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USE OF *IPOMOEA AQUATICA* FLOWER AS NEUTRALISATION INDICATOR

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ABSTRACT

Neutralisation titrations play a key role in titrimetric analysis. Nowadays synthetic indicators contribute active role in volumetric neutralization titrations. Industrial production and use of synthetic indicators cause pollution to environment and creates human health problems. The remedy of this is to use natural substrates instead of chemicals to prepare these indicators. The present study deals with this aspect in which a natural neutralisation indicator was prepared from flower extract of *Ipomoea aquatica* and standardized for neutralization titrations. Flowers of *Ipomoea aquatica* having pink or pale lilac colour. The 10% w/v water extract of *Ipomoea aquatica* shows different colours at different pH i.e. pink (between 0 and 8.0 pH); green (8.0 to 11.0 pH); greenish yellow (above 11.0 pH) in pH metric titrations of 0.1 M HCl with 0.1 M NaOH and CH_3COOH with NaOH, whereas it failed to produce color change at the end point in NH_4OH and HCl titration.

Key words: Titrimetric analysis, Plant parts, Natural indicator, Eco-friendly.

INTRODUCTION

Neutralisation titrations are widely used to determine the concentration of analytes that are themselves acids or base or convertible to such species by suitable treatment[1]. Nutralisation titrations require suitable indicator. Many substances, both naturally occurring and synthetic, display colour that depend upon the pH of solution in which they are dissolved. Many synthetic neutralisation indicators used in neutralisation titrations, like phenolphthalein, methyl orange, methyl red etc., are produced using organic solvent, acids, bases and organic compounds etc. in industries. Industrial production of these indicators may result in water, soil and air pollution. Phenolphthalein is carcinogenic[2] causes ovarian cancer and inhibit human cellular calcium influx whereas methyl orange causes mutagenic effect and methyl red also behaves as carcinogenic. For titrimatric analysis, the indicator

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powder is dissolved in organic solvent. The remedy of this is that, we should go to the natural product. Almost highly coloured fruits (Cherry, straw barry, grapes etc.), vegetables (Beet, red cabbage, carrot, onion etc.) and flowers (rose petal, pansy petal, tulip petal etc.) petals have the potential to use as a neutralisation indicator[3].

In the present study, flowers of *Ipomoea aquatica* have been used to prepare neutralisation indicator, which was then standardized to use in neutralisation titration. *Ipomoea aquatica* belongs to convolvulaceae family and grow to 0.5 to 1 feet height. Optimum growth of *Ipomoea aquatica* occurs in full sunlight. Marshy lands and waterlogged soils are ideal for growth of *Ipomoea aquatica*. Shallow ponds, ditches, peripheries of deep ponds, tanks, and slopes of wet soils are also suitable. Soils with a high percentage of organic matter are preferred. Flowers of *Ipomoea aquatica* have morning-glory like, two inches wide, funnel shaped, pink or pale lilac colour.

EXPERIMENTAL

Ipomoea aquatica flowers were collected from its plant. 10% w/v water extract was obtained by gentle heating of fresh flowers of *Ipomoea aquatica* with distilled water. Natural solvent (Water) and natural product (Flower) were used for preparation of this neutralization indicator, so it is called here a "Natural Neutralisation Indicator (NNI)". For preliminary study fourteen different solutions of 1 M HCl or 1 M NaOH in distilled water were prepared having pH between 0.0 to 13. Their pH was measured by pH meter and found as 0.1, 0.67, 1.85, 3.0, 4.0, 5.82, 6.0, 7.03, 8.07, 9.6, 10.0, 11.32, 12.62 and 13.0 pH. From each of these solutions 10 mL was transferred in different test tubes, which were previously labeled by specific pH values. 0.5 mL of NNI was added to each test tube and observed the pH value at which the indicator changes the colour of solution in test tube. Finally the pH metric titration of 0.1 M HCl and 0.1 M NaOH was run using NNI. The solution system used for this pH metric titration is as follows- 10 mL of 0.1 M HCl as titrand, 50 mL of double distilled water, 2.5 mL of freshly prepared NNI. The end point of mentioned solution system using 0.1 M NaOH as a titrant was measured using pH meter. The colour change at different pH values of solution system was recorded. To find out the suitability of prepared NNI, it was standardized with the help of synthetic indicators; phenolphthalein and methyl orange.

RESULTS AND DISCUSSION

General information such as colour and composition[4] of *Ipomoea aquatica* flower and colour of NNI are presented in Table 1. Different colours appeared at different pH of solutions due to NNI in preliminary and final studies are presented in Table 2. The theoretical pH of solution of various stages during different types of titrations is presented in Table 3[5]. Neutralisation indicators show the colour change in neutralization titration due to pH change at the end point. The suitability of NNI for various neutralization titrations can be decided easily with the help of Table 2 and 3. Table 2 reveals that NNI appears pink colour below the pH 8.0, green colour in the range of pH 8.0 to 11.0 and greenish yellow colour above pH 11.0.

In the titration of HCl and NaOH, at end point the pH jump from 4.30 to 9.70 (Table 3), which suggests that prepared NNI is more suitable for HCl and NaOH titration. NNI shows colour change at end point as green from pink in same titration (Table 2). Same end point is obtained in HCl and NaOH volumetric titration using phenolphthalein and NNI separately.

Table 1: General information of *Ipomoea aquatica* flower and NNI

Colour of flower	Light pink
Colour of prepared indicator	Pink
Composition of flower	Flavonoids: 3α,7β-o-D-diglycopyranosyl-dihydroquercentin N-cis-feruloyl tyramine N-trans-feruloyl tyramine 3,5-di-o-caffeoyl-quinic acid 3,4-di-o-caffeoyl-quinic acid 4,5-di-o-caffeoyl-quinic acid (Anthocyanine derivatives)

Table 2: Different colours appeared at different pH of solutions due to NNI (Preliminary and final study)

pH of solution	Colour of solution
$0 < pH < 8.0$	Pink
$8.0 \leq pH \leq 11.0$	Green
$11.0 > pH$	Greenish yellow

Table 3: pH of solution at various stages during different neutralisation titration

Volume of titrant (mL)	pH of solution		
	Titration of 100 mL of 0.1 M HCl with 0.1 M NaOH	Titration of 100 mL of 0.1 M CH_3COOH with 0.1 M NaOH	Titration of 100 mL of 0.1 M NH_4OH with 0.1 M HCl
0.0	1.0	2.9	11.1
50	1.5	4.7	9.3
90	2.3	5.7	8.3
99	3.3	6.7	7.3
99.5	3.6	7.0	7.0
99.8	4.0	7.4	6.6
99.9	4.3	7.7	6.3
100	7.0	8.7	5.3
100.1	9.7	9.7	4.3
100.2	10.0	10.0	4.0
100.5	10.4	10.4	3.6
101	10.7	10.7	3.3
110	11.7	11.7	2.3

In titration of CH_3COOH and NaOH, the pH jump at the end point is from 7.7 to 9.7 (Table 3). It suggests that prepared NNI is more suitable for CH_3COOH and NaOH titration. NNI shows colour change at end point as green from pink in same titration (Table 2). Same end point is obtained in CH_3COOH and NaOH volumetric titration using phenolphthalein and NNI separately.

In titration of NH_4OH and HCl, the pH jump at the end point is from 6.3 to 4.3 (Table 3), which suggests that prepared NNI is not suitable for NH_4OH and HCl titration because of NNI shows colour change (pink from green) before the end point.

Indicator properties of NNI may be due to change in structure of anthocyanine derivatives, present in flower with pH change[6].

CONCLUSION

This study suggests that a neutralisation indicator can be prepared successfully using *Ipomoea aquatica* flowers, which produces sharp, reliable and reproducible end point in HCl with NaOH, and CH_3COOH with NaOH titrations whereas it is not suitable for NH_4OH with HCl titration.

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