Experiment No (3):- Determination of Acetic Acid Content of Vinegar

Theory:- Determination of acetic acid concentration in commercially available white vinegar is one of the simplest and easiest titrations. It is also possible to determine concentration of acetic acid in other types of vinegar. The only problem is that the color of the vinegar can make it difficult to spot the end point. However, in most cases even vinegars made of red wine - after being diluted for titration - are pale enough so that the phenolphthalein color at the end point can be easily spotted.

Vinegar can have different strengths. Most popular are concentrations between 4% and 15% In case of such concentrated solutions it may be impossible to simply take a single sample for titration. We won't be able to measure such a volume of liquid with reasonable accuracy, thus we are forced to dilute the original acid.

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

Colorless **Red**

Acetic acid reacts with NaOH on the 1:1 basis

Procedure:-

1. Weigh accurately 5 ml volume of the Vinegar solution
2. Transfer to 50 ml conical flask and add 50 ml water .
3. Add one or two drops of ph. ph. indicator to this solution.
4. Add 0.05 N NaOH from the burette gradually with continuous swirling of the solution in the conical flask and near the end point, NaOH is added drop by drop. Continue the addition of NaOH until the color of the solution passes from Colorless to faint red /pink.
5. Repeat the experiment three times and tabulate your results then take the mean of the three readings

Calculations:- Calculate the rate of weighted percentages for Vinegar:-

$$m\ mol\ NaOH = m\ mol\ CH_3COOH * \frac{mole\ NaOH}{mole\ CH_3COOH}$$

$$(M * V_{burette})_{NaOH} = \frac{Wt.}{M.Wt} * 1000 * \frac{1}{1}$$

$$(M * V)_{NaOH} = 1000 * \frac{Wt.\ CH_3COOH}{60.05}$$

$$\frac{Wt.\%}{Wt.}\ CH_3COOH\ in\ vinegar = \frac{Wt.\ CH_3COOH}{Wt.\ of\ vinegar} * 100$$

$$\frac{Wt.\%}{V}\ CH_3COOH\ in\ vingar = \frac{Wt.\ CH_3COOH}{V\ of\ sample\ (vingar)} * 100$$

Discussion:-

1. A word equation summarizing the souring of wine is:

Grain alcohol (C_2H_5OH) + oxygen $\rightarrow$ acetic acid + water.

Please convert this word equation to a balanced chemical equation.

2. Different vinegars may have different percentages of acetic acid. Is vinegar a mixture, compound, or an element?

3. There are two kinds of vinegars, what the different between them?