

MURRAYA KOENIGII FRUIT EXTRACT AS HERBAL SUBSTITUTE FOR HAZARDOUS INTERNAL INDICATORS IN VOLUMETRIC ANALYSIS

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Abstract: Indicators used in neutralization titration show well marked changes of colour in certain intervals of pH. Most of these indicators are organic dyes and are of synthetic origin. 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 *Murraya Koenigii* fully ripened fruit extract as a pH indicator in strong acid-strong base and weak acid-weak base titrations. This natural indicator is easy to prepare as well as easily available. The results showed that the fruit extract of *Murraya Koenigii* indicator is colourless in acidic solution, while greenish yellow in basic solution. The comparison indicators used in this research were methyl red, methyl orange and phenolphthalein. Promising results were obtained when it was compared against standard synthetic indicators. Volumetric titrations between acid and base shows sharp colour change at the equivalence point. The equivalence points obtained coincide with the equivalence points obtained by standard indicators. Therefore this natural indicator is found to be a very useful, economical, simple, accurate and eco-friendly for acid base titration.

Key words: Fruit Extract, *Murraya Koenigii*, Natural indicator, Acid base indicator, Equivalence point.

I. INTRODUCTION

Murraya Koenigii, a small tree, growing 3–4 m tall, with a trunk up to 12 inch diameter is a deciduous valuable plant for its characteristic aroma and medicinal value, originally from India. It is known by several names such as *karepaku*, *narasingha bishahari*, and *mitha neem*, curry tree¹. The Curry fruit grows on the evergreen curry tree and called as curry berries. The tree is botanically known as *Murraya Koenigii* and belongs to the *Rutaceae*, or citrus, family. Though not as commonly consumed, Curry berries are also edible and contain a large amount of vitamin C and anthocyanins as well as the minerals calcium, phosphorus, magnesium, and iron^{2, 3}. Curry berries are also being studied for their potential use as a natural treatment for diabetes. Curry berries can be eaten fresh as a snacking fruit. They can also be squeezed for their juice. Most commonly they are used to make a nutritional juice or tonic used in Ayurvedic medicine⁴. Though the seeds are toxic, they do contain an antibacterial and antifungal essential oil that is used in perfumery. Most commonly it is the leaves of the curry tree that are used^{5, 6}.

Apart from the uses of Curry plant and Curry berries mentioned above, in this study it was aimed to make Curry berries extract as neutralization indicator for strong acid-strong base and weak acid weak base titrations with the comparison against standard indicators viz. methyl orange, methyl red and phenolphthalein. The pulps of the fully ripened fruits, black with a very shining surface are pH sensitive and give different colors in acidic condition (colourless) and basic condition (greenish yellow) due to anthocyanin. Therefore it has been hypothesized that the fruit extract could be utilized as an indicator for strong acid strong base and weak acid weak base titration.

II MATERIALS AND METHODS

Materials:

Analytical grade reagents of MERCK Ltd. namely Hydrochloric acid (HCl), Acetic acid (CH₃COOH), Sodium hydroxide (NaOH), Ammonium hydroxide (NH₄OH), Phenolphthalein, Methyl red and Methyl orange were procured from the R. A. Arts, Shri M. K. Commerce and Shri S. R. Rathi Science College Washim (M.S.). Reagents and volumetric solutions were prepared as per Indian Pharmacopoeia. For production of acid base indicator from *Murraya Koenigii*, the fresh *Murraya Koenigii* fruits were collected from my home garden in the month of December 2018 and authenticated at Department of Botany, R. A. College -Washim (M.S.) and by botanical Software.

Preparation of acid base indicator solution:

Fully ripened black-violet berries of *Murraya Koenigii* (150 g) were washed with distilled water and crushed in a mortar with a pestle and then transferred its pulp into a beaker where seeds were rejected and thrown away. Next, a crushed black pulp was soaked with 120 mL ethyl alcohol for about 20 hours. The extract was filtered by Mussolini cloth, while the residue was re-extracted again using 30 ml of ethyl alcohol for 20 hrs. The resulting solution is filtered through cellulose double filter paper and fairly wine red coloured solution obtained was used as an indicator. Its pH range is (10.5-11.1) 10.5 at and below which it is colourless and 11.0 at and above which it is greenish yellow. The extract was stored in tightly closed dark bottle and kept away from the source of heat and direct sun light.

EXPERIMENTAL:

At room temperature the titrations of Strong acid-Strong base (HCl versus NaOH) and Weak acid-Weak base (CH₃COOH versus NH₄OH) both of equal concentrations i.e. 0.25 M, 0.50 M and 1.0 M was carried by using the same set of glassware for all titrations. As the same aliquots were used for all titrations i.e. titrations by using standard indicators phenolphthalein, methyl red, methyl orange and indicator under study, the reagents were not calibrated. The equimolar titrations were performed using 10 ml of titrant with 5 to 6 drops of indicator. The trials were repeated 3 times to check the precision. The end points of the titrations using the indicator under study were reached when colour changed from colourless to greenish yellow. The color changes for the indicators are listed in the Tables 1. The results of screening for strong acid-strong base and weak acid-weak base are recorded as mean \pm SD in Table 2.

When weak base was titrated with the weak acid, the acid was constantly stirred on a magnetic stirrer for better results. For titrations involving a weak acid-weak base our indicator was added in excess (1.5 mL).

Titrant	Titrate	Indicator	Colour at end point	PH range
HCl	NaOH	Phenolphthalein	Colorless To Pink	8.00 – 10.00
		Methyl Red	Pink To Yellow	4.2 – 6.2
		Methyl Orange	Orange To Yellow	3.0 – 6.3
		Murraya Koenigii Fruit's Extract	Colourless To Greenish Yellow	10.5 – 11.1
CH ₃ COOH	NH ₄ OH	Phenolphthalein	Colorless To Pink	8.00 – 10.00
		Methyl Red	Pink To Yellow	4.2 – 6.2
		Methyl Orange	Orange To Yellow	3.0 – 6.3
		Murraya Koenigii Fruit Extract	Colourless To Greenish Yellow	10.5 – 11.1

Table 1: Colour changes for the Indicators during Acid - Base Titrations

S.N.	Titration	Strength	Indicator	Mean Value of Titrations \pm SD
1	HCl Vs NaOH	0.25 M	Phenolphthalein	10.18 \pm 0.057
			Methyl Red	10.19 \pm 0.060
			Methyl orange	10.15 \pm 0.055
			Murraya Koenigii fruit's extract	10.19 \pm 0.150
		0.50 M	Phenolphthalein	10.18 \pm 0.072
			Methyl Red	10.17 \pm 0.063
			Methyl orange	10.19 \pm 0.060
			Murraya Koenigii fruit's extract	10.19 \pm 0.065
		1.00 M	Phenolphthalein	10.16 \pm 0.066
			Methyl Red	10.19 \pm 0.060
			Methyl orange	10.18 \pm 0.063
			Murraya Koenigii fruit's extract	10.17 \pm 0.059
2	CH ₃ COOH Vs NH ₄ OH	0.25 M	Phenolphthalein	-
			Methyl Red	10.95 \pm 0.075
			Methyl orange	11.09 \pm 0.099
			Murraya Koenigii fruit's extract	-
		0.50 M	Phenolphthalein	-
			Methyl Red	10.93 \pm 0.062
			Methyl orange	11.06 \pm 0.095
			Murraya Koenigii fruit's extract	-
		1.00 M	Phenolphthalein	-
			Methyl Red	10.93 \pm 0.070
			Methyl orange	11.02 \pm 0.069
			Murraya Koenigii fruit's extract	-

TABLE 2: EXPERIMENTAL SCREENING OF 'MURRAYA KOENIGII FRUIT EXTRACT' AS ACID BASE INDICATOR

III RESULTS AND DISCUSSION:

The ethanolic solution of proposed indicator *Murraya Koenigii* fruit's extract was screened for its use as an acid-base indicator and the results were compared with that obtained using phenolphthalein, methyl red and methyl orange for strong acid-strong base (HCl and NaOH), weak acid-weak base (CH₃COOH and NH₄OH) titrations. The equivalence point of the titrations using *Murraya Koenigii* fruit's extract is almost close or coincides with that of phenolphthalein, methyl red and methyl orange for strong acid-strong base titration but not in the titration of weak acid and weak base as shown in Table 2.

Acid base titrations were carried out to ensure that the proposed colour of standard indicators like phenolphthalein, methyl red and methyl orange etc. reappears in titrations even after reaching the end point, but this is not happen in the case of this *Murraya Koenigii* fruit's extract indicator. Therefore, use of alcoholic solution of this indicator could be effectively employed as a substitute to the strong acid-strong base indicators. In other words usefulness of this indicator in strong acid-strong base was found to be more significant over standard indicator as it gives sharp colour change and very slight standard deviation.

IV CONCLUSIONS:

It can be concluded that, the *Murraya Koenigii* fruit's extract showed different colour changes in acid and base solutions and its titration equivalent points (end-points) matched with standard indicator. Hence it is plausible to suggest *Murraya Koenigii* fruit's extract as alternative source to existing standard acid base indicators due to its advantages like economical, eco friendly, simple preparation, , reversible sharp colour change, effective performance and ability to produce accuracy and precision in results for strong acid-strong base titrations. However it is ineffective as indicator in case of weak acid weak base titrations.

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