Estimation of the Total Dissolved Salts by Hydrometer Test

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Abstract: -

Water has ability to dissolve large amounts of salts if it added to soil. The density of brine could be measured with a hydrometer. The measurement results are related with the mass of the total dissolved salts in the water.

The main purpose of this research is proposing a new simple method to testing the total dissolved salts (TDS) in the soil. This method enables the engineers to find the total dissolved salts (TDS) by measuring the density of the saline solution, which result from dissolving the soil in distilled water. This method is based on finding the density by using the hydrometer. This method showed very good results by applying the proposed method, the dissolved salts test would be more easily and quickly.

The proposed method is equal or more in its accuracy on other testing methods, and has the advantage of being considerably faster if there were large numbers of samples have to be tested.

Keywords: - Hydrometer, total dissolved salts, saline density, gravimetric method.

1. Introduction

The wording salinity indicates the exist of the main dissolved inorganic solutes in aquatic samples. Where in soils samples the wording salinity indicates the existing of the soluble plus easily dissolvable salts in the soil or effectively in an aqueous demodulator from a soil sample. Salinity is specific in wording of the total concentration of soluble salts, or more operationally in wording of the electrical conductivity of the solution, because the two wording are closely relevant [39]. after [30].

All natural waters contain soluble salts also the water that fill the voids of soil particles contains soluble salts which named as free salts. [16]. In many regions of the world large areas are covered with soils containing water-soluble salts [3]; [7]. Construction on these soils is quite problematic especially in regions of dry and hot climates due to the severe effect of salt corrosion on structural elements [32] and due to its high collapse potential and low-bearing strength [4].

If the water table level is high and the direction of water is upward, the subsurface salts are present in regions and in this condition the salts will be collected near or at the soil surface.

In arid and semi-arid regions, the soil surface will dry because of the process of the evaporation, in this case if the suction head is greater than the depth of the water table the tendency for water to be dragged from the water table toward the soil surface continues as long as the suction head is greater [20]. The immoderate irrigation raises the water table and grating this problem [17].

Salts are compounder of positively ions which mention as cations and negatively ions which mention as anions. They can be dissolved in water as soluble salts or be attending as solids [21].

"Displacement methods, combination displacement / centrifugation methods, Centrifugation, Molecular adsorption, Vacuum or pressure extraction methods". The latter methods are labeled by Richards in [31];

-"Displacement methods", [1]

-"Combination displacement / centrifugation methods", [19], [14].

-"A combination vacuum/displacement method", [42].

-"A simple field-pressure filtration method ", [34].

-"adsorption techniques", [11], [23] and [14]. After [30]

So the total dissolved salts could be found in many ways, but it is commonly done **directly** by separating and weighing the salts by drying an aqueous specific volume and weighed the salts, or **indirectly** measuring the electrical conductivity of the soil solution. [15]

3. Effect of dilution

If the soluble salts like (CaCO3) and gypsum is found in soil the added water will dissolved these salts. [29]. when these soils exposed to salt solutions, assigner minerals will occur but these minerals normally are not ample adequately [9]. The mixture of soil and water will dilute the salts that found in soil so the concentration of the dissolved will be more than those predominant in field prerequisites. Therefore, it has been found coveted to bound the amount of water that will added to soil samples to the minimum that conformed to the eliciting of adequacy soil solution for analysis. This has conducted to the hugely grassroots of the saturated dough extractions proposed by workers at the U.S. Salinity Laboratory [39]. after [22]. [5] made a study of one part a soil dissolved in ten parts of water, from this study it found that the dissolved solids increased from 17 % after one day of contact to 84% after 23 day of contact. This result is happen because of biological activity and it also could be happen because of the slow solubility of a few of the compounds attendee ,and possibly to hydraulic activity [5]. in 1946 Reitemeier found that the CO_2 produced by the activity of microbes.

The noticed mutations in the ratios of ionic with increasing dilution of estuaries sediments with water can be prescribed by the Donnan theory. Diseasing dislodges the ratios of ions in the interchangeable positions to reconcile the increased sorption of bivalent ones. These changes are indicated as the dilution excites and the cations selective excite by Wiklander [41], Wiklander discuss the Donnan equilibrium and he presents a quantitative manipulation of the apprehensible.

In 1973 Murthy and Ferrell found that the increasing of the dilution ratio will effect on the dissolution ratio so in this research the dissolution ratio was constant and equal to 1:50.

4. The Particle-Size distribution analysis

The particle-size distribution analysis is the important property of the soil and the behavior of some the soil properties are influenced by its classes. [35]. By Particle-size distribution analysis soil sample is divided into single particles. These curves are used in many kinds of appreciation and estimation [18]. The final curve represents the drawing between percentage of particles finer and the diameter of the particles. [18].

The particle diameter or size could be used to extend soil composition, and soil texture, soil classification. [28].

5. Previous Studies

In 1999 Van Kessel [40] found the specific gravity of pig slurry by using hydrometer. By using this method one could apply affordable method to found the amount of nitrogen and phosphorus so the base of the process is the linkage between total solids and nutrient in slurries of pig, and also found that there is a linkage between total solids and the specific gravity of that slurry. [38]; [10].

The "specific gravity" is a gauge of the "density" of any questioner and could be swimmingly found with an instrument known as a hydrometer. [43].

6. The Correction of Temperature:

The CRC Handbook present advice for temperature correction based on Bonython research for ICI in 1948 [8], it's found that for each degree of temperature makes different change in brines (not constant), anywise the corrections for temperatures between (0 °C and 40 °C) are:

1. For brines between 1.000 and 1.100, for every 5 degrees above the hydrometers calibrated temperature we should add 0.001 while if the temperature below the hydrometer's calibrated temperature we should at this case subtracts 0.001 for every 5 degree. This not applies for temperature not within this range. Formula is:

Correction =hydrometer reading+ $(0.00000359*T^2 + 0.00006971*T - 0.00151687)$ … (1)

2. For brines between 1.100 and 1.200, for every 3 degrees above the hydrometers calibrated temperature we should add 0.001 while if the temperature below the hydrometer's

calibrated temperature we should at this case subtracts 0.001 for every 3 degree. This not applies for temperature not within this range. Formula is:

Correction=hydrometer reading+ $(0.000012*T^2 +0.000016*T - 0.00288)$ … (2)

3. For brines greater than 1.200, for every 2 degrees above the hydrometers calibrated temperature we should add 0.001 while if the temperature below the hydrometer's calibrated temperature we should at this case subtracts 0.001 for every 2 degree.

Correction = hydrometer reading + $(0.000009 * T^2 +0.000235 * T - 0.005475)$ … (3)

This not applies for temperature not within this range. Formula is:

7. Finding TDS (g/L) from specific gravity

In 1974 Baseggio derive equation to find the total dissolved salts from the hydrometer reading (SG) of the composition of seawater

$$TDS\ (g/L) = -91897\ SG^4 + 403869\ SG^3 - 663919\ SG^2 + 485355\ SG - 133408 \quad \ldots (4)$$

This equation could be used with brines that have densities between (1.000 and 1.250) so if the specific gravity readings not applied within this range the equation is not valid.

To found TDS directly from hydrometer reading, Baseggio, 1974 present Table 1 [6] which cover the range from 1.00 to 1.050 and temperatures between (5 ºC - 33 ºC).

Another studies made to converting directly from hydrometer reading and temperature to TDS (%).

Table.1 Conversion from specific gravity to TDS (g/L) after [6].

Salinity Conversions

Specific gravity	Brinometer degrees	Baume degrees	% Salinity (%NaCl in brine)	Seawater Salinity % scale	TDS (g/L or ppt w/v)	H2O content of 1 litre	TDS (g/kg or ppt w/w)	EC (mS)
1	0	0	0	0	0		0	0
1.004	2	0.6	0.528		6.6			
1.005		0.7			8.2	996.8		
1.007	4	1.0	1.056	29	10.9		10	16
1.01		1.4			14.94	995.06		
1.0107				43	15.1		15	23.2
1.011	6	1.6	1.584					
1.0143		2.0		57	20.2		20	30.2
1.015	8	2.1	2.112		21.75	993.25		
1.0178		2.5		71	25.4		25	37.1
1.019	10	2.7	2.64					
1.02		2.8			28.55	991.45		
1.0214		3.0		86	30.6		30	44
1.023	12	3.3	3.167					
1.025			3.54	100.0	35.8		35	50.7
1.026	14	3.7	3.695					
1.0286		4.0			41.1		40	57.3
1.03	16	4.2	4.223		42.41	987.59		
1.0322		4.5			46.4		45	63.8
1.034	18	4.8	4.75					
1.0359		5.0			51.7		50	70.1
1.038	20	5.3	5.279					
1.0395		5.5					55	76.3
1.04		5.6			56.39	983.61		
1.042	22	5.8	5.807					
1.0431		6.0			62.5		60	82.4
1.046	24	6.4	6.335					
1.0468		6.5			67.9		65	88.3
1.05	26	6.9	6.863		70.56	979.44		
1.0504		7.0			73.4		70	94.1
1.054	28	7.4	7.391					

Table (1): continued

Salinity Conversions

Specific gravity	Brinometer degrees	Baume degrees	% Salinity (%NaCl in brine)	Seawater Salinity % scale	TDS (g/L or ppt w/v)	H2O content of 1 litre	TDS (g/kg or ppt w/w)	EC (mS)
1.0541		7.4			78.9		75	99.8
1.0578		7.9			84.5		80	105
1.058	30	7.9	7.919					
1.06		8.2			84.91	975.09		
1.0615		8.4			90.1		85	110.5
1.062	32	8.5	8.446					
1.0652		8.9			95.7		90	116
1.066	34	9.0	8.974					
1.0689		9.4			101		95	121
1.07	36	9.5	9.502		101.4	970.59		
1.0726		9.8			107.1		100	126
1.074	38	10.0	10.03					
1.078	40	10.5	10.558					
1.08		10.7			114.1	965.9		
1.0801		10.8			118.6		110	136
1.082	42	11.0	11.086					
1.086	44	11.5	11.614					
1.0876		11.7			130		120	145
1.09	46	12.0	12.142		130.3	961.44		
1.094	48	12.5	12.67					
1.0952		12.6			142.1		130	154
1.098	50	12.9	13.198					
1.1		13.2			144	956		
1.102	52	13.4	13.725					
1.1028		13.5			154.1		140	163
1.106	54	13.9	14.253					
1.11	56	14.4	14.781		159.52	950.48		
1.1105		14.4			166.3		150	171
1.114	58	14.8	15.309					
1.118	60	15.3	15.837					
1.1182		15.3			178.6		160	179
1.12		15.5			175.05	944.95		
1.122	62	15.8	16.365					
1.126	64	16.2	16.893		190.64		170	186

Table.1 continued

Salinity Conversions

Specific gravity	Brinometer degrees	Baume degrees	% Salinity (%NaCl in brine)	Seawater Salinity % scale	TDS (g/L or ppt w/v)	H2O content of 1 litre	TDS (g/kg or ppt w/w)	EC (mS)
1.13	66	16.7	17.421		191.1	939.36		
1.1339		17.1			203.7		180	193
1.135	68	17.2	17.949					
1.139	70	17.7	18.477					
1.14		17.8			206.33	933.67		
1.1418		18.0			216.6		190	199
1.143	72	18.1	19.004					
1.147	74	18.6	19.533					
1.1498		18.9			229		200	204
1.15		18.9			229.6	927.94		
1.152	76	19.1	20.06					
1.156	78	19.6	20.588					
1.16	80	20.0	21.116		237.79	922.21		
1.164	82	20.4	21.644					
1.166		20.6			256.1		220	213
1.169	84	21.0	22.172					
1.17		21.1			253.68	916.32		
1.173	86	21.4	22.7					
1.178	88	21.9	23.228					
1.18		22.1			269.9	910.1		
1.182	90	22.3	23.756					
1.1825		22.4			283.3		240	220
1.186	92	22.7	24.283					
1.19		23.2			285.64	904.36		
1.191	94	23.3	24.811					
1.195	96	23.7	25.339					
1.1993		24.1			311		260	225
1.2	98	24.2	25.867		311.3	897.95		
1.204	100	24.6	26.395					
1.208		25.0						
1.21		25.2			318.17	891.83		
1.212		25.4						
1.216		25.8						
1.22		26.1			332.99	887.01		
1.224		26.5						
1.226		26.7						
1.23		27.1			341.4	888.6		
1.235		27.6						
1.24		28.1			350.79	889.2		
1.245		28.5			355.38	889.62		
1.25		29.0			360.15	889.85		

8. Samples Properties

The soil samples were taken from different locations in Baghdad and al Najaf Al-Ashraf, the samples were bundled at worded depths using a soil auger. The samples were dried by air, sieved using sieve no. 10, and stored in sampling satchels for analysis.

In this research, the soils used are spaciously different. The properties of the soil samples used shown in Table 2.

Salinity can be measured using a hydrometer or a refract meter. The hydrometer measures specific gravity which can then be converted to salinity.

9. Experimental procedure

For each sample the following tests are done;

1- The total dissolved salts test as described in [12].

2-The experiments were done by making a proposed test as follow: for each sample a cylinder was prepared by adding 20 gm for 1000 cm^3 distilled water and after the reading of the hydrometer becones constant, the reading is recorded with the temperature. These results are shown in Table 3.

10. Experimental analysis

To find the relation between hydrometer reading and the total dissolved salts, the following program was done:

1. First stage: finding the pest equation that could be applied to existing the total dissolved salts. This stage made by making a statistical analysis for hydrometer reading (of the soluble of the soil) and the temperature with the real total dissolved salts found by usual evaporation method .

2. Second stage: finding the pest equation that could be applied to existing the total dissolved salts. This stage made by making a statistical analysis for Baseggio data shown in Table 1.

3. Third stage: verifying the accuracy of the equation by making a comparison among the total dissolved salts found by applying the proposed equation and that's found by Baseggio equation (equation no. 4) with the equation found from Baseggio data on the same soil samples data.

Plate 1 show the steps of the setup and preparing the TDS test

Table. 2 The properties of the samples.

sample no.	sample name	depth	location	Specific Gravity	Organic Matter, OR %	SO3	CL	Soil Description
1	C1	18.75-19.75	Al-jadrea	2.67	0.2	1.25	40	green to brown clayey sandy silt
2	E1	14.5-15	Al-jadrea	2.62	0.3	0.67	40	brown sandy silt
3	E2	2	Al-jadrea	2.79	2.1	1.02	90	brown clayey silt
4	BH 1	12	Sahat al-wathek	2.76	0.9	0.82	90	brown silty clay
5	BH 2	15	Sahat al-wathek	2.79	0.9	1.24	135	dark brown silty clay
6	BH 2	6.5	Sahat al-wathek	2.8	1.9	1.46	40	brown clay
7	BH 1	2-2.5	Al-orfaly	2.77	1.9	3	250	brown silty clay
8	BH 1	9.5-10	Al-orfaly	2.73	1.7	1.6	350	black clay with silt
9	BH 2	2-4.5	Al-orfaly	2.72	0.9	2.23	40	brown clayey silt
10	BH 2	8-9.5	Al-orfaly	2.75	1.1	3.99	375	brown silty clay to clayey silt
11	BH 3	0-1.5	Al-orfaly	2.77	1.9	5.06	200	silty clay with fill material
12	BH 3	9.5-10	Al-orfaly	2.78	1.5	3.61	500	dark gray to black silty clay with fill materials
13	BH 1	0-1.5	Felesteen street	2.78	0.8	1.53	4000	brown silty clay with fill material
14	BH 1	5.5-7.5	Felesteen street	2.81	1.1	2.57	550	brown clay
15	BH 1	11.5-14.5	Felesteen street	2.77	1.1	1.06	550	bown clayey silt
16	BH 2	2-2.5	Felesteen street	2.79	0.5	1.58	450	brown silty clay with salts
17	BH 2	5-5.5	Felesteen street	2.79	1.2	4.3	700	brown silt clay
18	BH 2	11-11.5	Felesteen street	2.74	0.6	0.88	450	brown clayey silt
19	BH2	0.5-1.5	Al-najaf	2.66	2.1	8.72	80	white to yellow sand with gravel
20	BH4	16-17.5	Al-najaf	2.69	0.8	5.32	200	white coarse sand
21	BH11	5.5-6	Al-najaf	2.69	1.1	1.49	200	brown sand
22	BH2	14-15.5	Al-najaf	2.66	0.2	3.66	100	gray to yellow to brown sand with gravel
23	BH11	1.5-2	Al-najaf	2.66	2.5	4.34	150	gray to white sand with calcite
24	BH7	14-15.5	Al-najaf	2.68	0.1	4.68	100	white to light to brown sand with organics
25	BH8	1.5-2	Al-najaf	2.66	0.9	7.2	200	white to gray brown sand

Table.3 The experimental results of the soil samples.

Sample no.	sample name	depth	location	TDS by natural method %	r hydrometer	T °
1	C1	18.75-19.75	Al-jadrea	1.18	1.00055	19
2	E1	14.5-15	Al-jadrea	0.63	1.0003	19
3	E2	2	Al-jadrea	1.89	1.00045	19
4	BH 1	12	Sahat al-wathek	1.17	1.0004	21
5	BH 2	15	Sahat al-wathek	1.25	1.00035	19
6	BH 2	6.5	Sahat al-wathek	1.92	1.0005	19
7	BH 1	2-2.5	Al-orfaly	3.07	1.00075	20
8	BH 1	9.5-10	Al-orfaly	1.87	1.00055	21
9	BH 2	2-4.5	Al-orfaly	1.5	1.0003	20
10	BH 2	8-9.5	Al-orfaly	2.32	1.0006	21
11	BH 3	0-1.5	Al-orfaly	3.28	1.0009	20
12	BH 3	9.5-10	Al-orfaly	2.62	1.0007	21
13	BH 1	0-1.5	Felesteen street	2.51	1.0007	21
14	BH 1	5.5-7.5	Felesteen street	2.68	1.00065	20
15	BH 1	11.5-14.5	Felesteen street	1.63	1.0005	21
16	BH 2	2-2.5	Felesteen street	2.16	1.0006	21
17	BH 2	5-5.5	Felesteen street	3.54	1.00085	21
18	BH 2	11-11.5	Felesteen street	1.39	1.00045	21
19	BH2	0.5-1.5	Al-najaf	9.7	1.00225	19
20	BH4	16-17.5	Al-najaf	16.1	1.00325	19
21	BH11	5.5-6	Al-najaf	5	1.0011	19
22	BH2	14-15.5	Al-najaf	10.9	1.00225	19
23	BH11	1.5-2	Al-najaf	12.9	1.0025	19
24	BH7	14-15.5	Al-najaf	12.7	1.00225	19
25	BH8	1.5-2	Al-najaf	18.8	1.00375	19

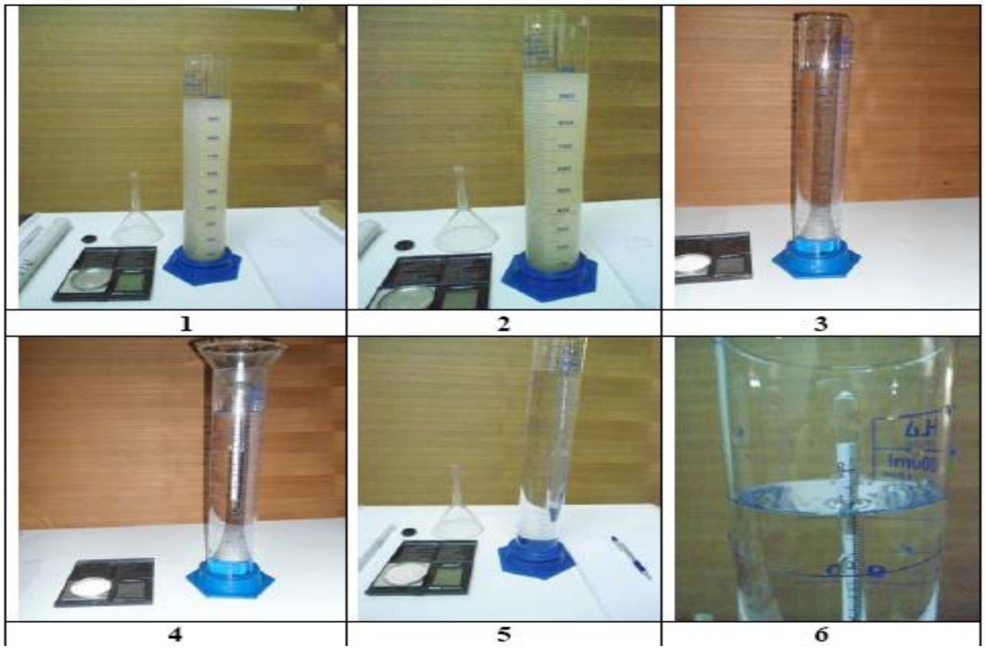

Plate 1 steps of the setup and preparing the TDS proposed test.

10.1 First stage results

Figure 1 shows the relation between the hydrometer reading and the actual total dissolved salts in (%) for all the tested samples. The experimental data shown in table (4) analysis by using SPSS program and the fallowing equation was found:

$$TDS=(4632.442\times r)-(0.226\times T)-4628.309 \quad \ldots(5)$$

In this equation, the effect of the solution temperature at the time of taking the hydrometer reading are taken in account. This equation was found to apply with the proposed dilution ratio only.

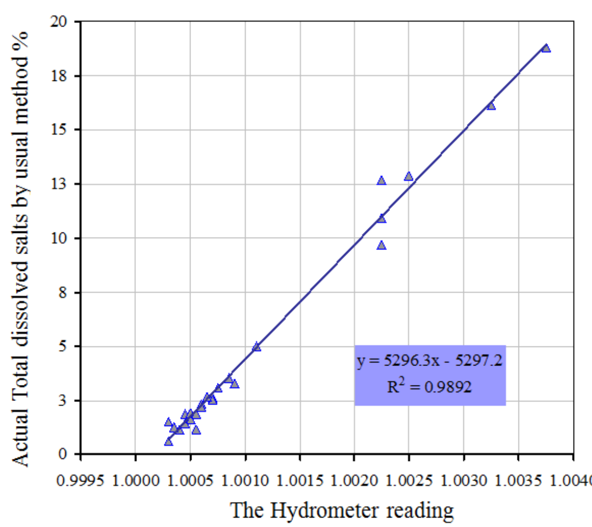

Fig. 1 the relation between the hydrometer reading and the actual total dissolved salts.

10.2 Second stage results

Figure (2) shows the relation between the hydrometer reading and the dissolved salts in (gm/kgm) for all the samples shown in Table (4).

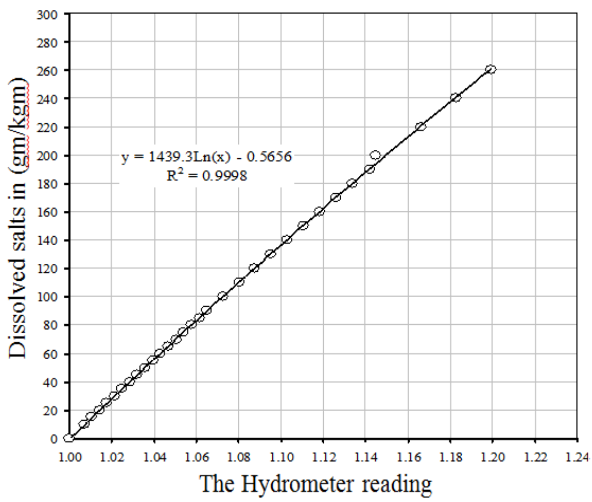

Fig. 2 the relation between the hydrometer reading and the dissolved salts in (gm/kgm) for all the samples shown in Table (4).

Table 4 shows the results of stage three, which done by applying the three equations on the experimental results (Hydrometer reading in soil soluble (r) and the soluble temperature (T)).

Figure 3 shows plots of tested (actual) dissolved salts and estimated total salts by hydrometer using the proposed equation in this research and that proposed from data in Table 4.

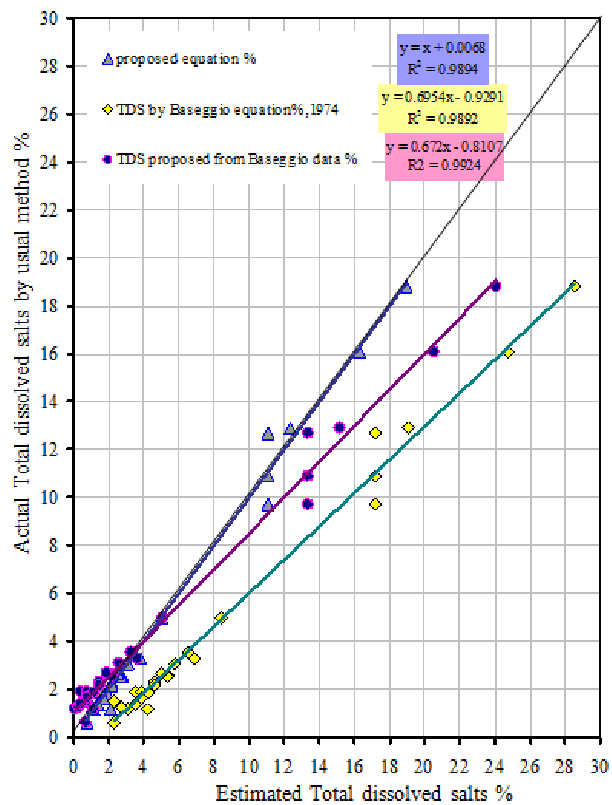

Fig. 3 The Relation between the Estimated Total Salts and the Actual Dissolved Salts.

Table .4 Final results of the samples

Sample no.	sample name	depth m	location	TDS by natural method %	volume of cylinder used (cm3)	weight of sample used (gm)	r hydrometer	T °	TDS by Baseggio equation%	TDS proposed from Baseggio data %	TDS by equation proposed in this paper %
1	C1	18.75-19.75	Al-jadrea	1.18	1000	20	1.00055	19	4.2184	1.1290	2.112
2	E1	14.5-15	Al-jadrea	0.63	1000	20	1.0003	19	2.3023	0.6694	0.799
3	E2	2	Al-jadrea	1.89	1000	20	1.00045	19	3.4523	0.4097	1.587
4	BH 1	12	Sahat al-wathek	1.17	1000	20	1.0004	21	3.0691	0.0500	1.126
5	BH 2	15	Sahat al-wathek	1.25	1000	20	1.00035	19	2.6857	0.3097	1.062
6	BH 2	6.5	Sahat al-wathek	1.92	1000	20	1.0005	19	3.8354	0.7694	1.849
7	BH 1	2-2.5	Al-orfaly	3.07	1000	20	1.00075	20	5.7497	2.5674	3.063
8	BH 1	9.5-10	Al-orfaly	1.87	1000	20	1.00055	21	4.2184	1.1290	1.914
9	BH 2	2-4.5	Al-orfaly	1.5	1000	20	1.0003	20	2.3023	0.6694	0.700
10	BH 2	8-9.5	Al-orfaly	2.32	1000	20	1.0006	21	4.6014	1.4886	2.176
11	BH 3	0-1.5	Al-orfaly	3.28	1000	20	1.0009	20	6.8972	3.6459	3.850
12	BH 3	9.5-10	Al-orfaly	2.62	1000	20	1.0007	21	5.3670	2.2078	2.701
13	BH 1	0-1.5	Felesteen street	2.51	1000	20	1.0007	21	5.3670	2.2078	2.701
14	BH 1	5.5-7.5	Felesteen street	2.68	1000	20	1.00065	20	4.9842	1.8482	2.538
15	BH 1	11.5-14.5	Felesteen street	1.63	1000	20	1.0005	21	3.8354	0.7694	1.651
16	BH 2	2-2.5	Felesteen street	2.16	1000	20	1.0006	21	4.6014	1.4886	2.176
17	BH 2	5-5.5	Felesteen street	3.54	1000	20	1.00085	21	6.5148	3.2864	3.489
18	BH 2	11-11.5	Felesteen street	1.39	1000	20	1.00045	21	3.4523	0.4097	1.389
19	BH2	0.5-1.5	Al-najaf	9.7	1000	20	1.00225	19	17.1886	13.3459	11.037
20	BH4	16-17.5	Al-najaf	16.1	1000	20	1.00325	19	24.7711	20.5227	16.288
21	BH11	5.5-6	Al-najaf	5	1000	20	1.0011	19	8.4259	5.0838	4.999
22	BH2	14-15.5	Al-najaf	10.9	1000	20	1.00225	19	17.1886	13.3459	11.037
23	BH11	1.5-2	Al-najaf	12.9	1000	20	1.0025	19	19.0874	15.1408	12.350
24	BH7	14-15.5	Al-najaf	12.7	1000	20	1.00225	19	17.1886	13.3459	11.037
25	BH8	1.5-2	Al-najaf	18.8	1000	20	1.00375	19	28.5497	24.1084	18.913

It is obvious in Figure 3 that plots of the proposed equation results show better results than the other equations, that's because the proposed equation takes the effect of the temperature of the soluble of the soil where the other equations didn't take that effect in account.

The results show that the use of the hydrometer to metering soluble material from soil can be a workable way and its accuracy can be largely suboptimal if used correctly. A comparative between equations of this study and the others is introduced from data shown in Table 4, clearly shows that the equation obtained in this study are the best because the values for the coefficient of correlation and R^2 are high. The values for the coefficient of correlation and R^2 for the equation equal to (0.995 and 0.9894) respectively

Conclusions

1-Salt water is denser than distills water because of the dissolved salt.

2-When water is added to the soil, it dissolved salt by breaking down it into ions. That is then gravitated to the water molecules. This gravitation causes them to interconnect hermetically, and that cause increasing in the quantity of issue per volume (density).

3- This research present a new proposed method for testing the total dissolved salts of the soil by using the hydrometer.

4-The proposed method has the feature of inexpensiveness contrast to other methods. But the breakables feature of hydrometers may be significant as a shortcoming.

5-Hydrometers are calibrated by the manufacturer so there is no need for calibration.

6- In this research a new equation is proposed to find the total dissolved salts from the density of the solution of the soil, this equation give a root square equal to (R^2) (0.9894) and the correlation factor equal to (0.995).

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تقدير الاملاح الذائبة الكلية بأستخدام الهايدروميتر

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الخلاصة:

ان الماء مذيب مذهل كما انه قادر على الاحتفاظ بكميات كبيرة من الأملاح وغيرها من المواد في محلوله. يمكن قياس كثافة المحلول الملحي باستخدام المكثاف .(hydrometer) النتائج المستحصلة مرتبطة بشكل مباشر بكتلة الاملاح المذابة في الماء .

الغرض الرئيسي من هذا البحث هو اقتراح طريقة جديدة مبسطة لاختبار الأملاح الذائبة الكلية (TDS) في التربة. في هذه الطريقة ممكن ايجاد الأملاح الذائبة الكلية (TDS) من خلال ايجاد كثافة المحلول الملحي، والذي ينتج عن حل التربة في الماء المقطر. ان هذه الطريقة مبنية على إيجاد الكثافة باستخدام مقياس ثقل السائل النوعي. وأظهرت هذه الطريقة نتائج جيدة جدا.

من خلال تطبيق الطريقة المقترحة فإن اختبار الأملاح الذائبة سيكون أكثر سهولة وسرعة. ان الطريقة المقترحة متساوية أو أكثر في دقتها من طرق الاختبار الأخرى، ولها ميزة كونها أسرع بكثير إذا كانت هناك أعداد كبيرة من العينات لدينا لفحصها.