Instruction Manual

HI 38078
Sodium Adsorption Ratio (SAR) Test Kit

HANNA instruments

www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Product.

Please read the instruction sheet carefully before using the test kit. It will provide you with the necessary information for correct use of the kit. If you need additional information, do not hesitate to e-mail us at tech@hannainst.com.

Remove the chemical test kit from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, notify your Dealer or the nearest Hanna office immediately.

Each kit is supplied with:

- DiST 4 conductivity tester (with instructions and screwdriver for calibration);
- HI 70039 calibration sachet 5000 µS/cm, 2 sachets;
- Buffer Solution pH 10.2 ± 0.2, 1 bottle (100 mL);
- Calmagite Indicator, 1 bottle with dropper (10 mL);
- HI 38078-0 EDTA Solution, 1 bottle (120 mL);
- Demineralizer Bottle with filter cap for about 12 liters of deionized water (depending on the hardness level of water to be treated);
- 1 calibrated vessel (50 mL);
- 1 plastic pipette (3 mL);
- 1 plastic pipette (1 mL);
- 1 syringe (1 mL) with tip.

Note: Any damaged or defective item must be returned in its original packing materials.

ISTR38078 02/00 PRINTED IN ITALY

SPECIFICATIONS

Range	> 0 meq/L
Smallest Increment	0.5 meq/L for 1.0 mL sample 0.2 meq/L for 2.5 mL sample
Analysis Method	Titration
Sample Size	1.0 mL or 2.5 mL
Number of Tests	100 (average)
Case Dimensions	235x175x115 mm (9.2x6.9x4.5")
Shipping Weight	785 g (27.7 oz.)

SIGNIFICANCE AND USE

Sodium is one of the most studied elements because of its toxic effects both to soil texture and crops:

- High concentration of sodium disperses soil colloidal particles, rendering the soil hard and resistant to water penetration.
- The build-up of osmotic pressure in soil due to high sodium concentration causes difficulty in water absorption by plant roots. Plants are sensitive to varying degrees to soil salinity and when this exceeds a certain limit their growth is impaired, thus lowering their productivity.

High amounts of sodium can be mitigated by presence of large quantities of calcium and magnesium in soil or with distribution of gypsum (calcium sulfate) directly on soil or as an additive to irrigation water.

The Hanna Test Kit determines Sodium Hazard in irrigation water by calculation of SAR (Sodium Adsorption Ratio) in relation to calcium and magnesium concentration.

Note: meq/L is milliequivalent per liter.

INSTRUCTIONS

READ THE ENTIRE INSTRUCTIONS BEFORE USING THE KIT

DETERMINATION OF CONDUCTIVITY

The concentration of total soluble salts dissolved in irrigation water is measured as the capacity to conduct electricity (EC) and is determined with a conductivity tester. Refer to the enclosed instructions for a proper use of the DiST 4 Conductivity Tester.

Calculate the meq/L of soluble salts by multiplying the conductivity mS/cm by 10.

meq/L Conductivity = mS/cm x 10

DETERMINATION OF CALCIUM AND MAGNESIUM

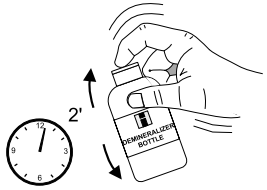
CHEMICAL REACTION

Calcium and Magnesium in irrigation water are determined via a titrimetric method: the indicator chelates with the Calcium and Magnesium ions to form a red colored complex. As EDTA is added, calcium and magnesium complex with it: the reaction end point is indicated by a change in color of the indicator from red to blue.

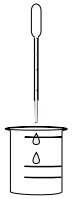
INSTRUCTIONS

- Remove the cap and fill the Demineralizer Bottle with tap water.

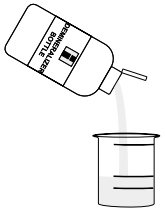
- Replace the cap and shake for at least 2 minutes. The demineralized water is now ready.



- Determine the conductivity of your sample using the Hanna DiST 4 Conductivity Tester (for accurate results, follow the DiST 4 instructions attentively):
  - if the conductivity is < 2.00 mS/cm, take 2.5 mL of water sample;
  - if the conductivity is > 2.00 mS/cm, take 1.0 mL of water sample.

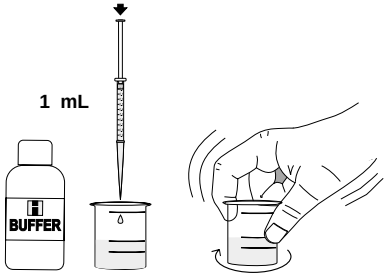


- Use the 3 mL plastic pipette and transfer 2.5 mL or 1.0 mL of your sample (see above) to the vessel.



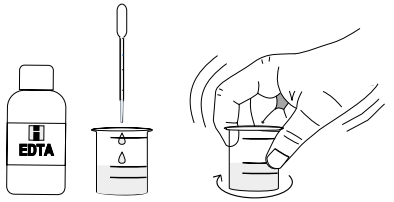
- Flip open the top of the Demineralizer Bottle cap. Squeeze the bottle gently to add demineralized water to the vessel up to the 25 mL mark.

- Using the syringe, add 1 mL of Buffer Solution and swirl to mix.



- Add 1 drop of Calmagite Indicator and swirl to mix. If calcium and magnesium are present, the solution will turn wine red.

- Using the 1 mL plastic pipette, add drops of HI 38078-0 EDTA Solution. Swirl after each drop and keep an accurate count of the number of drops being added to the solution.



- As the color changes from pink to purple, swirl for 15 seconds after each additional drop, until the solution turns pure blue. Record the number of drops needed to obtain the final color change (from wine red to pure blue).

Note: high amounts of copper in your sample will alter the final end point color. The solution will change from wine red to purple without turning pure blue. In this case add drops of titrant until no visible change in color is obtained.

- Calculate the meq/L of Calcium and Magnesium in your sample as follows:

$$\textbf{meq/L [Ca + Mg]} = \frac{\text{drops of Titrant}}{2 \times \text{mL of Sample}}$$

where mL of sample is equal to:

a) 2.5 mL if the conductivity is < 2.00 mS/cm;

b) 1.0 mL if the conductivity is > 2.00 mS/cm.

- Rinse all labware with demineralized water after each analysis and shake dry.

SODIUM ESTIMATION

To estimate the sodium content in your irrigation water, subtract from the conductivity value (in meq/L) the value of Calcium and Magnesium (in meq/L):

Sodium Estimation (meq/L) =

= Conductivity (meq/L) - [Ca + Mg] (meq/L)

SODIUM ADSORPTION RATIO CALCULATION

SAR is a parameter that evaluates the Sodium Hazard in relation to Calcium and Magnesium concentration.

The Sodium Adsorption Ratio (SAR) is calculated as:

$$\textbf{SAR} = \frac{\text{SODIUM ESTIMATION (meq/L)}}{\sqrt{\frac{[\text{Ca} + \text{Mg}](\text{meq/L})}{2}}}$$

PERMEABILITY HAZARD TABLE

It is possible to draw general indications about the permeability hazards in relation to EC_w and SAR of the irrigation water tested [from Ayers and Westcot, FAO#29, Rev.1, Rome, 1985].

Note: EC_w is the electrical conductivity of the irrigation water and can be expressed as mS/cm (or dS/m) @25°C.

Nature of problems and relative parameters	Limitation of use of irrigation water		
	none	partial	total
Reduction of the level of available water in soil for plants, due to high concentration of salts **with EC_w (mS/cm) at:**	<0.7	0.7-3.0	>3.0
Reduction of water permeability in soil, in relation to SAR			
SAR = 0-3 with EC_w:	>0.7	0.7-0.2	<0.2
SAR = 3-6 with EC_w:	>1.2	1.2-0.3	<0.3
SAR = 6-12 with EC_w:	>1.9	1.9-0.5	<0.5
SAR = 12-20 with EC_w:	>2.9	2.9-1.3	<1.3
SAR = 20-40 with EC_w:	>5.0	5.0-2.9	<2.9

REFERENCES

Adaptation of the *Standard Methods for the Examination of water and wastewater*, 18th Ed. 1992, APA AWWA WEF.

P. Sequi, *Chimica del suolo*, Patron Editore, Ed. 1991

HEALTH AND SAFETY

The chemicals contained in this kit may be hazardous if improperly handled. Read the relevant Health and Safety Data Sheet before performing this test.