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Rhoeo spathacea (Swartz) Leaf Extract as Indicator for Acid-Base Titration and Development of Litmus Paper



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ABSTRACT

Synthetic indicators are used for detection of end point of acid-base titration. Indicators help to detect the equivalence point of titration. Indicators show quick color change with respect to change in *pH*. *Rhoeo spathacea* (Sw.) belonging to family Commelinaceae studied for its indicator property. The methanolic extract of *Rhoeo spathacea* (Sw.) leaf extract is compared with that of previously present synthetic indicators used for different types of acid-base titrations. Present study shows the methanolic extract of *Rhoeo spathacea* (Sw.) gives an indicator property that is color change with respect to change in *pH*. Leaves were extracted using methanol, a specific volume was added which gave perfect and reliable results for all the four different types of neutralization titrations - strong acid against strong base, strong acid against a weak base, weak acid against strong base and weak acid against weak base. By using this extract developed litmus paper which shows color changed in alkaline medium.

INTRODUCTION

Rhoeo spathacea is common known as Oyster plant, boat lily, Moses-in-a-boat. *Rhoeo spathacea* originated from West Indies, Mexico, Central America. It is fleshy or luscious perennial garden herb with short, heavy unbranched stem nearly unseen by overlapping leaf base belonging to family Commelinaceae. Forms clumps by branch from fleshy rootstock. Leaves are developed vertical, overlapped in spiral patterns formed rosette are sword like. Leaves are linear, sharp tipped, rigid, waxy 3-5 cm wide and 15 to 45 cm long. Upper surface of leaf is dark green or green and lower surface is purple reddish in color. Tiny white flower clustered at the leaf axils and lodged inside the boat shaped bract, fruit a 2-seeded capsule, in clusters within the bracts. [1, 2]

Anthocyanins are the widespread natural pigments and found in large variety of fruits, vegetables and flower. *Rhoeo spathacea* leaves are the source of anthocyanines, which is popularly used as natural food colorants. [3, 4] *Rhoeo spathacea* shows cytotoxic, [5] antibacterial and antioxidants,[6] anti-inflammatory [7].

Indicators are substances whose solutions change color due to changes in pH. Methanolic extract of *Rhoeo spathacea* leaves is tested for acid-base indicator.

2. MATERIALS AND METHODS

2.1 Plant Materials

The fresh flowers and leaf of *Rhoeo spathacea* (Sw.) were collected from the Medicinal garden of Ashokrao Mane College of Pharmacy, Peth-Vadagaon, Taluka-Hatkanagle, District-Kolhapur on 29/01/2019. The flowers and the plant parts were identified and authenticated at Department of Botany, Yashwantrao Chavan Warana Mahavidyalaya, Warananagar with reference to Flora of Kolhapur District PP 508.

2.2 Reagents

All the reagents and chemical used for study were of analytical grade provided by Ashokrao Mane College of Pharmacy, Peth-Vadagaon. All the volumetric solutions and reagents were prepared as per Indian Pharmacopoeia 1996.

2.3 Glass Wares

The glassware like burettes, pipettes, volumetric flask used for the experiment was calibrated as per the standard procedures in as per Indian Pharmacopoeia 1996.

2.4 Preparation of Flower Extract

Rhoeo spathacea (Sw.) leaves were collected washed and dry for 3 hours at room temperature. *Rhoeo spathacea* (Sw.) leaves are cut into small pieces, weigh 10 gm and soaked into methanol for 24 hours for extraction of pigment present in leaf. Then after 24 hours solution is filtered to get pure methanolic extract of *Rhoeo spathacea* (Sw.) leaves which we can use as natural indicator. [8]

2.5 Preparation of Litmus Paper

Whatman filter paper (45) were cut into small strips and soaked in extract of flower for 24 hours for development of litmus paper. After 24 hours strips of Whatman filter paper is removed from extract and dried at room temperature. [9]

3. RESULTS AND DISCUSSION

The experiment was carried by using the same set of glassware's for all types of titrations. As the same aliquots were used for both titrations i.e., titrations by using phenolphthalein and leaf extract. The reagents were not calibrated. The equimolar titrations were carried using 10 ml of titrate with three drops of standard indicator and flower extract. The titration of strong acid-strong base, strong acid-weak base, weak acid-strong base, weak acid-weak base was carryout. All these parameters are shown in Table-1. For all titrations the equivalence point obtained by the flower extract matched with the equivalence point obtained by standard indicators. A set of five reading was carried out and mean of reading and standard deviation were calculated from reading Table-2. Stability of indicator color was checked after every hour. Developed litmus paper shows color changed in alkaline medium. Fig.-1

Table-1: Parameters Used For Analysis and the Comparison of Color Change.

Titrant	Titrate	Indicator Color Change	Standard Flower Extract
HCl	NaOH	Pink to Colorless	Faint Yellow to Colorless
HCl	NH ₄ OH	Pink to Colorless	Faint Yellow to Colorless
CH ₃ COOH	NaOH	Pink to Colorless	Faint Yellow to Colorless
CH ₃ COOH	NH ₃	Pink to Colorless	Faint Yellow to Colorless

Table 2: Screening Results of various titrations.

Sr. No.	Titration (Titrant v/s Titrant)	Strength in Moles (M)	Indicator	Readings with S.D. (±)
1	HCl V/S NaOH	0.1	Leaf Extract	6.14±0.04
			Phenolphthalein	6.90±0.02
		0.5	Leaf Extract	9.08±0.06
			Phenolphthalein	9.98±0.04
		1	Leaf Extract	8.68±0.04
			Phenolphthalein	9.80±0.02
2	HCl V/S NH ₄ OH	0.1	Leaf Extract	6.02±0.04
			Phenolphthalein	6.94±0.05
		0.5	Leaf Extract	8.05±0.02
			Phenolphthalein	9.02±0.06
		1	Leaf Extract	10.27±0.06
			Phenolphthalein	10.32±0.07
3	CH ₃ COOH V/S NaOH	0.1	Leaf Extract	8.02±0.06
			Phenolphthalein	19.98±0.04
		0.5	Leaf Extract	9.05±0.06
			Phenolphthalein	15.82±0.065
		1	Leaf Extract	10.08±0.05
			Phenolphthalein	20.82±0.06
4	CH ₃ COOH V/S NH ₃	0.1	Leaf Extract	20.62±0.04
			Mixed indicator	20.38±0.04
		0.5	Leaf Extract	12.84±0.06
			Mixed indicator	12.54±0.05
		1	Leaf Extract	13.08±0.09
			Mixed indicator	14.72±0.05

Mean of 5 reading

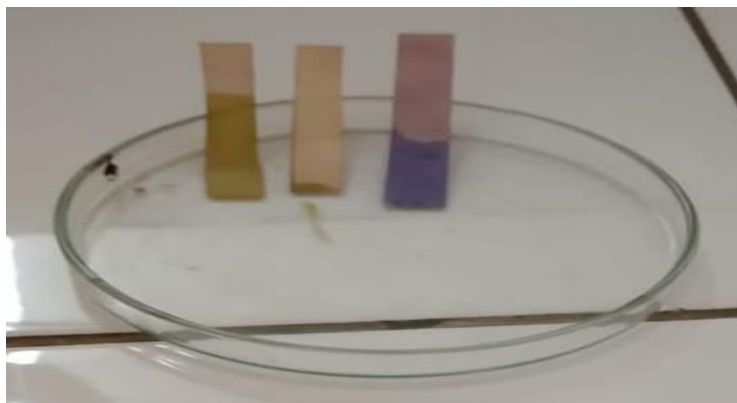


Fig.1 Developed litmus paper

4. CONCLUSION

Rhoeo spathacea (Sw.) leaves extract single-handedly can serve the purpose of indicator in weak acid and weak base titration, where generally mixed indicators are employed. Another benefit of this titration is that it gives colored end point at the equivalence point with stability of result after 12 hours. Litmus paper also developed which shows color changed in alkaline medium. The preparation of indicator and litmus paper was very easy and students can easily prepare and used in college laboratory. From results it can be concluded that it shows sharp color change occurs at the end point and because of economy, availability and better alternative to synthetic indicator and litmus paper.

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