Electrical conductivity EC

It's an expression of total concentration for soluble salts, the salts are mostly (NaCl, Na_2SO_4, $CaCO_3$ and $MgCO_3$) in water, in order to constitute salinity degree and alkalinity of the soil.

Electrical conductivity: can be defined as the reciprocal of electrical resistance of a solution to electric current at $25C^0$ ((expressed with unit dSm^{-1}).

1 S(Siemens) means that the soil will transmit 1 ampere of electricity if we applied 1 volt of electrical potential

The objectives of EC measurement are:-

1- To know the salinity of the soil.

2- To measure osmotic pressure:

Osmotic pressure (O.P) = EC * 0.36

Total soluble salt (T.S.S) ppm = EC * 640

T.S.S g/l= EC * 0.64

3- To classify of the water type.

4- To determine the ion strength

I= C* EC dsm^{-1}

Where

C= constant but it's differs from water to other (ranged from 0.012 to 0.016).

I= Ion strength (mol/L)

I= ½ $\sum Ci* Zi^2$

Where Ci= ion concentration mol/L, Zi =ion charge

For example

Ion	Ca^{2+}	Mg^{2+}	K^+	Na^+	HCO_3^-	$CO_3^=$	Cl^-	$SO_4^=$
Conc, meq/L	2	2	1	0.5	2	1	1	1.5

mmol/L= meq/L/charge

I= 1/2 $\sum(1*2^2)+(1*2^2)+(1*1^2)+(0.5*1^2)$……..+$(1.25*2^2)$ = mmole/L divided on 1000 to convert the result to mole/L.

5- To study the effect of EC on plant germination

most plant are more sensitive to salinity during germination than at any other growth stage.

6- To define the salinity threshold for plant (the level of soil salinity at which yield decreases begin) below the threshold yield is minimally affected followed by an approximately linear decrease in yield with increase in salinity.

Methods of EC determination: -

1- EC meter

2- Chemical method:

$$EC\ (dSm^{-1}) = \frac{\sum \text{cation or anion meq/L}}{10}$$

Cation = (Ca^{2+}, Mg^{2+}, K^{+}, Na^{+})

Anion = (SO_4^{-2}, CO_3^{-2}, HCO_3, Cl^{-})

3- Gravimetric method: -

a) Making soil suspension (1:5) soil: water
b) Weight container (clean and dry).
c) Take a known volume of extraction in a can, then evacfporation of water extraction at 100 C^0 in order to obtain salts, and after that weight a can with salts (after evaporation) weight a salts (in volume of extraction which taken).

TS S %= total of soluble salts * 100 / weight of soil sample.
TSS%= EC * 0.064* 5

Procedure of determination EC by Ec meter:-

1- Calibrate EC meter by prepare 0.01N KCl
(Dissolve 0.745 gm KCl in liter of water at 25C^o)

EC (0.01) KCl = 1.41 dsm^{-1} at 25 C^o

2- Measurement EC of water or extract sample, and measure the temperature.

3- Correct EC meter reading according to the temperature because, The increase of temperature leads to increase EC about 2% for each temperature, for that for each degree of temperature more than 25C^o we will decrease 0.02 from the result. While for each degree less than 25C^o we'll increasing 0.02.

Q1. what is the EC of a soil with the following ion concentrations

Ion	Ca^{2+}	Mg^{2+}	K^+	Na^+	HCO_3^-	$CO_3^=$	Cl^-	$SO_4^=$
Conc, meq/L	2	2	1	0.5	2	1	1	1.5

A1.

$$EC\ (dSm^{-1}) = \frac{\sum \text{cation or anion meq/L}}{10}$$

= (2+2+1+0.5)/10

=5.5/10

=0.55 dS/m

Q2. What is the EC of a soil at 25c, if its EC at room temperature (20c) was 3.1 dS/m

A2. EC will increase 2% with increase of each celsios degree

The difference of temperature is 25-20=5C

EC at 25c = EC + (EC * 5*2/100) = 3.1+(3.1*5*2/100)

= 3.1+0.31

= 3.41

Q3. what is the EC of a soil with the following ion concentrations

Ion	Ca^{2+}	Mg^{2+}	K^+	Na^+	HCO_3^-	$CO_3^=$	Cl^-	$SO_4^=$
Conc, mmol/L	2	2	1	0.5	2	1.5	1.5	1.5

A3.

Meq = mmol* charge

Ion	Ca^{2+}	Mg^{2+}	K^{+}	Na^{+}	HCO_3^{-}	$CO_3^{=}$	Cl^{-}	$SO_4^{=}$
Conc, mmol/L	2	2	1	0.5	2	1.5	1.5	1.5
meq	4	4	1	0.5	2	3	1.5	3

$$EC\ (dSm^{-1}) = \frac{\sum \text{cation or anion meq/L}}{10}$$

$= (4+4+1+0.5)/10$

$= 9.5/10$

$= 0.95$ dS/m

Q. Methods of EC determination include

1- EC meter

2- Chemical method

3- Gravimetric method

Q. **Electrical conductivity** is an expression of total concentration for soluble salts

or the reciprocal of electrical resistance of a solution to electric current at $25C^0$(expressed with unit dSm^{-1}).

Q . One S(Siemens) means that the soil will transmit 1 ampere of electricity if we applied 1 volt of electrical potential

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