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Original Article

Use of *Argyreia cuneata* Flower Extract as a Natural Indicator in Acid Base Titration

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Abstract

Indicators help to determine the equivalence point in acid – base titrations (neutralization titrations). They show sharp color change with respect to change in pH. Commonly used indicators for neutralization titrations are synthetic in nature. They are found to posses hazardous effects in human body. The highly colored pigments obtained from plants are found to exhibit color changes with change in pH. In the present work, acid base titration has been performed by using natural indicators. The natural indicator is prepared from the ethanolic extract of Argyreia cuneata. Two acids (H2SO4 and CH3COOH) and two bases (KOH and NH4OH) were selected for acid base titration. 0.1N, 0.5N, 1N and 5N strength of these acids and bases were prepared. The end points obtained by the flower extract coincide with the end points obtained by standard indicators. Therefore, use of ethanolic extract of flower as an indicator is more economical and having the same accuracy of result as that given by synthetic indicator.

Keywords: Indicator, ethanolic extract, titration, Acid, Base, methyl red, pigments.

1. Introduction

The pH indicators are substances whose solutions change color due to changes in pH. These are also called acid-base indicators or neutralization indicator. They are usually weak acids or bases, but their conjugate base or acid forms have different colors due to differences in their absorption spectra. [1] Indicators are complicate organic weak acids or bases with complicated structures. For simplicity, we represent a general indicator by the formula HIn for acidic indicators and InOH for basic indicator. The ionization of acidic indicator in a solution is represented by the equilibrium,

$$HIn \longrightarrow H^+ + In^-$$

Colors of substances make the world a wonderful place. Because of the colours and structures flowers, plants, animals, and minerals show their unique characters.[3] There are various organic and inorganic compounds responsible for natural colours. The color intensity depends on various factors including the composition.[9,10] In plants the colour is due to the presence of naturally occurring organic substances like flavones, flavonol, xanthine, anthocyanins, azo compounds etc. Some of the naturally occurring flavones, flavonol, anthocyanins and other coloured substances are pH sensitive. They exhibit different colours in acids and basic medium. These substances give sharp distinct and stable colour change on a change of acid to alkaline medium. Thus they may be used as acid base indicators in volumetric analysis.[7,8] *Argyreia cuneata* is a perennial climbing shrub which is native to the Indian subcontinent and is related to *Argyreia nervosa* common names include purple morning glory, mahalungi, and kallanagida. *Argyrei acuneata* is a perennial climbing shrub growing from 150-200cm. Its stems are

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covered with soft white hair. The leaves are about 6 centimeters long by 2.5 wide with wedge-shaped bases. The flowers are purple and about 5 cm long. The seeds are brown, about 1 cm long and elliptically shaped. The leaves are traditionally used for treatment of diabetes.[6,11]

Fig. 1: *Argyrei acuneata*

2. Materials and Methods

Fresh flowers of ***Argyreia cuneata*** were collected from medicinal plant garden of GES's Satara College of Pharmacy, Degaon, Satara and authenticated at the Department of Botany, from Yashwantrao Chavan Institute of Science, Satara. Analytical grade reagents like hydrochloric acid (HCl), sodium hydroxide (NaOH), Acetic Acid (CH_3COOH), ammonia (NH_3) and methyl red were procured from College of Pharmacy D.Pharm, Degaon, Satara.

Collection of fruits

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Authentication of plant

↓

Isolation of seeds

↓

Extraction of fruits

↓

Acid base titration

↓

Compared with standard indicator (Methyl Red) [2]

Result and Discussion

For all types of titrations equivalence point obtained by ethanolic extract of *Argyreia cuneata* was found to be nearly closed with equivalence point obtained by standard indicator methyl red. This represents the usefulness of alcoholic fruit extract as an indicator in acid-base titration.

Table 1: Technological characterization for analysis and comparisons of color change [4, 5]

Titrant	Titrate	Standard (pH range)	Indicator color change (pH range)
HCl	NaOH	Yellow to Red (9-4)	Pink to greenish yellow(2-7)
HCl	NH_4OH	Yellow to Red(9-4)	Pink to greenish yellow(2-7)
CH_3COOH	NaOH	Yellow to Red(9-4)	Pink to greenish yellow(2-7)
CH_3COOH	NH_4OH	Yellow to Red(9-4)	Pink to greenish yellow(2-7)

Table 2: Parameters used for experiment and the results of screening of *Argyreia cuneata*

Titration (titrant v/s titrate)	Strength (M)	Indicator	Mean of three titration ± S.D
	0.1	Methyl red	10.06±0.0577
		Flower extract	9.33±0.0577

HCl v/s NaOH	0.5	Methyl red	11.76±0.0577
		Flower extract	9.83±0.0577
	1	Methyl red	10.26±.1527
		Flower extract	11.6±0.1
	5	Methyl red	11.2±0.0577
		Flower extract	11.53±0.0577

Table 3: Parameters used for experiment and the results of screening of *Argyreia cuneata.*

Titration (titrant v/s titrate)	Strength (M)	Indicator	Mean of three titration ± S.D
HCl v/s NH_4OH	0.1	Methyl red	10±0
		Flower extract	9.56±0.0577
	0.5	Methyl red	12±0
		Flower extract	11.16±0.0577
	1	Methyl red	12.1±0
		Flower extract	11.96±0.0577
	5	Methyl red	12.76±0.1527
		Flower extract	13.03±0.0577

Table 4: Parameters used for experiment and the results of screening of *Argyreia cuneata.*

Titration (titrant v/s titrate)	Strength (M)	Indicator	Mean of three titration ± S.D
CH_3COOH v/s NaOH	0.1	Methyl red	9.03±0.0577
		Flower extract	8.63±0.0577
	0.5	Methyl red	8±0
		Flower extract	8.63±0.0577
	1	Methyl red	9.3±0.1
		Flower extract	9.83±0.0577
	5	Methyl red	10.06±0.0577
		Flower extract	11.33±0.1154

Table 5: Parameters used for experiment and the results of screening of *Argyreia cuneata.*

Titration (titrant v/s titrate)	Strength (M)	Indicator	Mean of three titration ± S.D
CH_3COOH v/s NH_4OH	0.1	Methyl red	10.5±0
		Flower extract	10.13±.1527
	0.5	Methyl red	9.76±0.0577
		Flower extract	10.76±0.0577
	1	Methyl red	9.8±0.1
		Flower extract	10.06±0.0577
	5	Methyl red	10.76±0.0577
		Flower extract	10.96±0.1527

Conclusion

From results obtained in all types of acid-base titrations lead us to conclude that, the synthetic indicators could be replaced successfully by fruit extract. As they are easily available, cheap, accurate and precise and can be prepared just before the experiment by simple maceration process.

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