried out in the Sirte region, which is located 450 km east of the Libyan capital, Tripoli. During this study, 15 different agricultural soil samples were taken at a depth ranging between (0-20 cm) from 15 sites in Sirte region were evaluated in order to evaluate some natural and chemical parameters such as mechanical analysis and acidity, as well as images and phosphorous concentration in soil (available phosphorous). In this study, a single-beam UV spectrophotometer was used to estimate the absorbance of phosphorous. Through the analysis processes that were reached and estimation of some concentrations of phosphorus, it was found that several samples contain a high percentage of phosphorous, and several of them contain a low percentage, and the majority of samples range from medium to the last, which are considered suitable for global standards.

Introduction

It is known that many types of soil lose many of their nutrients, whether through displacement by cultivated crops or as a result of washing and erosion processes, and often the process of loss occurs immediately than the compensation process through the decomposition of mineral rocks and organic matter in the soil, which leads to a disturbance in the equilibrium state. This is a breach that makes the need for continuous addition of mineral and organic fertilizers in order to maintain the level of soil fertility **(Al-Falahi, Mahmoud Howaidi, 1988)**

Phosphorous is similar to nitrogen and potassium in its importance for the plant, despite its presence in plant tissues in smaller quantities, as the plant absorbs this element to meet its needs for various vital processes such as photosynthesis, formation of intentions, cell division, seed formation, regulation of cellular processes and transfer of genetic traits. An essential role in the formation of energy compounds**(Abdali Rana Saadallah Aziz. 2005).**

Lands vary in their total phosphorous content, affected by many factors, the most important of which are the material of origin - agricultural exploitation - climate and others. In general, the soil content of total phosphorous is in the range between (0.15-0.02) and this quantity is related to the presence of organic matter, where organic phosphorus represents 20-80% of the total phosphorous **(Al-Ani, Abdullah Najm. 1980)**

The total phosphorous in the soil is not necessarily a good measure of the amount of phosphorus ready for the growth of plants, because a large part of the phosphorus may be found in a way that is difficult to benefit from, as the plants obtain phosphorus from the soil solution mainly in the form of dihydrogen orthophosphate ions (42 H_2 PO^-). Secondly, in the form of mono-hydrogen orthophosphate (HPO_4^{2-}), as for the greater part, it is subject to sedimentation and stabilization reactions (adsorption), where phosphorous turns from the ready form to the unready one, and this leads to the lack of full utilization of phosphorous due to its loss and loss **(Al-Qardaghi, Nikar Ali Aziz. 2006)**

Phosphorus: -

It is a non-metallic chemical element with the chemical symbol P. It is located in the fifteenth group of the periodic table. It has an atomic number of 15 and an atomic weight of 30.974. Phosphorous was discovered in 1669 by German chemist Heng Brand during his experiments to prepare gold from silver. Phosphorous is found in three allotropic forms: normal or white phosphorous, red phosphorous and black phosphorous. Of these allotropes, only white phosphorous and red phosphorus are of economic importance **(Al-Jasmi, Abdullah Shaneen (2014).**

Figure1: structure of phosphorus(Tisdale,S.L.,W.L.Nelson and J.D. Beaton(1985)

White phosphorous turns yellow when exposed to sunlight. It is a crystalline solid and waxy in texture and glows weakly in the presence of moist air. It is also a very toxic substance. And white phosphorous ignites spontaneously in the air at a temperature of 34 degrees, so it must be kept under water. It is insoluble in water, but poorly soluble in organic solvents and highly soluble in carbon disulfide. The melting point of white phosphorous is 44.2 degrees and its boiling point is 280.5 degrees. White phosphorous is prepared on a commercial scale by heating calcium phosphate with sand (silicon dioxide) and coke in an electric furnace**(Al-Obaidi, Karim Saeed Aziz (1986)**

$$4Ca_5(PO4)_3F + 18SiO_2 + 30C \rightarrow 3P_4 + 30CO + 18CaSiO_3 + 2CaF_2$$

Figure 2 : solid state of phosphorus(Bell, L. C. and C. A. Black.1970)

And when heated to temperatures ranging between 230-300 degrees in the absence of air, it turns into red phosphorous. Red phosphorous is a fine, non-toxic crystalline powder that sublimates (transformation directly from the solid state to the gaseous state without passing through the liquid state) at a temperature of 416 degrees and its density is 2.34 g/cm^3. As for black phosphorous, it is formed as a result of heating white phosphorous at a temperature of 200 degrees in the presence of high pressure, and its density is 2.69 g/cm^3**(Al-Ani, Abdullah Najm. 1980)**

Phosphorous is widely distributed on the earth and is ranked eleventh in terms of its presence in the earth's crust, but it does not exist in its free state. It is found in the form of phosphate compounds, as is the case in phosphate rock and apatite. It is also found in its united states in all fertilized soils and in natural water. Phosphorous is an important element for plants and animals, as it is the component of animal bones in the form of calcium phosphate.

Most phosphorous compounds are trivalent or pentavalent. Phosphorous combines easily with oxygen to form oxides, the most important of which are phosphorous oxide (III) and phosphorous oxide (V). Phosphorous oxide (III) is a white solid compound and a soft ester. It can be dissolved through the moisture in the air and its vapors are toxic, and it is used as a reducing agent.

As for phosphorous oxide (V), it is a solid, amorphous compound that sublimates at a temperature of 250 degrees and it reacts with water to form phosphoric acid and is used as a drying agent **(Al-Jasmi, Abdullah Shaneen (2014).**

Phosphorous also forms hydrides with hydrogen, and one of the most important of these is phosphine hydrides (PH). All halogens combine directly with phosphorous to form halides, which are used to prepare halogenated acids and organic compounds. The most important phosphorous compounds are phosphoric acid and phosphoric acid salts, which are usually used as agricultural fertilizers. Phosphorous compounds are also used in the purification of sugar solutions and the manufacture of fire-resistant materials and alloys such as phosphorous bronze and others. White phosphorous is used in the manufacture of rat poisons and red phosphorous in the manufacture of matches **(Al-Rawi, and Abdel Aziz (1980).**

Phosphorous in the soil:

Soil phosphorous exists in three forms:

1- Inorganic phosphorous compounds

2- Organic phosphorous compounds.

3- Phosphorous dissolved in the soil solution. It is found in various minerals in the soil that contain phosphorous. Most of the inorganic phosphorous compounds, whether in the soil or the original substance in general, are characterized by their low solubility in water. Phosphorous interacts with other components in the soil to a high degree, such as calcium, magnesium, iron and aluminum, forming some compounds such as dovrenite $Fe_2(OH)_3PO_4$, vivianite $Fe_3(PO_4)_2$ 8H2O. It is found in highly weathered lands, fluroapatite is the least available and soluble compound among calcium compounds. She has been for a long time**(Cresser, M.S. and J.W. Parsons(1979).**

As for aluminum and iron phosphates, they are a group of complex minerals with different compositions. These compounds predominate in acidic soils, where they are more volatile. All these compounds are characterized by low solubility and represent forms of the element phosphorous that are not available to plants. These conditions were identified for their formation in Section 4.33. Organic phosphorous forms are considered in Soils are more different than inorganic forms among themselves, and most phosphorous compounds are found in the plant as well as in the soil for the least variable period of time. The components of these compounds are subject to change when mineralized. The available data on organic phosphorous compounds in the soil indicate their presence in three main groups**(Al-Jasmi, Abdullah Shaneen (2014) :**

A - nucleic acids

B - Phytin (PHYTIN). Its derivatives are calcium and magnesium salts and phosphoric acid (inositol Hexaphosphosphoric**).**

C - phospholipids (phospholipids) The last group is more vulnerable to decomposition and therefore the first two groups represent most of the organic phosphorous. The phosphorous concentration in the soil solution is characterized by being very low when the field capacity of the soil ranges between 0.01 - 0.06 ppm and on this basis it can be calculated how many times its concentration must be renewed to provide the right amount of this element for the plant**(Al-Obaidi, Karim Saeed Aziz (1986)**

Among the factors that affect the availability of phosphorus from the inorganic and organic form and its availability in the soil solution is the pH (pH), the temperature and the surface area of the primary inorganic phosphorous minerals exposed to erosion, the amount of organic matter in the soil, and the moisture content of the soil. The reaction of phosphorous in the soil is completely different from that of nitrogen, which is eventually converted into flocculants under aerobic conditions in the soil. It is not free to move due to its interaction with the phases of other soil components. component is phosphorous compounds with little solubility. Phosphorous can be lost from the soil surface through erosion. As for leaching, it does not represent a problem for this element. Most studies indicate that the movement of phosphorous in the soil is less than 2 cm from the point of addition, in soft and medium-textured lands, Hargert and Reuss, who studied the movement of phosphorous in coarse (sand) lands in the state of Colorado under central circular irrigation, found that the movement of phosphorous reached a depth of 18 cm when adding poly-ammonium phosphate.with irrigation water**(Ajil, Salma Zayer (1999)**

Phosphorus cycle in soil

Phosphate-mineral compounds were organically transformed constantly and could not remain in their new form for long if they were quickly undergoing reactions in the soil as a result of environmental and climatic factors, and thus suffered a series of transformations in the form of balanced equations as in the following figure:

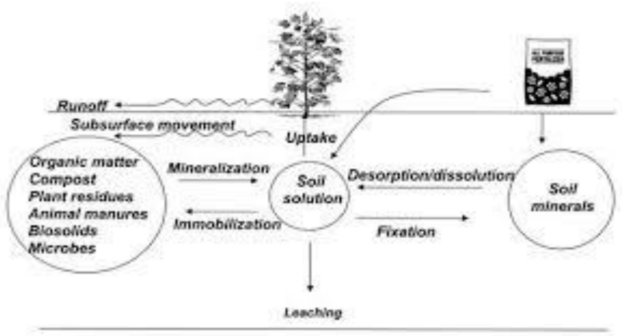


Figure 3 : Phosphorus cycle in soil(Tiessen,H,J.W.B.Stewart and C.V. Cole(1989).

The transformations of phosphorous in the soil depend on three sources, the first: phosphate fertilizers added to the soil and the organic matter in it, and mineral phosphorous compounds originating from minerals containing phosphorous. Its nature and forms in the soil There is no doubt that phosphorus is a residual effect in the soil, meaning that not all of the added quantities of phosphate fertilizers will be taken by the plant, as some of them are fixed in a chemical way (fixation) with chemical compounds and soil colloids, and some of them turn into shapes Organic as a result of the process of _immobilization)) in the bodies of microorganisms, and some of them absorb (adsorbe) on soil colloids and minerals, and this remaining amount may be released ready for the plant from its proven forms depending on a number of factors such as temperature, soil reaction number (Ph), lime, reaction period and type of colloids soil and soil moisture **(McDowell , R., A.Sharpley ,P.H. Brookes,and P.Poulton(2001).**

Phosphorous in plants:

Phosphorous in plants is one of the nutrients that play an important role in fertilizing agricultural lands, as large quantities are added to the soil, and phosphorous is absorbed in the form of mono or binary phosphate ions. With plant roots, phosphorous pumps energy through high-energy phosphate bonds[11].

The importance of phosphorous in plants: Phosphorous is one of the three most important nutrients and the most common one in fertilizers that feed all plants. And (ribosomal RNA) and is included in the composition of the enzymes necessary for the occurrence of energy reactions in the processes of respiration and photosynthesis of plants. Phosphorous also enters the composition of some fats and in phosphorous compounds with abundant energy bonds, such as: (ADP and ATP). It is included in the composition of enzyme conjugates, the importance of which is in the oxidation-reduction reactions that are relied upon in the vital reactions of plants**(Zang,.Mackenzie and C.F.Drury (2004).**

The reason for the presence of phosphorus in the meristematic areas of the plant is due to the fact that the growth is active in the roots. soil for nitrogen. Seeds and fruits by absorption that helped phosphorus to ripen seeds and fruits and increase their vitality and quality. Symptoms of phosphorous deficiency in the plant appear clearly and can be seen with the uncovered eye and the symptoms **vary(Bell, L. C. and C. A. Black. 1970).**

How to enhance phosphorous in plants:

If the soil suffers from a deficiency of phosphorous, it is necessary to provide it with the use of chemical fertilizers that can enhance the presence of phosphorus and create a balance in the important nutrients of the soil and then plants. During the research, fertilizers that contain a high value of phosphorous are targeted It has the letter P, which is the second number in the classification of NPK fertilizers. If there is a desire to enhance phosphorus in the soil by using organic fertilizers, targeting rock phosphate or crushed bone remains both can help enhance the presence of phosphorus in the soil

Also, sometimes, organic fertilizers can help plants make them better able to absorb the phosphorous that is already in the soil, so it is best to apply organic fertilizers first before chemical fertilizers. Despite the importance of phosphorus and the importance of enhancing its presence in the soil, it is never recommended to excessively provide it in the soil in excessive quantities because an increase in the amount of phosphorous in the soil can cause water pollution, and it will be very severe. It is difficult for the plant to absorb **it (Al-Jasmi, Abdullah Shaneen (2014).**

Depictions of phosphorous absorbed by the plant :

Briefly referred to the absorption of phosphorous in chemistry and soil biology. Plants absorb this element in two anionic forms, the first in the form of the primary ion $H_2PO_4^{-2}$ artophosphate, also known as dihydrogen phosphate. The plant can absorb secondary phosphorous,$H_2PO_4^{-2}$ (which is also called phosphate). One of the hydrogen. The concentration of these two molecules in the soil solution and the image of phosphorous that the plant absorbs depends on the pH of the soil solution. The following figure shows the relationship between the pH and the image on which the phosphorus islocated**(Zang,T.Q.,A.F.Mackenzie.,B.C.Liang and C.F.Drury (2004) .**

Experimental part :

Sample taking :

soil samples was taken from the city of Sirte and its suburbs, and there were 15 samples, through which the highest and lowest concentration of phosphorous were estimated, and that was on April 20, 2019. The samples were taken according to the sites listed in the table below:

Table (1) : location of sample taking

Sample No:	*Location*
1	***Althaher 1***
2	***Althaher 2***
3	***algabeba***
4	***alnabeelea***
5	***alakwees***
6	***Algarbeyat 1***
7	***Algarbeyat 2***
8	***Alswawa***
9	***Altawela***
10	***Iabozaheya***
11	***Algerthabea 1***
12	***Algerthabea 2***
13	***Alkhet 1***
14	***Alkhet 2***
15	***abohade***

Materials used:-

The main idea: -
The soil is extracted using a solution of sodium bicarbonate PH = 8.5 M 0.5 with the addition of a teaspoon of activated charcoal to absorb the resulting color if it is found from the dissolution of the alkali sodium bicarbonate of the dissolved organic materials and then shaken for 30 minutes using an electric shaker and then filtered and the phosphorous in the filtrate is estimated by measuring the absorbance Or the blue color resulting from adding ammonium molybdate, sulfuric acid and tin chloride to the spectrophotometer and signing this reading on a standard curve to know the corresponding concentration and then calculating the soil content of phosphorous from the equation of the straight line**(Tiessen,H,J.W.B.Stewart and C.V. Cole(1989).**

Sodium bicarbonate solution NaHCO3 0.5 M pH = 8.5:
It is prepared by dissolving 42 g of pure salt in a liter of water, then adjusting the pH 8.5 using dilute NAOH. It is noted that when leaving the solution, the acidity number will increase due to exposure to the atmosphere, so by placing a layer of mineral oil on the surface of the solution **(Tiessen,H,J.W.B.Stewart and C.V. Cole(1989).**

Sulfo molybdic solution:
It is prepared by dissolving 25 g of ammonium molybdate in 200 ml of distilled water with heating, then dilute 275 ml of pure concentrated sulfuric acid to 750 ml of distilled water. After cooling the solutions, the molybdate solution is added to the acid with stirring with a glass leg. After the mixture cools, a liter of distilled water is completed and kept in a sterile bottle in the **refrigerator (Tiessen,H,J.W.B.Stewart and C.V. Cole(1989).**

Tinos chloride solution: -
It is prepared by dissolving 2.5 g of solid salt in 10 ml of concentrated hydrochloric acid HCl with heating and diluted to 100 ml to the mark in the standard flask and it is preferable to prepare it current when used.

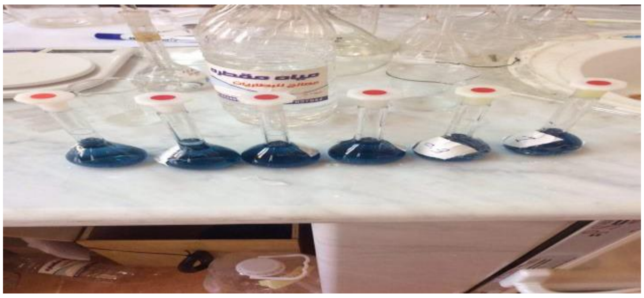
Preparation of a standard solution of mono potassium phosphate : -
It is prepared by dissolving 0.4393 g of dry pure salt in a standard flask of 1 liter capacity, following the method of dissolution and quantitative transfer.
Monopotassium phosphate solution KH_2PO_4:
It is prepared by diluting 25 ml of 100PPM solution in a standard cycle of 250 ml **(Tiessen,H,J.W.B.Stewart and C.V. Cole(1989).**

Instruments and equipment : -

Sensitive scale - electric oven - standard flasks with a capacity of 1000-250 - 100-50 ml funnels - a funnel holder - a cup of 100 capacity - glass stems - sampling bottles of 1000 ml - 250 ml - 100 ml - 50 ml - electric vibrator–spectrophotometer **(Tisdale,S.L.,W.L.Nelson and J.D. Beaton (1985).**

Procedures Steps :-
Standard Curve Processing:
a standardised preparation solution of mono potassium phosphate was prepared with a concentration of KH_2PO_4 100ppm by dissolving 4.393.0 gm of dry pure salt on 100 ml in a liter standard flask, following the method of dissolution and quantitative transfer.

A dilute solution of 10 ppm of 100ppm of the base solution was prepared by diluting 25 ml of the base solution in a standard 250 ml beaker and supplementing with distilled water to the mark with respectable shaking.
Then, we prepared the following standard curve concentrations:
Zero -0.1-0.2-0.3-0.4-0.5-0.6-0.7-0.8-0.9-1.0 ppm



By taking the following volumes of 10 PPM solution in standard 50 ml beakers and do not supplement the mark with distilled water to add the scouting gems and form the blue complex to measure it[(11)] :
Zero - 0.5 -1.0-1.5-2.0-2.5-3.0-3.5-4.0-4.5-0.5 ml
Then we added to each beaker an amount of distilled water up to two thirds of the turn with shaking to mix the ingredients**(Hocking, P. J. 2001.)**
After this, we added to the components of each flask from the burette 2 ml of sulfomolybdic solution with good shaking. We completed the flask with distilled water of the mark with good shaking where the ammonium phospho molybdate complex was formed with a pale yellow color that is difficult to measure on a spectrophotometer, so we reduced it by adding 3 drops of tin chloride solution before measurement Immediately then we waited 5 minutes for the complex to form a blue color, whose intensity is proportional to the concentration of phosphate anions **(Zang,T.Q.,A.F.Mackenzie.,B.C.Liang and C.F.Drury (2004).**
We set the spectrophotometer at a wavelength of 660 nm and zero on the plank.
We recorded the Aabsorbance reading corresponding to each concentration and plotted the standard curve so that it is a straight line that passes through most points, including the origin, where the horizontal axis represents the concentrations in ppm and the vertical axis represents the absorption reading.
Sample processing:
With the knowledge of the percentage of microscopic moisture, we calculated the weight of a sample equivalent to 5 g of completely dry soil using the following equation:
The weight of the air dry soil sample is exactly 5 g **= 5 (100 +% moisture) / 100 = ... g**
We put the soil sample in a suitable shaker bottle and added to it 100 sodium bicarbonate solution 8.5 pH Note (adding a teaspoon of activated charcoal to absorb the color resulting from dissolving alkali of sodium bicarbonate for humic materials, if any), then we shake for 30 minutes by vibrator and then filtered .
10 ml was taken from the filtrate of each sample and positioned in a 50 ml beaker. We followed the steps of the standard curve as follows:
We added to each beaker an amount of distilled water up to two thirds of the beaker with shaking to mix the ingredients**(Zang,.Mackenzie and C.F.Drury (2004).**
Then we added to the components of each flask from the burette 2 ml of sulfomolybdic solution with good shaking, then we completed the beaker with distilled water of the mark with good shaking, where the ammonium phosphomolybdate complex is formed with a pale yellow color that is difficult to measure on the spectrophotometer, so we reduced it by adding 3 drops of tin chloride solution before measurement Immediately, we waited 10 minutes for the complex to form a blue color, whose intensity is proportional to the concentration of phosphate anions.
We read the obtained sample and then predict the standard curve and record the corresponding concentration and from it calculate the phosphate anion concentration as shown in the results **(Zang,.Mackenzie and.Drury (2004).**

Results and discussion

Colorimetric methods for the determination of phosphorous:
The phosphorous concentration in the soil is measured by following the colorimetric methods without performing digestive processes to estimate the permanent phosphate. Digestion methods are used to estimate the total phosphate only, by converting it to artophosphate to one of its colored compounds and this is done in two ways**(Mengel, K. and E. A. Kirkby. 1987)**

vanadium molybdenum and phosphoric acid.
This method is used in samples containing 1-20 mg/L of phosphorous in each phosphate molecule. Where artophosphate reacts with ammonium molybdate in an acidic medium and in the presence of vanadium, it turns into a yellow-coloured phosphoric acid phenydiomollipid**(Bell, L. C. and C. A. Black. 1970)**

Tin chloride.
In this method, phosphate is measured at a concentration of 0.01 - 6 mg/L. From phosphorous in each phosphate molecule, where this method is sensitive to the first method, where it consists of a compound of molybdenum phosphoric acid, which reduces the solution to a seat with a blue color, where this method was used in the process of estimating phosphorus, due to the availability of materials needed for this method.
To determine the concentration of phosphate in the soil by comparing the color intensity of the resulting sample solution with the values of the standard curve using a set of standard solutions of monohydrogen phosphate with different concentrations with the amount and intensity of the color of their solutions, and then applying the straight line equation resulting from the standard curve, which was as follows **(Mengel, K. and E. A. Kirkby. 1987) :-**

$$Y = a + bx$$

Where the intensity of the color (absorption) was measured by determining a wavelength of 660 nm after preparing the sample for 5-10 minutes and distilled water was used in the calibration of the device as a blank solution as a (plank) to zero the device.

Results :-

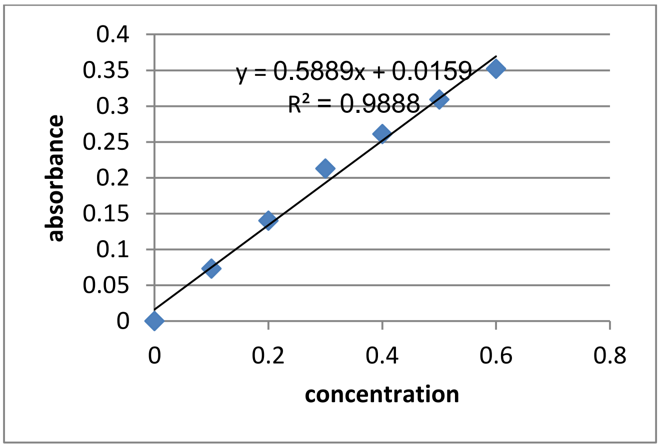
First: a standard curve where the potassium salt mono hydrogen phosphate (K_2HPO_4) was used to prepare the standard solution of 100 ppm phosphorous. Then the sulfur chloride method was used previously mentioned in the section Materials and methods of work to measure phosphorus and the concentration was as follows:
0 - 0.1 - 0.2 - 0.3 - 0.4 - 0.5 - 0.6 - 0.7 - 0.8 - 0.9 - 1.0 ppm
Then the absorbance of these concentrations was measured on a spectrophotometer at a wavelength of 660 nm, and the results were as follows**(Al-Rawi, and Abdel Aziz (1980).**

Table 2 : Standard solution concentration and absorbance

concentration	absorbance
0	**0**
0.1	**0.073**
0.2	**0.14**
0.3	**0.213**
0.4	**0.261**
0.5	**0.309**
0.6	**0.352**
0.7	**0.395**
0.8	**0.4075**
0.9	**0.42**
1	**0.466**

The standard curve is drawn as follows:

Figure 4: shows the standard curve:



The straight line equation was extracted and the values of x concentrations were found from the samples, and the results were as
shown in the following table : -

Table 3: It shows the samples and the phosphorous concentration in each sample:-

Discussion : -
After using the straight line equation that was obtained from the standard curve, it became clear that sample No. 13, which occupies the Al-Qardabiya site, contains the highest concentration of phosphorous equal to 39.59 mg/kg soil. the following **(Akinremi, O. O.1991)** : -

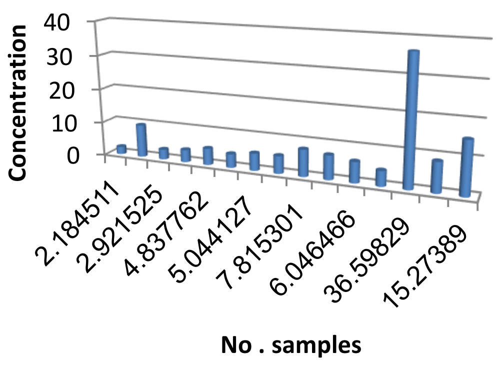
No. Sample	Grade of pH	Concentration mg/L	Concentration mg/Kg
1	8.09	0.125828	2.184511
2	8.15	0.737137	9.598138
3	8.03	0.16828	2.921525
4	8.95	0.207336	3.599578
5	8.65	0.278655	4.837762
6	9.45	0.231109	4.012306
7	8.96	0.290542	5.044127
8	8.64	0.295636	5.132568
9	9.20	0.450161	7.815301
10	8.70	0.404313	7.019325
11	8.80	0.348276	6.046466
12	8.62	0.253184	4.395554
13	8.69	1.1243	36.59829
14	8.67	0.499406	8.670237
15	8.81	0.879776	15.27389

Table 4: It shows the standard criteria for the proportion of phosphorous in the soil.

P	**$NaHCO_3$ 0.5 , Ph , 8.5 Olsen**	**L**	**< 10**
		M	**10 - 15**
		H	**> 15**

While in sample No. 1, which is represented in the back site, where the percentage of phosphorous was very low, which was equal to 2.1845 mg/kg, and this percentage is considered very small compared to the standard standards of phosphorus found in the soil according to Table No. .3 . In the rest of the samples, the percentage of phosphorus ranged from low to medium, as these percentages are considered close to the standard standards. Through the previous results in the sample with the highest concentration, the reason for the high concentration of phosphorus in this sample is likely to be the use of high amounts of phosphate fertilizers and also the low acidity of the soil, which leads to a high percentage of phosphorus, while the sample containing the lowest concentration of phosphorus and bearing No. 1 may be the reason in low phosphorousIt is the exposure of the soil to erosion factors such as wind and water, and also one of the reasons that leads to a decrease in the percentage of phosphorous is the adsorption of phosphorus on the soil granules, which makes it insoluble in water and cannot be used. While the rest of the samples contain appropriate proportions of phosphorous, which makes them suitable for cultivation without exposure to chemical treatment processes. Where the variation of phosphorous ratios for all samples was clarified according to the location and concentration of phosphorus, as shown in the following figure **(Hocking, P. J.2001)**: -

Figure 5: shows the percentage of phosphorous in the various sample locations



pH is a measure of the hydrogen ion concentration in any substance. There are certain nutrients in the soil that cannot reach the plant unless the pH or alkalinity of the soil reaches a certain amount, and if the pH factor is not appropriate, any fertilizer you will use will not benefit the plant until after adjusting Soil pH is suitable for plants.

The hydrogen number (PH) of the soil, which is an indicator that indicates the degree of alkalinity or acidity of the soil. The hydrogen number is measured on a scale ranging from 1 to 14, with 7 as a neutral number and any degree below 7 is considered acidic, and any number above 7 is considered a soil Alkaline, phosphorous is available in the soil between 7 - 6.5 PH, and it is relatively less in alkaline soils 7.5 - 8.5 and in alkaline soils, triple calcium phosphate is formed, which is also insoluble **(EL-baruni, B. and S. R. Olsen.1979)**

Conclusion : -

when a UV spectrophotometer was used to analyze a group of samples, some different compositions of the phosphorous ratio in the soil were identified.This was according to the amount of available phosphorous, which was proportional to the low, medium and high levels according to some standard criteria.

The study made clear some of the factors that have been relatively identified that affect the presence of phosphorous in the soil according to the concentration obtained, as it was clarified in the study thanks to conducting some other studies on the study of phosphorus using different conditions or modern devices in order to obtain a better study**(EL-baruni, B. and S. R. Olsen.1979)**

References

- **Abdali Rana Saadallah Aziz. 2005**. Interactions of some phosphate fertilizers in limestone soils and their effect on wheat plant growth. Master Thesis. College and Forest. University of Al Mosul.
- Ajil, Salma Zayer 1999. Using mathematical models to predict the phosphorous availability index and fertilizer requirements for maize grown in limestone soils. Master's thesis, College of Agriculture, University of Basra.
- **Akinremi, O. O.1991**. Phosphate and accompanying cation transport in a calcareous cation exchange resin system. Soil Sci. Soc. Am. J. 55:959 - 964.
- Al-Ani, Abdullah Najm. 1980. Principles of Soil Science. Ministry of Higher Education and Scientific Research. Iraq. p.: 294.
- Al-Falahi, Mahmoud Howaidi, 1988. Effect of levels and methods of adding phosphate fertilizer on ready phosphorous and plant growth in desert soil. Master Thesis. College of Agriculture and Forestry. Baghdad University.
- Al-Jasmi, Abdullah Shaneen 2014. The movement of phosphorous in the soil of the marshes irrigated with different levels of irrigation for the two systems of drip irrigation and Basrah (Al-Maroz) and its relationship to some properties of the soil and the growth of maize plants. PhD thesis, College of Agriculture, University of Basra.
- Al-Obaidi, Karim Saeed Aziz 1986. The effect of adding organic residues on the interactions and efficiency of superphosphate fertilizer in some limestone soils. Master's thesis, College of Agriculture, University of Basra.
- Al-Qardaghi, Nikar Ali Aziz. 2006 . The relationship between the amount of extracted phosphorus and the absorbent phosphorus at equilibrium in limestone soils. Kirkuk University Journal - Scientific Studies.
- Al-Rawi, Khasha Mahmoud and Abdel Aziz Muhammad Khalaf Allah 1980. Design and analysis of agricultural experiments, University of Mosul. 480.
- **Bell, L. C. and C. A. Black.1970**. Transformation of dibasic calcium phosphate dehydrate and octacalcium phosphate in slightly acid and alkaline soils. Soil science society of America proceedings 34:583– 587.
- **Cavazza, L. and A. Patruno.1997.** Type of phosphorus fertilizer. III.Effects on available phosphorus content in different soils. Rivista di Agronomia. 31(2):347– 360.
- **Cresser, M.S. and J.W. Parsons 1979.** Sulfuric-perchloric acid digestion of Plant material for the determination of nitrogen, phosphorus ,potassium, Calcium and magnesium.Anul.Chem.Acta.,109:431-436.
- **EL-baruni, B. and S. R. Olsen.1979.** Effect of manure on solubility of phosphorus in calcareous soil. Soil Sci., 128:219 - 225.
- **Hocking, P. J. 2001.** Organic acids exuded from roots in phosphorus uptake and aluminum tolerance of plants in acid soils. In advances in agronomy. Ed. D. L sparks. Academic press, NewYork. Pp: 63–79.
- **McDowell** ,R., A.Sharpley ,P.H. Brookes,and P.Poulton(2001).Relationship Between soil test phosphorus release to solution.Anal.Soil.Sci.166:137-194.
- **Mengel, K. and E. A. Kirkby. 1987.** Principles of plant nutrition.4th di..Int. Potash Institute. Bern, Switzerland.

- **Tiessen,H,J.W.B.Stewart and C.V. Cole1989** .Pathways of phosphorus transformation in soils of differing pedogenesis.Soil Sci.Soc.Am.J.:853-858.
- **Tisdale,S.L.,W.L.Nelson and J.D. Beaton1985**.Soil fertility andfertilizers 4th (ed.).Macmillan publishing company ,New York.pp,161-169.
- **Zang,T.Q.,A.F.Mackenzie.,B.C.Liang and C.F.Drury 2004** Soil test Phosphorus fractions with long-term phosphorus addition and depletion. Soil.Sci.Soc.Am.J.68:519-528.