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# **Experiment No-9. Determination of Carbonate and Bicarbonate in irrigation water (Richards, 1954)**

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## Theory:

Titration of definite quantity of water against a standard acid using phenolphthalein & Methyl orange as indicators. Firstly phenolphthalein is added as an indicator. On adding the standard acid drop – wise, the pink colour disappears when all the carbonate in the sample water are converted to bicarbonates. At this stage methyl orange is added as an indicator. Now the colour of the sample water is yellow. Titrate further against the same standard acid. Colour changes to orange when the end – point is reached.



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## Requirements

0.05M  $\text{H}_2\text{SO}_4$ , 100 ml, Sample water, Conical flasks, Burette, Pipette 25 ml, Phenolphthalein & Methyl orange indicator.

## Procedure

Pipette out 25 ml, of sample water into a clean dry flask. Add 5 drops of phenolphthalein. The solution turns pink showing the presence of carbonates. Add the acid from the burette drop wise till the solution becomes colour less. Note the reading; now to the same bulk of

solution add 3 drops of methyl orange. The solution turns yellow. Titrate further adding the acid from the burette drop wise till the colour change to orange. Note the reading. This procedure should be repeated a number of times with fresh quantity of sample water each time till constant reading are obtained.



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### Calculation:

If  $X$  ml. of  $0.05$  M  $H_2SO_4$  is required to convert the quantity of carbonates present in  $25$  ml. sample water to bicarbonate (phenolphthalein reading) then  $2X$  ml. of  $0.05$  M  $H_2SO_4$  will be required to neutralize the total amount of carbonates.

If  $Y$  ml. of  $0.05$  M  $H_2SO_4$  are required to neutralize bicarbonates (Methyl orange reading) then  $Y-X$  ml. of  $0.05$  M  $H_2SO_4$  will be required to neutralize the bicarbonates present in  $25$  ml of the sample water because  $X$  ml. are required to neutralize the bicarbonates obtained from carbonates.



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1 Mole of  $\text{H}_2\text{SO}_4$  = 120 gm of  $2\text{CO}_3^{-2}$

So 1 ml. of 0.05 M  $\text{H}_2\text{SO}_4$  = 0.006 gm  $\text{CO}_3^{-2}$

So  $2X * 25 * 0.006 * 10^6 = \underline{\hspace{2cm}}$  ppm Carbonates.

1 Mole of  $\text{H}_2\text{SO}_4$  = 122g  $\text{HCO}_3^-$

So 1 ml. of 0.052 M  $\text{H}_2\text{SO}_4$  = 0.0061 g  $\text{HCO}_3^-$

So  $(Y-X) * 25 * 0.0061 * 10^6 = \underline{\hspace{2cm}}$  ppm bicarbonates.

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

Sample No	Carbonates (ppm)	Bicarbonates (ppm)
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1.

2.

3.