VIVEKANANDA COLLEGE
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NAAC ACCREDITED 'A' GRADE

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ESTIMATION OF DISSOLVED FREE CARBON DIOXIDE (CO_2) IN TWO DIFFERENT WATER SAMPLES

➢ PRINCIPLE:

Free Carbon dioxide (CO_2) reacts with NaOH or Na_2CO_3 to form $NaHCO_3$. Free CO_2 can be determined by titrating the two samples using a strong alkali (NaOH) at pH 8.3. At this pH all the free CO_2 is converted into bicarbonate. Completion of the reaction is indicated by the development of a pink color of Phenolphthalein indicator at the equivalence pH of 8.3.

$$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$$

$$Na_2CO_3 + H_2O + CO_2 \rightarrow 2NaHCO_3$$

Amount of alkali needed to produce the pink color indicates the amount of free CO_2 present in the two samples.

➢ REQUIREMENTS:

i. Burette and burette stand
ii. Pipette
iii. Measuring cylinder
iv. Beaker
v. Conical flask (100ml)
vi. Funnel
vii. Bottle with stopper (250ml)
viii. Dropper

REAGENTS:

i. 0.05(N) NaOH solution
ii. Phenolphthalein indicator

➢ PREPATION OF REAGENTS:

Preparation of reagents:

i. **0.05(N) NaOH solution**- 40gmof NaOH was dissolved in CO_2 free distilled water and volume made upto 1000ml. 50ml of 1(N) NaOH was taken and diluted with distilled water to make 1000ml of 0.05(N) NaOH solution. This solution was standardized with pH 8.3 with HCl or H_2SO_4 or oxalic acid.

ii. **Phenolphthalein indicator**- 0.5gm of phenolphthalein indicator was dissolved in 50ml of 90% ethanol and 50ml of distilled water was added to it. This solution was neutralized by adding 0.05(N) NaOH solution until a faint pink color appeared.

➢ PROCEDURE:

(1) Preparation of reaction mixture:

i. Two different water samples were collected from two different water bodies. First water sample (**Sample- 1**) was collected from one pond in a narrow mouthed bottle with minimum exposure to air and precautions were taken so that the sample was not agitated. Bubbling or mixing with air or other gases was avoided.

ii. 50ml of water sample was taken in a 100ml conical flask. 3 such sets were prepared for Sample- 1.

iii. A few drops of phenolphthalein indicator (3-4drops) were added to the sample sets.

iv. Each conical flask was placed against a white background.

v. If the color turns pink then free CO_2 is absent. If the sample remains colorless then it is titrated against 0.05(N) NaOH. At the end point a faint pink color appears.

vi. The end point reading was recorded.

vii. Second water sample (**Sample- 2**) was collected from another pond and tested in same procedure as Sample- 1.

➢ RESULTS:

Water samples	No. of observations	Volume of sample taken	Initial burette reading (ml)	Final burette reading (ml)	Difference (ml)	Mean (ml)
Sample-1	1.					
	2.					
	3.					
Sample-2	1.					
	2.					
	3.					

➢ CALCULATION:

For Sample- 1:-

Total free CO_2 (mg/L) → [ml × (N) of NaOH × 44 × 1000] ÷ ml of sample

For Sample- 2:-

Total free CO_2 (mg/L) → [ml × (N) of NaOH × 44 × 1000] ÷ ml of sample

➢ COMMENT:

Free CO_2 is a measure of one of the important environmental factor affecting aquatic life. The value of free CO_2 in Sample- 1 is _____mg/L and the value of free CO_2 in Sample- 2 is _____mg/L. We can see that the amount of free CO_2 in Sample- 1 is more than that of Sample- 2. Higher concentrations of CO_2 have inhibitory effects on plants and animals. Free CO_2 value is not that much high in Sample- 1 so, no inhibitory effect on plants and animals is seen.

➢ PRECAUTIONS:

Since atmospheric CO_2 is readily soluble in water, method of determining the amount of free CO_2 is always subjected to more or less 50% error. The following precautions should be taken for increasing the degree of accuracy.

I. While collecting the sample in both cases, care should be taken to avoid contact of sample from air. This can be achieved by collecting the sample from subsurface water by opening the lid of empty sample bottle under water.

II. The sample should be analyzed immediately after collection because CO_2 is liable to escape easily from the sample.

III. The sample should not be agitated.

IV. The surface of water sample exposed to air during the titration should be kept as small as possible.

V. The sample should not be agitated during the titration.