The kinetic behavior of the magnesium ion release in different soils salinity and texture

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Abstract

The study was conducted in order to identifying the kinetic behavior of the magnesium ion in different soil salinity and texture. Five different locations were selected from the soils of the Middle Euphrates provinces, (Aufi village and Al Kifil district - Abu Najm marsh (Sabkha)) and Najaf province (Kufa district - Hasawiya village) and two sites of Diwaniyah province, one of Shoura and the other Sabkha (AL Sudair district). The selection was made on the basis of variation in salinity levels 13.61, 163.76, 22.21, 215.6 and 234.16.ds.m^{-1}, respectively, and texture clay loam, silt loam, sandy loam, silt loam and clay respectively. These soils were treated with three water types which at different ionic strength such a river water, a well and a Drainage that ranged from 0.02 to 0.03 and 0.09 mol, respectively. It was found that the efficiency of washing increased by increasing the number of wash cycles and that the Cumulative electrical conductivity values for the study soils were 23.50-941.42 ds.m^{-1}. Magnesium release values cumulatively ranged between 308.29-3.10 cmol. Kg^{-1}. The lowest value for cumulative electrical conductivity and Magnesium release cumulatively was found in the Awfi village that treated with river water and highest value in AL Sudair district (Sabkha) treated with Drainage water. Two kinetic equations were applied to describe the kinetic behavior of magnesium ion release, namely the parabolic diffusion equation and the Power function equation. Both equations were applied using Statistica. The results showed the superiority of the Power function equation on the Parabolic diffusion equation by giving the highest determination coefficient of (R2 0.987) and the lowest a standard error of (SE 0.045) for the soils irrigated with Drainage water of AL Sudair district, and the values of the magnesium release rate range of (6.451-0.251).

Research paper from the thesis of Master for the second Author

1. INTRODUCTION

The soils of the Middle Euphrates are located in dry and semi-dry areas affected by salinity. Magnesium and its salts are one of the common ions and salts found in many saline soils. The magnesium ion has a small ionic diameter of (0.078 nm) is less than sodium of (0.098 nm) and therefore behaves differently from bivalent positive ions and approaches the behavior and effect of sodium ion [14]. The behavior of magnesium is similar to that of calcium in terms of its electrostatic effects in soil colloid and its reciprocal capacity [15]. Soil salinity is daily increasing due to poor soil management, drought conditions, and lack of efficient drainage networks coupled with a significant deterioration in the quality of irrigation water. There is a decrease in the quantity of fresh water resources that can be used for land reclamation, and to leave these lands without exploitation will lead to saline deserts becoming a source of salts and dust for adjacent agricultural soils and water bodies [8]. The quality of water adds a quantity of salts which irrigated by it. The effect that these salts can cause changes in the salt composition of the solution of the soil through the mitigation and concentration and with these changes, the salts will be redistributed in the soil if there is a new balance between the liquid and solid phase. The ecosystem of saline is not only affected by increasing the concentration of soluble salts, but also with its content of dissolved and

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reciprocating ions [12]. There are some studies, although they are limited to two main groups, namely AL Sabkha and Shoura soils. These two groups of soils can differ in terms of the causes and nature of salinization and the type of salts accumulated in them. These groups were characterized by a good response to washing operations [2,11]. The use of kinetic concepts in recent years is important to describe the quantification of chemical and physiochemical processes in soil such as adsorption and release of food ions and contaminants as well as sedimentation and salinity processes and mineralization of soil. Salinity is an important factor in increasing the release of magnesium in soil [3, 23]. The two best equations showing magnesium release are the parabolic diffusion equation based on the kinetic chemistry and that the constants of this equation are used to explain the liberated ions in the soil and the Power function equation is experimental. The best kinetic equations can be determined to describe the release and adsorption of the element by comparing the values of the correlation coefficient R2 and the standard error SE as a measure of the preference between the equations. The equivalent Parabolic diffusion equation states that the driving force of the propagation process arises from the difference between the liberated element and its concentration in the outer solution, However, the release or absorbed quantity is directly proportional to time and is raised to certain square [19]. Therefore, the study aims to know the efficiency of continuous washing of the different salinity and tissue culture and knowledge of the kinetic behavior of the release of the magnesium ion in ten washings with different water ionic strength and the adoption of parabolic diffusion equation and Power function equation.

2. MATERIALS AND METHODS

The soils of the study areas (Middle Euphrates) are located within dry and semi-dry areas characterized by high temperatures, low rainfall and low density of vegetation. It is a sedimentary soils result from the deposits of the Tigris and Euphrates rivers which classified according to the suggested mechanism by [27] to two levels, namely the level of the desert soil (Aridisol) and the class of the newly formed soil (Entisol). The samples were taken from the depth (0-30 cm) depth of the root region. Five different salinity and texture locations were selected from the Middle Euphrates governorates. Samples were taken from Babylon (Awfi and Abu Najm marsh) and Najaf (Kufa district - Hasawiya village) and two locations from Diwaniyah (Shoura, Sabkha). Different types of water with different ionic strength were used such a river water, a well and a Drainage that ranged from 0.02 to 0.03 and 0.09 mol, respectively. To determine the speed of magnesium release cumulatively, based on the time factor, statistical program Statistca. The intermittent washing method is inefficient when time is the criterion for determining the efficiency of washing, so the method of continuous washing on the selected soil samples for the study. Some chemical and physical analysis of the soil and some chemical analyzes of the different ionic water types were performed as shown in Table (1 and 2) according to methods of Richards [21], Welkaly and Black [31] and Drouineau and Galet [18]. The columns with a diameter of 5 cm and a length of 30 cm were used to wash, filled with dry soil weighing 500 g, which grinded and entrained with a sieve 2 mm, depending on the size of the column and placed a filter paper in the bottom of the soil to ensure that the soil was not lost during the washing. The soil was also recycled when added to the wash columns, A filter paper was also placed on top of the soil surface in the column to ensure that the surface of the soil was not stimulated when washing water was added, The columns were quietly knocked to obtain homogeneous virtual density. Soil column models were washed with three different types of water in ionic power and on the basis of the porous size of the soil minutes within each column. Wash water was added in a continuous quiet flow according to [24]. The addition of

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water was repeated ten times, and the pore size of each soil column was calculated according to Jensen equation [17]:

1- **Parabolic diffusion equation**

$C_t = C_0 + K_d \sqrt{t}$ (2)

2- **Power function equation**

$\ln C_t = \ln C_0 + K_d \ln t$ (3)

Where C_0 = Magnesium concentration at zero time.

C_t = Magnesium concentration at time t (extraction time).

Kd = the slope of the straight line and equal to the release velocity coefficient KMg expressed in unit mol. Kg^{-1}. h^{-1} or mmol.Kg^{-1}.h^{-1} or cmol.kg^{-1}. h^{-1} or mg.Kg^{-1}. min^{-1}.

t = Time is minutes, hours or days.

In order to determine the best mathematical equation describing the process of magnesium release and the speed of release (KMg) of the soil is calculated by calculating the correlation coefficient (r) between the amount of liberated magnesium and time and the calculation of standard error (SE) and represents the difference between the experimental results and the calculated results of the linear motor equation. The correlation coefficient (r) was calculated between the amount of liberated magnesium and time (t) and the calculation of the standard error values SE for equation of Simard et al [22].

$$SE = \left[\frac{\Sigma (C_t - C_t*)^2}{n-2} \right]^{\wedge 0.5} \quad (4)$$

Where C_t - Magnesium concentration measured from solution at time t.

C_t* - Magnesium concentration calculated from the equation at time t.

n - Number of measurements in the experiment.

1. RESULTS AND DISCUSSION

Table (3) show the Cumulative electrical conductivity values and Cumulative magnesium to the study soils which have been irrigated with different types of water, with different ionic strength and the electrical conductivity and the different textures. The different washing efficiency is observed according to the nature of the electrical conductivity. A sample of the soil of the Awfi village with electrical conductivity of (13.61 dS.m^{-1}) and when treated with river water, the Cumulative electrical conductivity of ten washings ranging of (54.17-23.50 dS.m^{-1}) began from the first day of washing to the last day and that concentration of Cumulative magnesium release of (7.09-3.1 cmol.kg^{-1}), when treated with a well water, the value of the Cumulative electrical conductivity ranges of (59.18-24.84 dS.m^{-1}) and the cumulatively released magnesium concentration ranges of (7.72-3.25 cmol.kg^{-1}). When treated with water, the value of the Cumulative electrical conductivity of (27.62 to 26.35 dS.m^{-1}). The cumulative concentration of magnesium is (9.64-3.51 cmol.kg^{-1}) and the water transit time is about 19 days for 10 washings and is characterized by Clay Loam, while the sample of Abu Najm marsh soil with electrical conductivity (163.76 dS.m^{-1}) when treated with the river water, its Cumulative electrical conductivity range of (535.94-182.18 dS.m^{-1}), And the concentration of Cumulative magnesium release ranges of (65.46-22.25 cmol.kg^{-1}). When treated with well water, the Cumulative electrical conductivity values ranges of (574.76-183.46 dS.m^{-1}), and the cumulative magnesium concentration ranges of (71.05 -22.44 cmol.kg$^-$

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1), when treated with Drainage water, the cumulative electrical conductivity values ranges of (682.16 to 185.24 $dS.m^{-1}$) and that the concentration of Cumulative magnesium release ranges of (87.37 to 23.73 $cmol.kg^{-1}$) and the time it takes to pass water is about (15) days which characterized by Silt Loam texture. A sample of Kufa district soil with electrical connectivity (22.21 $dS.m^{-1}$), When treated with river water, its cumulative electrical conductivity ranges of (88.61-30.12 $dS.m^{-1}$) and the cumulative concentration of Magnesium is (8.51-3.18 $cmol.kg^{-1}$). When treated with well water, the cumulative electrical conductivity value ranges of (110.87-34.72 $dS.m^{-1}$) and the cumulative magnesium concentration range of (9.72-3.35 $cmol.kg^{-1}$). When treated with water, the cumulative electrical conductivity value ranges of (130.75 -35.27 dS.m-1) and the concentration of cumulative magnesium released ranges of (12.99-4.16 $cmol.kg^{-1}$) and characterized by its sandy loam texture and the washing velocity has taken less time than the rest of the other washing columns (10) days for ten washings.

Table 1: Chemical and physical properties of the study soil

Traits	Unit	Soil of Awfi Village	Soil of Abu Najm marsh	Soil of Kufa district	Soil of Al-Sudair district (Shoura)	Soil of Al-Sudair district (Sabkha)
EC	$ds.m^{-1}$	13.61	163.76	22.21	215.6	234.16
pH		7.9	7.1	7.7	6.7	6.8
Ca^{+2}	$mmol.L^{-1}$	4.00	35.72	5.50	40.00	120.12
Mg^{+2}		25.00	219.29	30.00	437.00	832.00
Na^{+1}		92.61	1322.50	174.00	1611.57	1348.52
K^{+1}		0.3	2.57	1.97	12.00	2.63
CO_3^{-2}		Nil	Nil	Nil	Nil	Nil
HCO_3^{-1}		6.00	4.00	12.00	9.00	16.00
SO_4^{-2}		24.94	104.61	39.32	92.23	117.34
Cl^{-1}		87.42	1461.14	160.74	1980.64	2185.70
CEC	$cmol.kg^{-1}$	13.23	21.19	17.57	20.48	21.88
Lime	$g.kg^{-1}$	161.32	270.29	199.41	281.53	279.68
Gypsum		8.11	8.06	12.87	10.23	7.06
O.M		5.93	15.63	9.16	13.66	20.84
Clay		289.4	82.2	108.5	358.7	457.7
Gluten		507.5	542.7	329.8	289.4	352.3
Sand		203.1	375.1	561.7	351.9	190
Soil texture		clay loam	silt loam	sandy loam	silt loam	clay
Porous volume	cm^{-3}	189	184	146	163	174

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Table 2: The chemical properties of water with different ionic strength

water types	EC $dS.m^{-1}$	Ionic strength $mol.L^{-1}$	pH	Dissolved ions ($mmol.L^{-1}$)								SAR
				Ca^{+2}	Mg^{+2}	Na^{+1}	K^{+1}	CO_3^{-2}	HCO_3^{-1}	Cl^{-1}	SO_4^{-2}	
River water	1.34	0.02	8.06	2.6	7.4	4.42	0.03	Nil	2.1	10.32	1.82	1.89
Well water	2.5	0.03	7.8	3.8	8.2	12.1	0.18	Nil	2.2	14.13	5.84	4.94
Drainage water	7.09	0.09	7.73	12.8	21.34	28.96	0.5	Nil	2.8	38.4	18.13	7.01

AL Sudair soil sample with electrical conductivity of (215.6 $dS.m^{-1}$) when treated with river water, the cumulative electrical conductivity ranges of (654.88-222.32 $dS.m^{-1}$) and the concentration of cumulative magnesium is (129.80-44.04 $cmol.Kg^{-1}$) and when treated with well water, the value of cumulative electrical conductivity ranges of (699.41-223.81$dS.m^{-1}$), While the concentration of cumulative magnesium released ranges of(140-44.26 $cmol.kg^{-1}$). When treated with piping water, the value of the cumulative electrical conductivity ranges of (846.75-226.48 $dS.m^{-1}$) and that the concentration of cumulative magnesium is (167.12- 45.36 $cmol.kg^{-1}$) which characterized by its silt loam, the washing time was longer than the rest of the previous wash columns for about 23 days to complete ten washings.

Sabkha soil sample with electrical conductivity (234.16 $dS.m^{-1}$) When treated with river water, its cumulative electrical conductivity ranges of (717.77-250.43 $dS.m^{-1}$) and the concentration of cumulative Magnesium is (238.70-83.28 $cmol.kg^{-1}$). When treated with a well water, the value of the cumulative electrical conductivity ranges of (786.56-254.84 $dS.m^{-1}$) and the concentration of cumulative magnesium release ranges of (257.85-83.54 $cmol.kg^{-1}$), when treated with water the value of cumulative electrical conductivity is (941.42-259.16 $dS.m^{-1}$) and the concentration of cumulative liberated magnesium ranges of (308.29-84.87 $cmol.kg^{-1}$), which characterized by its Clay and high salinity texture, which took longer than the previous wash columns, and the time period was about 49 days.

Table (4) shows the final values of cumulative electrical conductivity and the concentrations of the liberated magnesium. The values vary according to the ionic strength of the water, soil and its texture. The final values of cumulative electrical conductivity range of (54.17-941.42 $dS.m^{-1}$) and the concentrations of the liberated magnesium are also different (3.10- 308.29 $cmol.kg^{-1}$). The highest value of the cumulative electrical conductivity and the released magnesium is found in al-Sudair soils (Sabkha) which have been irrigated by Drainage water with ionic strength (0.09 $mol.L^{-1}$) and the ratio of sodium adsorption 7.01. The liberated magnesium is found in Aufi village which have been irrigated with river water of ionic strength (0.02 $mol.L^{-1}$) and sodium adsorption ratio 1.98). The high ionic strength and the high sodium adsorption rate in the water of the Drainage water have released a higher amount of magnesium than the water of low ionic strength and the sodium adsorption rate is low in river water. This is agreeing with [1], and [4, 10, 20]. There is an increase in the amount of magnesium released collectively with increasing number of soil wash cycles, the sodium ions replace the magnesium ions found in the soil and by increasing the ionic strength of the water, the amount of release from the ions increases. The [5, 9] found that the ionic water has an important role in liberating the ion is due to the ionic structure. The ion is an atom carrying a positive or negative electrical charge as a result of its loss or acquisition of one or more electrons during the chemical reaction.

ISSN 2072-3875

Table 3: Cumulative electrical conductivity and the concentrations of the cumulative magnesium of Continuous Washing soils irrigated with Different types of Ionic Strengths

Province	Location	Time (day)	Electrical conductivity (dS.m-1) When washing the soil with river water	Concentration of cumulative magnesium (cmol.kg-1) when soil is washed with river water	Electrical conductivity (dS.m-1) When washing the soil with well water	Concentration of cumulative magnesium (cmol.kg-1) when soil is washed with well water	Electrical conductivity (dS.m-1) When washing the soil with Drainage water	Concentration of cumulative magnesium (cmol.kg-1) when soil is washed with Drainage water
Babylon	Awfi Village Sample (7) Electrical conductivity (13.61 $dS.m^{-1}$)	**1**	23.50	3.10	24.84	3.25	26.35	3.51
		2	34.78	4.59	37.01	4.84	40.58	5.40
		3	40.76	5.36	43.46	5.68	48.40	6.46
		4	44.58	5.86	47.78	6.24	53.88	7.19
		6	47.42	6.22	51.03	6.65	58.43	7.78
		8	49.51	6.49	53.46	6.97	62.20	8.30
		10	51.08	6.70	55.28	7.21	65.34	8.71
		13	52.34	6.86	56.81	7.40	68.00	9.04
		16	53.36	6.99	58.10	7.56	70.29	9.37
		19	54.17	7.09	59.18	7.72	72.26	9.64
Babylon	Abu Najm marsh Sample (18) Electrical conductivity (163.76 $dS.m^{-1}$)	**1**	182.18	22.25	183.46	22.44	185.24	23.73
		2	295.13	36.05	299.04	36.79	309.35	39.62
		3	365.16	44.60	373.01	45.98	392.51	50.27
		4	414.18	50.59	428.49	52.87	459.03	58.79
		5	450.46	55.02	470.10	58.04	514.24	65.87
		6	477.30	58.30	501.30	61.92	560.07	71.74
		8	497.17	60.72	524.71	64.83	598.11	76.61
		10	513.06	62.66	544.37	67.27	630.44	80.75
		12	525.77	64.22	560.88	69.32	658.24	84.31
		15	535.94	65.46	574.76	71.05	682.16	87.37
Najaf	Kufa district Sample (31)	**1**	30.12	3.18	32.11	3.35	35.27	4.16
		2	48.79	5.15	52.66	5.49	58.90	6.95
		3	60.37	6.13	65.81	6.64	74.73	8.54

ISSN 2072-3875

		4	68.48	6.82	75.68	7.51	87.40	9.76
		5	74.47	7.33	83.07	8.16	97.91	10.69
	Electrical conductivity (22.21dS.m^{-1})	**6**	78.91	7.71	88.62	8.65	106.74	11.38
		7	82.20	7.99	92.79	9.02	114.16	11.92
		8	84.82	8.21	96.24	9.32	120.54	12.38
		9	86.93	8.38	99.14	9.56	126.03	12.75
		10	88.61	8.51	101.58	9.72	130.75	12.99
Diwaniyah	Al-Sudair district Sample (37)	**1**	222.32	44.04	223.81	44.26	226.48	45.36
		2	360.16	71.35	367.05	72.59	378.22	75.76
		3	445.62	88.28	458.72	90.72	479.89	96.12
		4	505.44	100.13	525.64	104.32	561.22	112.41
		6	549.71	108.90	575.83	114.51	631.17	125.93
	Electrical conductivity (215.6 dS.m^{-1})	**8**	582.47	115.39	613.48	122.16	689.22	137.16
		11	608.67	120.58	641.33	127.90	737.41	146.47
		14	628.59	124.52	664.45	132.72	779.33	154.39
		18	643.53	127.52	683.87	136.77	815.39	161.20
		23	654.88	129.80	699.41	140.00	846.75	167.12
Diwaniyah	Al-Sudair district Sample (38)	**2**	250.43	83.28	254.84	83.54	259.16	84.87
		5	405.70	134.92	417.94	137.01	432.80	141.73
		10	501.96	166.93	522.32	171.23	549.13	179.83
		15	569.35	189.34	595.39	195.18	642.20	210.30
		20	616.52	205.03	650.19	213.15	718.52	235.30
	Electrical conductivity (234.16 dS.m^{-1})	**25**	649.54	216.01	691.29	226.62	781.10	255.79
		31	672.65	223.70	722.11	236.72	832.42	272.59
		37	691.14	229.85	747.70	245.11	875.52	286.71
		43	705.93	234.77	768.94	252.07	911.73	298.57
		49	717.77	238.70	786.56	257.85	941.42	308.29

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Table 4: Final values of cumulative electrical conductivity and magnesium released from continuous washing soils treated with different ionic water

Province	Location	Electrical conductivity to soil study samples	Ionic strength for water types	cumulative electrical conductivity	cumulative magnesium released	Texture
Babylon	Awfi Village Sample (7)	**13.61**	River water (0.02)	54.17	7.09	Clay loam
			Well water (0.03)	59.18	7.47	
			Drainage water (0.09)	72.26	9.36	
	Abu Najm marsh Sample (18)	**163.76**	River water (0.02)	535.94	65.46	Silt loam
			Well water (0.03)	574.76	71.05	
			Drainage water (0.09)	682.16	87.37	
Najaf	Kufa district Sample (31)	**22.21**	River water (0.02)	88.61	9.93	Sandy loam
			Well water (0.03)	101.58	10.91	
			Drainage water (0.09)	130.75	18.02	
Diwaniyah	Al-Sudair district Sample (37)	**215.6**	River water (0.02)	654.88	129.80	Silt loam
			Well water (0.03)	699.41	140.00	
			Drainage water (0.09)	846.75	167.12	
	Al-Sudair district Sample (38)	**234.16**	River water (0.02)	717.77	238.70	Clay
			Well water (0.03)	786.56	257.85	
			Drainage water (0.09)	941.42	308.29	

Figures (1,2,3,4,5) show the magnesium release curves of the studied soil samples, where the amount of release increasing by increasing the time of water contact with the soil. It is shown by the behavior of these curves that there is a general tendency to increase the amount of free magnesium with the increase in the number of washing times until this increase gradually decreases over time in all soil samples. When we follow the magnesium release processes in the soils above, two stages of emancipation can be distinguished, which appear clearly in soil samples with high magnesium content. In the early stages, the release of magnesium takes the

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form of a highly inclined curve over short periods of time (the release of a massively magnified magnesium mass over a short period of time). In the second stage there is a decrease in the slope of the magnesium release curves to follow the shape of the straight line and is almost parallel to the x-axis. This stage represents the release of magnesium that is difficult to release, these results agree with [7]. Continuation and sequencing of the addition of water washing through the soil columns to the pore size 10 led to an increase in the amount of released magnesium by constantly changing the movement of dissolved materials due to ion exchange and melting processes of magnesium-bearing minerals that get between the liquid and solid phases of the soil as it shows that the amount of magnesium release of soil samples surpassed the rest of the long interaction periods may be due to weak ion bonding on the surface of colloids, which is a very high proportion of ion exchange capacity, which leads to easy to be liberated, but the increase in the duration of reaction after the first porous size, this helped to increase the strength of the added ion bond of sodium water. It is observed that the greater the reaction time, the less release amount depends on the reaction products during the process of emancipation of the ion, but the liberation does not reach the fixed state of emancipation, since the release of the magnesium in the first stage represents the relatively easy magnesium release in the soil solution and the magnesium adsorbed on the location. The slow-release magnesium, which is the second phase of release, which is associated with specialized adsorption sites, resulting in a slow release from the clay to the soil solution [6]. There is similarity in the behavior of the cumulative magnesium release curves of all soil samples in general, but they differed at the levels of curves, so the total cumulative amount of magnesium during the processes of release from each soil column according to soil texture and salinity levels.

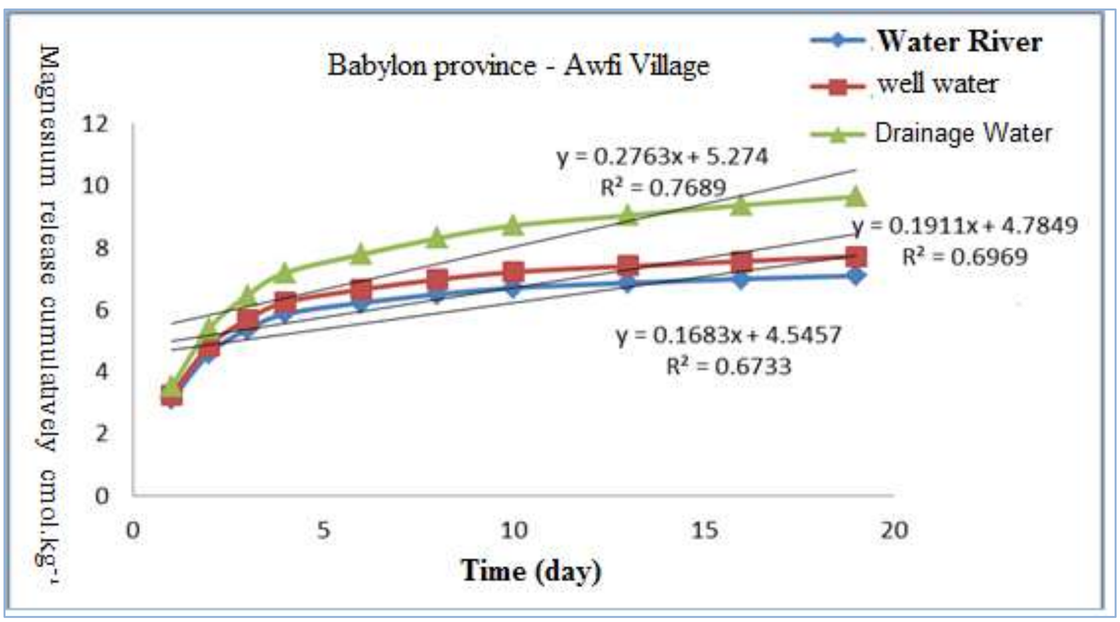
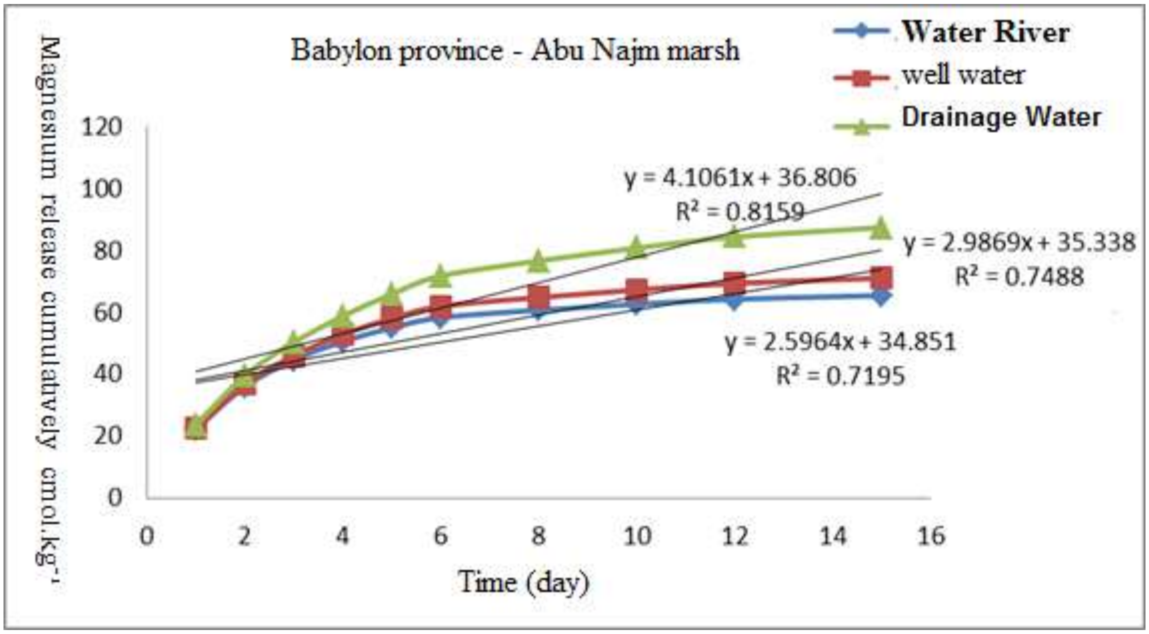
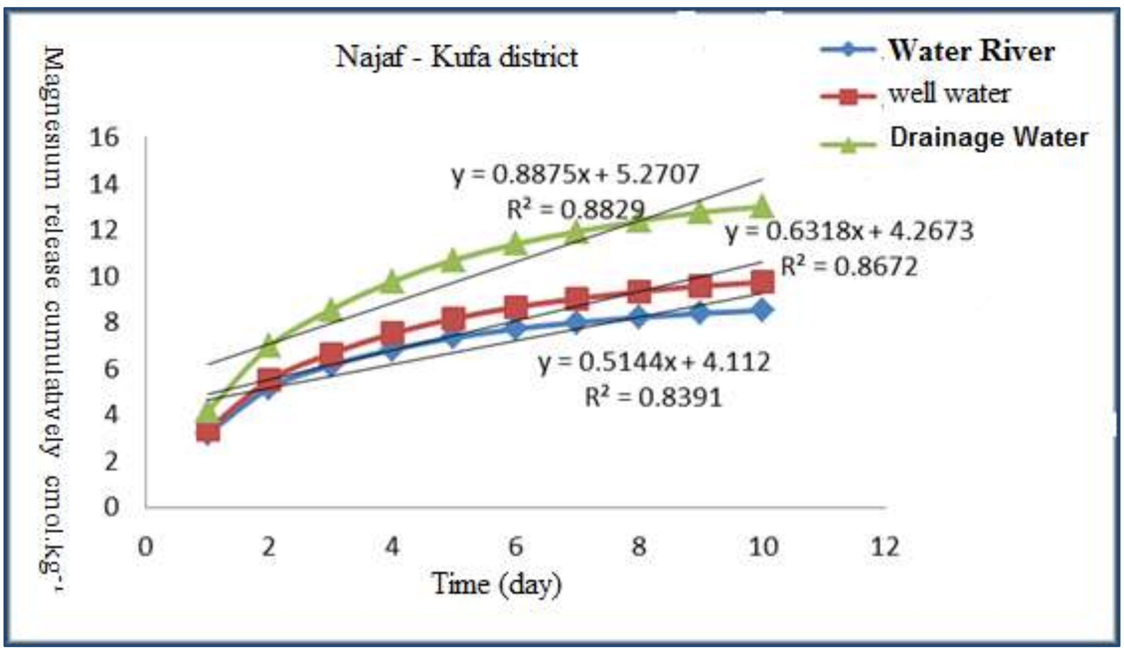


Figure 1: Magnesium release cumulatively with time in the soil sample. Babylon province - Awfi Village

ISSN 2072-3875

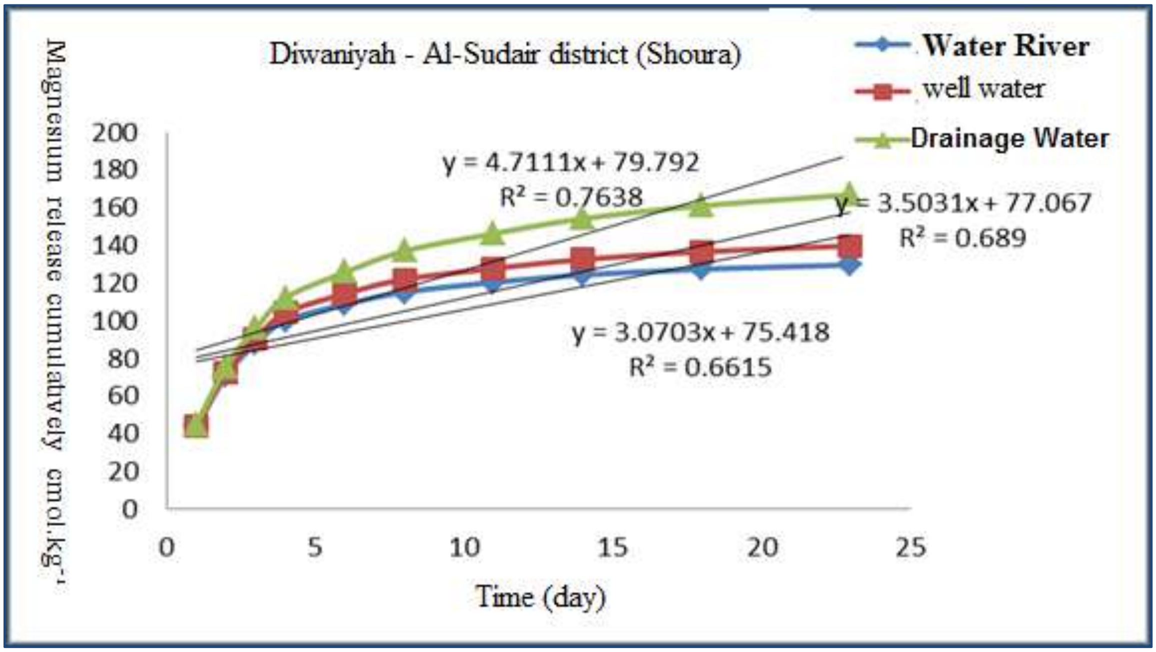


Form 2: Magnesium release cumulatively with time in the soil sample. Babylon province - Abu Najm marsh

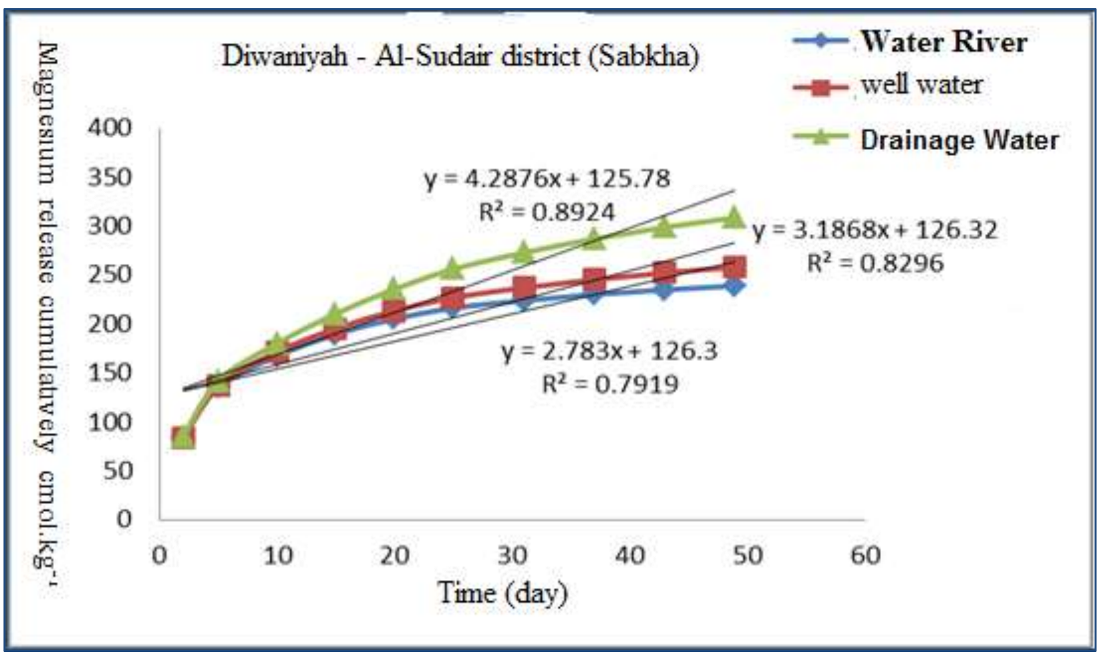


Form 3: Magnesium release cumulatively with time in the soil sample. Najaf - Kufa district

ISSN 2072-3875



Form 4: Magnesium release cumulatively with time in the soil sample. Diwaniyah - Al-Sudair district (Shoura)



Form 5: Magnesium release cumulatively with time in the soil sample. Diwaniyah - Al-Sudair district (Sabkha)

In order to know the best equation describing the release of magnesium in the study soil and to detect the mechanics of this liberalization were applied standards of kinetics, which represent the best means to calculate and emancipate the release of ions from the soil and

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the purpose of the application of these criteria is the motor to obtain the coefficient of speed of the release of ions in the concept of kinetic chemistry, so the speed of interactions within the soil and the associated transport operations depending on the time factor, Where two equations are used: propagation and power function. For the purpose of determining the best kinetic equation, the highest value of the R2 is taken as shown in Table (5). Table (6) indicates the lowest value of the standard error (SE). The results of the study show that the highest value of R2 (0.987) and the lowest value of standard error SE (0.049) were found in the Power function equation compared to the parabolic diffusion equation. Figure (6) show the relationship between the cumulative and time-release amount of magnesium for the sample column of the Sabkha treated with Drainage water and the statistical program Statistca note that most points are located on the extension of the straight line. The highest value of the magnesium release speed coefficient is shown in Table (7) in Abu Najm soil sample that treated with Drainage water 6.45 according to the Parabolic diffusion equation and the lowest value of 0.251 in Aufi village that treated by river water according to the power function equation. From this we conclude that increasing the ionic power of the water leads to an increase in the speed of the release coefficient of magnesium and may be due to the role of electrolytic concentration of water expressed by ionic strength. Either the highest value of the magnesium release velocity coefficient according to the power function equation in Kufa district column of (0.48) that treated with Drainage water or less value for the magnesium release velocity coefficient in the soil column of Awfi village of (0.25) that treated with river water.

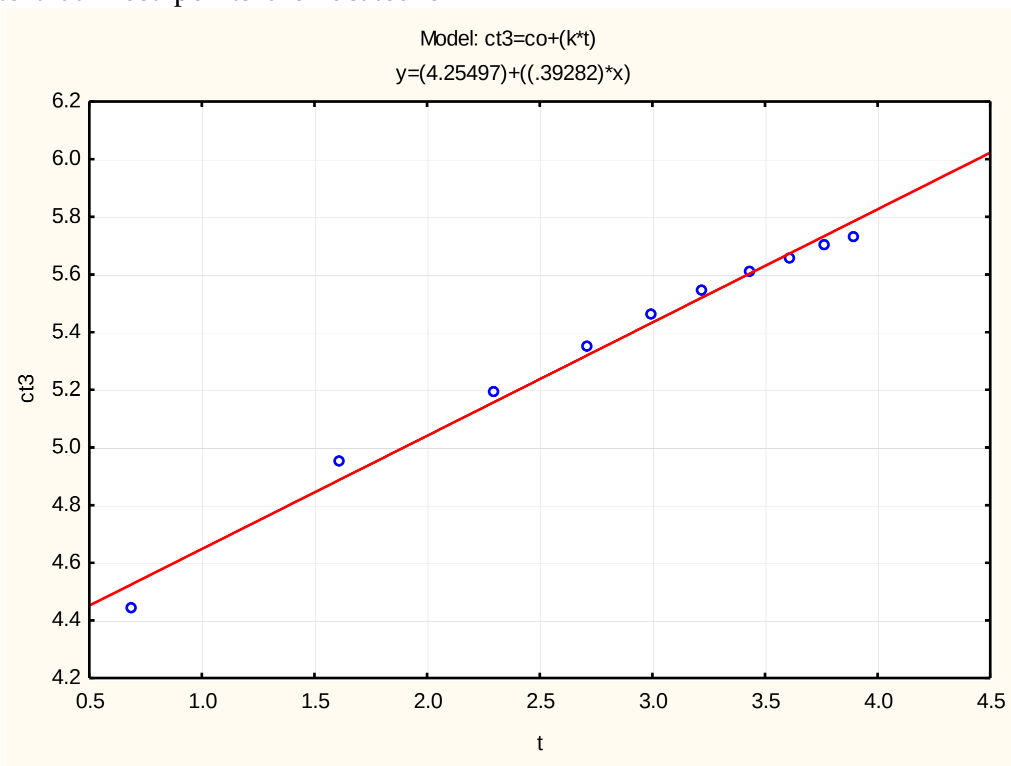

Figure 6: Relationship between the amount of magnesium released cumulatively and the time of the sample column of AL Sudair district treated by the Drainage water according to the power function equation

ISSN 2072-3875

Table 5: Magnesium release determination coefficient by parabolic diffusion equation and power function equation when using different water types with different ionic strength

Table 6: Determination of the lowest standard for magnesium release according to the parabolic diffusion equation and the power function equation when using different types ionic water

Table 7: Magnesium release speed coefficient by parabolic diffusion equation and power function equation when using different types of ionic water

The results indicate that high ionic strength with high sodium adsorption ratio has the ability to release magnesium higher than low ionic water and low sodium adsorption ratio. The soil salinity has an effect on magnesium release, Where Magnesium release increase by increasing its magnesium ratio and when soil treatment with high ionic water and high sodium adsorption, magnesium and sodium are exchanged, leading to increased release, soil texture has an effect on the time factor. The time taken from the fall of the first diameter to the last diameter of each pores volume is added, which is faster in the sandy loam soil than the clay soil. Thus, the time taken in clay soil is increased, Thereby increasing the amount of magnesium release. The kinetic behavior of the magnesium ion release above the power function equation showed the parabolic diffusion equation where the highest coefficient of determination was obtained. The study recommends that further research on the kinetic behavior of magnesium release from the soil and consideration of the behavior and properties of magnesium in the management of Middle Euphrates soils with high levels of magnesium when using magnesium-rich water. It also requires observing the behavior of magnesium when reclaiming saline soil so as to avoid reaching the limits of toxicity to plants.

2. REFERENCES

[1] Al Hadidi, Abdul Qader Abbas (2012). Effect of Water Quality in Physical and Chemical Behavior of Non-Calcium and Magnesium of soils of Irrigation Project North Island Nineveh Iraq. PhD Thesis. college of Agriculture and Forestry. University of Al Mosul. Iraq.

[2] Alhusseni, Ali Abbas Mohammed. (1984). Studying the soils properties of sabkha and shoura in some areas of Iraq. Master Thesis . college of Agriculture . Baghdad University.

[3] Alhusseni, Ali Abbas Mohammed. (2007). transmission and movement of Chloride during the washing of two different soils and affected by salts. PhD. college of Agriculture. Baghdad University.

[4] Al Sultani, Zainab Ali Habib (2015). Study of the effect of water quality on the physico-chemical behavior of calcium carbonate in some areas of the Middle Euphrates by adopting thermodynamic and kinetic parameters. Master Thesis. college of Agriculture. University of AL-Qasim Green

[5] Alobeidi, Hamdiya Shehab Ahmed (2006). Effect of Water Quality on Magnesium Release kinetics in lime Soils. Master Thesis. college of Agriculture. Baghdad University.

[6] Alobeidi, Mohammed Ali Jamal. (1996). Potassium kinetics in some Iraqi soils. Master Thesis. college of Agriculture . Baghdad University.

[7] Alobeidi, Mohammed Ali Jamal, Amer Wadih Abdul Karim and Abdelkader Abash Spak Al Hadidi. (2012). Calcium and magnesium kinetics release from lime soils irrigated with different water types. Tikrit University Journal of Agricultural Sciences, vol. 12, No. 4.

[8] Al-Ghurairi, Fadel Auda Kareidi (2012). The use of phosphate gypsum in the reclamation of saline and soda saline soils Irrigated with saline groundwater. PhD

ISSN 2072-3875

thesis, college of Agriculture, University of Baghdad.

[9] Al-Qazwaini, doaa Faiz kareem (2014). Evaluation of phosphorus readiness using thermodynamic parameters in calcareous soil. Master thesis, college of Agriculture, University of AL-Qasim Green.

[10] Abdullah, Hazem Mahmoud Ahmed (2006). Thermodynamics and kinetics of the solubility of calcium carbonate in some lime soils. college of Agriculture and Forestry, University of Mosul.

[11] Aboud, Mohammed Reza Abdul Amir and Leith Saleem Salman (2014). Washing saline soil using different types of water and its effect on some chemical and physical properties of soil. Al-Furat Journal of Agricultural Sciences 6 (4): 232-214.12-Ashraf, M.Y. A.R.Awan and K.Mahmood.(2012).Rehabilitation of saline ecosystem through cultivation of salt tolerant plants . Pakistan Journal of Botany,44:69-75.

13-Black,C.A.(1965).Methods of soil analysis ,part 1 .physical and mineralogical ، properties . Wisconsin,Madison. American Society of Agronomy,Inc.Publishisher.

14_Bolt,G.H.,andM.G.M.Bruggenet. (1967). Soil chemistry, A. Basic elements. Elsevier scientific publishing company .Amsterdam.

15-Halitim, A.(1988).Sols des regionsaridesd'Algerie.O.P.U. Alger. 384 P.

16- Hundal, L.S., and N.S. Pasrichal. (1993). Non exchangeable potassium release kinetics in illicit soil profiles. Soil. Sci. Vol. 156, No. 1.

17- Jensen, U.(1983) .Influence of salts on loamy sand soil.Soil Sci.14:456-459.

18- John Ryan ,G.Aand A.Al-Rashid.(2003).InternationalCenterfor Agricultural Research in the Dry Areas(ICARDA)Aleppo. Syria National Agricultural Research Ceter (NARC)Islamabad. Pakistan.

19_Martin,H.WandD.L.Sparks.(1983).Kinetics of of non-exchangeable potassium release from two coastalplainsoils.soil sci.soc.Am.J.,47:883-887.

20- Rezaei,M.E.Sanz and E.Rezaei. (2004).Simulation of Dissolution in Salt Water Mixing Zone of carbonate Aqufers.European UninoProject(SALTRANS).Barcelona.Spain

21-Richards, L. A. (1954) Diagnosis and improvement of saline and Alkaline,soil.Agriculture HandBook.No.60.USDA.Washington.

22-Simard, R. R., C.R. Dekimpe, and J. Zizka. (1992). Release of potassium and magnesium from soil fractions and its kinetics. Soil. Sci. Soc. Am. J. Vol. 56: 1421-1428.

23- Sparks, D.L. (1992). Kinetics of soil chemical processes. Academic press. Inc. England. Oxford Univ. Press. New York.

24- Sparks, D.L.(2003). EnvironmentalSoilChemistry.Seond Edition, ACADEMIC PRESS.

25-Sparks, D.L. (1985a). Soil pHysical chemistry.CRS press, Baca Roten, FI.

26-Sparks, D.L.(1985b). Kinetics of ionic reaction in clay minerals and soils. Adv. Agron. 38: 231-266.

27-Soil Survey Staff.(1999).Keys to Soiltaxonomy.7th EditionUSDA.NRCS.Washingt.

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