

Flower Sap: A Natural Resource As Indicator In Acidimetry And Alkalimetry

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Abstract: Today synthetic indicators are the choice of acid base titrations. But due to environmental pollution, availability and cost, the search for natural compounds as an acid base indicator was started. The present vocation highlights the exploit of the acidified methanolic and aqueous extract of the flowers of few medicinal plants as an acid base indicator in acid base titrations. Natural indicator is easy to prepare as well as they are easily available. Promising results were obtained when it was tested against standard synthetic indicators.

Titration shows sharp colour change at the equivalence point. The equivalence points obtained by the flower extract coincide with the equivalence points obtained by standard indicators. In case of weak acid and weak base titration the results obtained by the flower's extract matched with the results obtained by mixed indicator. Thus natural indicator is found to be a very useful, economical, simple and accurate for the said titrations.

Keywords :- Acid base indicator, Natural indicator, Anthocyanins, titration.

Introduction

The almighty God has bestowed this creativity on this planet in various life forms. Each creation is unique and distinguished from the other. The creativity of God has crossed all the milestones when he designed the flowers. The amazing colour combinations, shapes and sizes of flowers leave us in wonder. They increase the beauty of surroundings, provide calmness to the eyes and their sweet fragrance spread positivity in the air. They contribute in making food items, scents and even medicines. Flowers also attract the insects for pollination. Thus flowers are miracle of the nature, by the God, for the world.

But, eyes of chemists perceive flowers as a complete chemical entity which is composed of different chemical compounds. By the years of research on them, the great minds discovered that the fragrance in flowers is due to terpenes and terpenoids. Their colour is due to flavones,

flavanols, anthocyanins etc. While their nectar is a mixture of sweet carbohydrates. Digging deeper into the chemistry of flowers their mystery gets the world witness many application where flowers can be used. One such application is the use of flower sap in acidimetry and alkalimetry as an indicator.

Almost any flower such as blue, purple or red in colour contain a class of organic pigment called anthocyanins that change colour with pH. The use of natural dyes as acid- base indicator was first reported in 1664 by Sir Robert Boyle in his collection of essays "Experimental History Of Colours." According to Mendham (2004)¹ the term titrimetric analysis refer to quantitative chemical analysis carried out by determining the volume of solution of accurately known concentration which is required to react quantitatively with a measured volume of a solution of the substance to be determined. The addition is made until reaction is complete. This is called the end point or equivalence point of the reaction. The end point is

detected by using a chemical compound known as an indicator. This indicator may be used internally or externally. Many acid base titration themselves indicate the end point of the reaction.

According to Lorraine (2002)² the two most commonly found flavanoid aglycones in *Hibiscus Rosa Sinensis* are quercetin and anthocyanin cyanidin. Geissman et al.,(1962)³ the term flavonoids to embrace all compounds whose structure is based on flavone. Thus the anthocyanins are group of flavonoid compounds.

According to Vishwas et al (2008)⁴the extract was preserved in tightly closed container and stored away from direct sunlight.

As reported by Pathade (2009)⁵ the intention behind this study is simply to bring in market the use of plant pigments and to increase the wealth of traditional medicinal system of India which is mostly plant based and to help farmers regarding cultivation, collection of plants as well as to industry regarding preparation of natural indicators.

Anthocyanidins (anthocyanins) are notable plant pigment, which are responsible for red violet-blue colour seen in plant flowers Harborne (1998)⁶.

According to Vankar (2008)⁷ the appearance of red color is due to presence of flavonoids,phenols and anthocyanins.

Anthocyanins may serve as pH indicators in the presence of acids or alkalies .

Hibiscus is a genus of flowering plants in the mallow family, malvaceae. It is quite large, containing several hundred species that are native to warm temperate, subtropical and tropical regions throughout the world. Member species are often noted for their showy flower and are commonly known as hibiscus, sorrel, and flor de Jamaica, or less widely known as rosemallow. The genus includes both annual and perennial herbaceous plant as well as woody shrubs and small trees. The generic name is derived from the Greek word (Hibiskos) which was the name Pedanius Dioscorides (Ca 40-90) gave to *Althaea officinalis* (Lawton 2004)⁸.

Material And Methods

Identification and collection of China rose

China rose was identified from the flora of Botany Department of the Holkar Science College Indore. Flowers were collected during winter and spring

season. China rose was collected for the purpose of study of natural indicator. It is available throughout the year. Fresh petals were collected in the month of January and February because it is the blooming season of these plants. Natural indicator can be isolated from the China rose. Several plant pigments like Anthocyanin, Flavonoids occur in petals of these flowers which acts like natural indicator. Flowers were cleaned by distilled water and petals of these flowers were kept in strong sunlight until they get completely withered. The dried petals were grinded into fine powder with a mechanical blender. Dried powder of petals were soaked in 40 ml methanol for 48 hours and then triturated in mortar and pestle and the resulting solution was filtered through muslin cloth. The resulted methanolic extract was further used as natural indicator for acidimetry and alkalimetry. The extract was preserved in light closed container and stored away from direct sunlight. Following the similar process aqueous extract of dried pulverized petals was prepared, filtered and used as natural aqueous indicator. Analytical grade HCl, NaOH, CH₃COOH, NH₄OH, phenolphthalein, methyl orange, and phenol red were made available by the Department of Chemistry, Government Holkar Science College, Indore. Reagents and volumetric solutions were prepared as per standard. The experimental work was carried out by using the same set of glasswares for all types of titration.

As the same aliquots were used for both titrations the standard indicator, floral extract and the reagents were not calibrated. The equinormal titrations were performed using 10 ml of titrant with five drops of natural indicator.

A set of four experiments each for all the types of acid base titrations were carried out. The t-value and standard deviation for each type of acid base titrations were calculated from results obtained.

Results And Discussion

The flower was screened for its use as an indicator in acid base titration and the results were compared with the results obtained by standard indicators phenolphthalein, methyl orange and phenol red. The results of the screening for strong acid-strong base (HCl & NaOH),strong acid- weak base (HCl & NH₄OH), weak acid-strong base (CH₃COOH & NaOH),weak acid –weak base (CH₃COOH & NH₄OH) are listed in table A & B.

TABLE A- Colour change in titration

Titrant	Titrand	Indicator colour changes and PH range		
		Standard	Methanolic floral extract of HRS	Aqueous floral extract of HRS
HCl	NaOH	Colourless to pink (PH)	Pink to green	Pink to greenish yellow
HCl	NH ₄ OH	Pink to yellow (MO)	Pink to dark green	Pink to dark green
CH ₃ COOH	NaOH	Colourless to pink (PH)	Pink to yellow	Pink to yellow
CH ₃ COOH	NH ₄ OH	Yellow to red (PR)	Pink to green	Pink to green

Keyword :- PH = Phenolphthlein, MO = Methyl orange, PR = Phenol red, HRS = Hibiscus Rosa sinensis

The strength of acid and bases (HCl, CH₃COOH, NaOH, NH₄OH) taken were **1.0N, 0.1N, and 0.5N**. Four different types of titration performed were strong acid/strong base, strong acid/weak base, weak acid/strong base, and weak acid/weak base. The titrant v/s titrand were NaOH v/s HCl, NH₄OH v/s HCl, NaOH v/s CH₃COOH, NH₄OH v/s CH₃COOH.

The colour changed from pink to green in the case of methanolic floral extract of Hibiscus Rosa sinensis as natural indicator and the colour changed from pink to greenish yellow in the case of aqueous floral extract of Hibiscus Rosa sinensis as natural indicator. The standard deviation ranged from ± 0.05 to ± 2.9 in methanolic floral extract and aqueous floral extract of Hibiscus Rosa sinensis. The results obtained showed that the routinely used indicator can be replaced successfully

Titration Titrant V/s Titrand	Strength in normality	Methanolic floral extract of HRS as natural indicator	t value \pm S.D*	Aqueous floral extract of HRS as natural indicator	t value \pm S.D*
NaOH v/s HCl	1.0	PH v/s MFE	0.2299 \pm 0.53	PH v/s AFE	0.1564 \pm 0.26
	0.1	PH v/s MFE	0.4482 \pm 0.09	PH v/s AFE	1.3468 \pm 0.09
	0.5	PH v/s MFE	0.4650 \pm 0.35	PH v/s AFE	0.8577 \pm 0.11
NH ₄ OH v/s HCl	1.0	MO v/s MFE	0.0470 \pm 0.05	MO v/s AFE	2.1290 \pm 0.05
	0.1	MO v/s MFE	1.2647 \pm 0.25	MO v/s AFE	0.4475 \pm 0.09
	0.5	MO v/s MFE	0.4475 \pm 0.09	MO v/s AFE	1.7964 \pm 0.09
NaOH v/s CH ₃ COOH	1.0	PH v/s MFE	1.0917 \pm 0.33	PH v/s AFE	0.3638 \pm 0.67

by floral extract. The table represents t value and standard deviation for four type of titration.

TABLE-B- Statistical Data Of Methanolic And Aqueous Floral Extract Of HRS As Natural Indicator For Acid Base Titration

	0.1	PH v/s MFE	0.2772 \pm 0.14	PH v/s AFE	0.0447 \pm 0.09
	0.5	PH v/s MFE	0.8956 \pm 0.09	PH v/s AFE	2.1226 \pm 0.05
NH ₄ OH v/s CH ₃ COOH	1.0	PR v/s MFE	0.4045 \pm 0.20	PR v/s AFE	0.7256 \pm 0.22
	0.1	PR v/s MFE	0.0446 \pm 0.09	PR v/s AFE	2.1231 \pm 0.05
	0.5	PR v/s MFE	0.2426 \pm 0.16	PR v/s AFE	2.1231 \pm 0.05

*All values are t value \pm S.D. for n = 4

Keyword:- HCl : Hydrochloric acid, CH₃COOH : Acetic acid, NaOH : sodium hydroxide, NH₄OH : Ammonium hydroxide, PH : Phenolphthlein, MO : Methyl orange, PR : Phenol red, MFE : Methanolic floral extract, AFE : Aqueous floral extract, HRS : Hibiscus Rosa Sinensis.

Conclusion

The results obtained in all the types of acid base titrations lead us to conclude that due to the presence of flavonoids sharp colour changes, which occurred at end point of titrations. The standard deviation calculated for synthetic indicator and methanolic and aqueous floral extract of natural indicator shows very less variation in the results. Thus statistically also the use of natural indicator in acid base titration is proved. As the methanolic and aqueous floral extract provide similar results hence methanolic and aqueous floral extract can be used with cent percent reliability and accuracy for acid base titration. Thus the use of natural indicator in acid base titration is more beneficial because of its economy, easy to prepare, simplicity, easy availability, pollution free inert and accurate results.

Acknowledgement

Creation is quite a difficult task in this world, it becomes more hedious without God's inspiration,

References

1. Mendham J., Denny R.C., Barness J.D., Thomas M. Vogel. (2004). A Textbook of Quantitative Chemical Analysis. 6th ed. New Delhi 10. 29, 335 – 339.
2. Lorraine S., Puckhaber Robert D., Stipanovic and Georgia, A. (2002). Trends in new crops and new use. J. Janick and A. Whipkey ASHS Press Alexandria. 556-563.
3. Geissman (1962).The Chemistry of Flavonoid compounds Pergamon.
4. Vishwas C. Bhagat, R.D., Patil, P.R. Channekar, Shetty S.C., Akarte A.S. (2008) International Journal Green Pharm ; 2:162.
5. Pathade K.S., Patil S.B., Kondawar M.S., Naikwade N.S. and Magdum C.S. (2009). Morus Alba Fruit Herbal alternative to synthetic acid base indicators. International Journal of Chem Tech Research CODEN (USA) Vol. 1 No. 3, 549-551.
6. Harborne J.B. (1998) Phytochemical methods Third ed. Thompson Science, London 107-150.
7. Vankar P.S., Srivastava J. (2008). International Journal of Food Engineering, 4(3), 1-17.
8. Lawton, Barbara perry (2004) Hibiscus : Hardy and Tropical plants for the garden. 86 – 94.
