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Research Article

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Natural indicator as a eco-friendly in acid base titration

Shivaji H. Burungale* and Ankush V. Mali

Yashwantrao Chavan College of Science, Karad, Maharashtra, India

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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 Euphorbia mili, Erythrina varigata and Nelumbo nucifera methanolic and aqueous extract of the flowers of plants as an acid-base indicator in titrations. This natural indicator is easy to extract as well as easily available. Promising results were obtained when it was compared against standard synthetic indicators. Titration shows sharp color change at the equivalence point. The equivalence points obtained by the flowers extract coincide with the equivalence points obtained by standard indicators. These natural indicators are found to be a very useful, economical, simple, accurate and eco-friendly.

Keywords: *Euphorbia mili*, *Erythrina varigata* and *Nelumbo nucifera*, Natural acid base indicator.

INTRODUCTION

Literature survey revealed that, many researchers have conducted studies on isolation, separation [1-3] and characterization of compounds present in plants and animals and they also studied the extractions procedures, optimization of extraction conditions to get pure and maximum yield of naturally occurring compounds from different parts of plants. Literature survey also shows that chemists are studying the medicinal [4-12] bacteriological and anti-oxidant [13] activities of the extracted compounds. Saxena [14] and coworkers studied the antifungal activity from melilotus indica extract while Meera Harit [15] successfully carried out the antifungal activity of unsaponifiable fraction of fixed oils of Trischosanthes seeds. The colour changed from pink to greenish yellow in the case of aqueous floral extract of Hibiscus rosa sinensis as natural indicator and the colour changed from pink to green in the case of methanolic floral extract of Hibiscus rosa[16]. Flower Extract of Jacaranda acutifolia used as a natural indicator in acid base titration [17]. In this experiment, some of these indicators will be extracted and the pH at which the indicators change color will be investigated. Many substances around us that can be used as an indicator of acid and alkali. For example, leaf, flower, turmeric, mangosteen skin, and purple cabbage. This is because the solution of these materials give a different color on acid, alkali and neutral. Erythrina varigata is an evergreen shrub reaching up to four meters in height and belongs to the family–Fabaceae, is a shrub or occasionally tree distributed in tropical Asia. Erythrina varigata is cultivated worldwide as an ornamental plant. It is native to the Mediterranean region and is also found in Southern Europe and Southwest Asia, but is naturalizing very easily and in many areas the plant is sub-spontaneous. Leaves are 5 to 10 cm. long, narrow shortly petiolate, with a curvaceous dark green blade narrow, untouched, short-stalked and dark or grey- green in color. Euphorbia mili (crown of thorns, Christ plant, and Christ thorn) is a species of flowering plant in the spurge family Euphorbiaciae, native to Madagascar. The species name commemorates Baron Milius, once Governor of Reunion, who introduced the species to France in 1821. Nelumbo nucifera known by numerous common names including Indian lotus, sacred lotus, bean of India, or simply lotus, is one of two species of aquatic plant in the family Nelumbonaceae.

The present study reported the use of flower extract of an Erythrina varigata, euphorbia mili and Nelumbo nucifera in acid base indicator in different types of acid base titrations. The equivalence points obtained by the flower extract

coincident with the equivalence points obtained by standard indicators. The results obtained by the flower extract matched with the results obtained by mixed indicator in case of weak acid and weak base titration. This natural indicator was found to be a very useful, economical, simple and accurate for the said titration.

EXPERIMENTAL SECTION

A digital pH meter with glass and calomel electrodes, a stock a solution of 0.1N HCl 8.9 mL diluted with 1000 mL distilled water, 4g NaOH dissolved in about 1000 mL distilled water, 0.1 N CH_3COOH and 0.1N NH_4OH methyl red, phenolphthalein, methyl orange, flower extract of Erythrina varigata, euphorbia mili and Nelumbo nucifera, known by numerous common names including Indian lotus, sacred lotus, bean of India, or simply lotus, is one of two species of aquatic plant in the family Nelumbonaceae. Whatman filter paper No.41. The apparatus such as volumetric flasks (100 mL, 500 mL and 1000 mL), conical flask with volume size of 125 mL, burette of 50 mL, and graduated measuring cylinders of volume size 10, 20, 25 and 100 mL were used to carried out the experiment.

i. Preparation of Flower Extract

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 and then triturated in mortal and pestal and the resulting solution was filtered through muslin cloth. The resulted aqueous extract was used as natural indicator for acidimetric and alkalimetery. The extract was preserved in light closed container and stored away from direct sunlight. Following the similar process methanolic extract of dried pulverized petals was prepared, filtered and used as natural methanolic indicator. Reagents and volumetric solutions were prepared as per standard. The experimental work was carried out by using the same set of glassware's for all types of titration. As the same aliquots were used for both titrations the standard indicator, flower extract and the reagents were not calibrated. The equinormal titrations were performed using 10 ml of titrant with five drops of natural indicator.

Table 1.- Colour change in titration

Titrant Titrand	Synthetic Indicators	Color Change	pH	Natural Indicators	Color Change	pH
HCl vs NaOH	MR	Pink to Yellow	4.2-4.6	EM	Pink to green	12.0-6.30
	MO	Orange to Pink	3.1-4.4	EV	Pink to green	11.45-5.0
	PT	Colorless to Pink	8.3-10.0	NN	Colorless to green	11.80-4.3
HCl vs NH_4OH	MR	Pink to Yellow	4.2-4.6	EM	Pink to green	10.0-6.45
	MO	Orange to Pink	3.1-4.4	EV	Pink to green	9.45-4.2
	PT	Colorless to Pink	8.3-10.0	NN	Colorless to green	9.80-4.9
CH_3COOH vs NaOH	MR	Red to Orange	4.2-4.6	EM	Pink to green	12.0-6.30
	MO	Yellow to Red	3.1-4.4	EV	Pink to green	11.45-5.0
	PT	Colorless to Pink	8.3-10.0	NN	Colorless to green	11.80-4.3
CH_3COOH vs NH_4OH	MR	Pink to Yellow	4.2-4.6	EM	Pink to green	10.0-6.45
	MO	Orange to Pink	3.1-4.4	EV	Pink to green	9.45-4.2
	PT	Colorless to Pink	8.3-10.0	NN	Colorless to green	9.80-4.9

MR= Methyl Red, MO= Methyl Orange, PT= Phenolphthalein, EM= Euphorbia Mili, EV= Erythrina Varigata NN=Nelumbo Nucifera.

ii. Effect of diverse ions: The tolerance limit was set at the amount of diverse ions required to cause a ±2% error in the end of the titration. Most of the s block cations showed very high tolerance limit in the titration of acid and base. Amongst the p and d block cations also showed very high tolerance limit in the titration of acid and base. The tolerance limit shown as in the table No.2

Table No.2 -Effect of diverse ions

Cations	Tolerance limit in mg	Cations	Tolerance limit in mg	Cations	Tolerance limit in mg
Li^+	25	B^{3+}	5	V^{3+}	20
Na^+	22	Al^{3+}	10	Cr^{3+}	25
K^+	35	Ga^{3+}	30	Mn^{2+}	22
Rb^+	40	In^{3+}	45	Fe^{3+}	24
Cs^+	42	Tl^{3+}	55	Co^{3+}	28
Mg^{2+}	15	Pb^{2+}	10	Ni^{2+}	30
Ca^{2+}	24	Sb^{3+}	5	Cu^{2+}	32
Ba^{2+}	15	Bi^{3+}	18	Zn^{2+}	35

RESULTS AND DISCUSSION

The results obtained in all the types of acid-base titrations lead us to conclude that, it was due to the presence of flavonoids sharp color changes occurred at end point of the titrations. Neutralization points obtained by methanolic extract of Euphorbia mili, Erythrina varigata and Nelumbo nucifera is very closed with equivalence point obtained

by standard indicators phenolphthalein, methyl red and methyl orange. This represents the usefulness of alcoholic flower extract as an indicator in acid base titrations. Titrate and titrant with indicators showed sharp and intense color change at the equivalence point that is at neutralization. Its use in strong acid-strong base titration was found to be more significant over standard indicator as it gives sharp color change at equivalence point as results obtained showed that the routinely used indicators could be replaced successfully by flower extract as they are simple, accurate, economical and precise and can be prepared just before experiment. The proposed herbal indicators can be used as a substitute to synthetic indicators. We can also conclude that, it is always beneficial to use Euphorbia mili, Erythrina varigata and Nelumbo nucifera flowers extract are used in acid base titrations because of its economy, simplicity and wide availability.

CONCLUSION

The synthetic indicators are very hazardous to health and cause pollution therefore to solve this problem floral extract has been selected as a source of indicator for acid base titration. The accuracy of results has been judged by performing a variety of acid base titration. The results were obtained by methanolic and aqueous extract of Euphorbia mili, Erythrina varigata and Nelumbo nucifera. Thus the use of natural indicators in acid base titration is more beneficial because of their economy, easy to prepare, simplicity, easy availability, eco-friendly pollution free, inert and accurate results.

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