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Experiment No-14: Computation of RSC and SAR of irrigation water.

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Principle

The Sodium Adsorption Ratio is a ratio of Na concentration in meq/l to the square root of half the concentration of Ca + Mg in meq/l.

$$\text{SAR} = \frac{\text{Na}^+}{\sqrt{\frac{\text{Ca}^{2+} + \text{Mg}^{2+}}{2}}}$$

The Residual Sodium Carbonate is the sum of concentration of carbonate plus bicarbonate in meq/ minus the concentration of calcium plus magnesium in meq/l
i.e. $\text{RSC} = (\text{CO}_3^{--} + \text{HCO}_3^-) - (\text{Ca}^{++} + \text{Mg}^{++})$

The water sample has to be analysed for the determination of the concentration of Na, Ca + Mg and $\text{CO}_3^{--} + \text{HCO}_3^-$ in meq/l to estimate SAR and RSC by way of assessing sodicity hazard.



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Reagents

for Na determination

Sodium solution -0, 5, 10, 15 and 20 ppm

For Ca + Mg determination

EDTA solution, 0.01N Heavy metal
complexing reagents Calcium chloride solution, 0.01N
1% KCN solution

Magnesium chloride solution, 0.01N 4%

Na. K ferrocyanide solution Ammonium Chloride-
Ammonium 5%Hydroxylamine hydrochloride Hydroxide

Buffer (1 1) Triethanol amine

Eriochrome Black T indicator

for $\text{CO}_3 + \text{HCO}_3$ determination



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0.1% Sulphuric acid,
0.5 N Phenolphthalein indicator,
0.5% Sodium carbonates solution,
0.1N Methyl orange,
The preparation of reagents are described in
experiment no 11.



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Procedure

Na determination in water sample. Adjust flame photometer reading to 0 by atomizing 0 ppm Na after placing Na filter opposite air-propane blue flame, and then atomize 20 ppm Na solution and adjust flame photometer reading to 100. Repeat atomization of 0 and 20 ppm Na solution, and check the flame photometer reading

If necessary again adjust the flame photometer reading. Then atomize the intermediate Na standards. Thereafter, atomize to spray water sample diluted 50 to 500 times. If flame photometer reading is found in the range of 0 to 100, note down the flame photometer reading and the corresponding dilution. Determine Na concentration (ppm), in diluted water sample by the following equation:
meg Na/lit in water sample = (ppm Na in diluted sample x times

of dilution)/23



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Ca + Mg determination in water sample. Transfer 5.0 ml aliquot of water sample and 20 ml of distilled water into 150 ml Erlenmeyer flask. Then add 1 drop MgCl_3 (0.01 N), 5 drops each of four heavy metal complexing reagent, 2 ml of NH_4Cl^-

NH_4OH buffer and 2 drops of EBT indicator. Titrate with 0.01N EDTA until the reaction mixture colour changes from pink to purple and then from purple to clear blue or green with 1 drop of EDTA. Similarly run a blank taking distilled water instead of sample aliquot.



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$\text{meq Ca +Mg / l in water sample} = \frac{\{\text{EDTA titre (sample-blank)} \times 0.01 \times 1000\}}{5}$

CO_3^{--} and HCO_3^{--} determination in water sample. Transfer 50.0 ml aliquot of filtered water sample into a 150 ml Erlenmeyer flask. Add 3 drops of 0.5% phenolphthalein indicator and titrate with 0.05 N H_2SO_4 until the solution colour changes from purple to colourless. Note down the acid titre and designate it as "P". Then add 2 drops or 0.1% methyl orange indicator, and titration with 0.05 N H_2SO_4 without refilling the burette until the colour changes from yellow to orange.



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Heat the contents to boil gently for 1 minute. If the orange colour turn yellow on heating, and it does not turn orange on cooling add few drops of 0.05N H₂SO₄ till the solution turn orange. Note down the total acid titre, and designate it as "T".

Calculation

meq CO₃²⁻ / lt in water sample = (2P x .05 x 1000)/50 When P < 0.5 T or when P = T

meq CO₃²⁻ /lt in water sample = {2(T-P) x .05 x 1000} when P > 0.5T

meq HCO₃⁻ /lt in water sample = (T x .05 x 1000)/50 when P = 0

meq HCO₃⁻ /lt in water sample = {(T - 2P) x .05 x 1000}/50 when P < 0.5 T

where P is acid titre for phenolphthalein end point and T is total acid titre ke, 'p plus acid titre to methyl orange end point.

Sodium Adsorption Ratio = $Na^+ / \sqrt{(Ca^{++} + Mg^{++}/2)}$

Residual Sodium Carbonate = (CO₃²⁻ + HCO₃⁻) - (Ca⁺⁺ + Mg⁺⁺)

where the concentration of each ion is expressed in meq/l



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Observation: Students must complete your calculation with above formula and write proper result.

Sample No	SAR (meq/lit)	RSC(meq/lit)
Remark		

1.

2.

3.

4.