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Use of Bombax Malabaricum Flower Extract as a Natural Indicator in Acid Base Titration

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ABSTRACT

Bombax malabaricum is a species of the bombax genus, belonging to the family malvaceae. The present work highlights the use of Bombax malabaricum flower extract as an 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. In case of weak acid and weak base titration, the results obtained by the flower extract matched with the results obtained by mixed indicator. This natural indicator was found to be a very useful, economical, simple and accurate for the said titration.

Key Words: Bombax malabaricum, Acid base indicator, Natural indicator.

INTRODUCTION

Bombax malabaricum**,** also known as Rakta shalmali, Silk cotton tree, Deokapas, Shimal, Tambdi-savaru, Lal katyan, is a species of the Bombax genus, belonging to the family malvaceae[1]. It grows in the hotter forest region of India, Ceylon, China Java and Sumatra. In pakistan it is found in Hazara and other parts of North west Frontier province and also in Sindh province[2,3]. A lofty, deciduous tree butteressed at the base, up to 40 m in height and 6 m or more in girth, with a clear bole of 24-30m. Leaves large, spreading, glabrous, digitate. Flower numerous, fleshy, clustered at end of branches, appearing before the new leaves[4].

Bombax malabaricum found to contain pelargonidin, β-sitosterol, quercetin, kaempferol as the major chemical constituents[1]. The flowers of Bombax malabaricum are deeply red. The appearance of red color is due to presence of flavonoids, phenols and anthocyanins[5].

The dry flowers with poppy seeds, goat's milk and sugar are boiled and are given in haemorrhoids, bark is used externally in inflammations and cutaneous eruptions. Root is stimulant, slightly diuretic, astringent to bowels. Flowers and fruit in combination with other drugs is used in snake-bite[6]. Leaves ground and mixed with milk are given for strangury. Gum is bitter, astringent, styptic, aphrodisiac and used in diarrhea, dysentery, menorrhagia. A decoction of the root with fermented rice is used in the treatment of gonorrhea and amenorrhoea. The plant is also considered to be demulcent, diaphoretic and diuretic[7].

The biological activities of plant have been extensively reviewed. Some of them have been found to possess Antiangiogenic[8], Antioxidant[9], Antihypertensive[10], Antimicrobial[11] , antitumor activities[12].

Flavonoids have also been found to inhibit a wide range of enzymes involved in oxidation systems such as 5–lipoxygenase, cyclooxygenase, monooxygenase, or xanthine oxidase[13].

As flavonoids, anthocyanins are present in flowers of Bombax malabaricum and are pH sensitive[14]; it was hypothesized that the flower extract could be utilized as an indicator for different types of acid base titrations. Hence the flavonoids were extracted, and identified for their potential use as an acid base indicator in various acid base titrations.

MATERIAL AND METHODS

Analytical grade reagents were made available by Shree Santkrupa College of Pharmacy, Ghogaon. Reagents and volumetric solutions were prepared as per standard books[15,16]. Bombax malabaricum flowers were collected from plants growing wild in the hilly region of Ghogaon (Karad) and authenticated from prof. B.D. Mohite, Department of Botany Sant. Gadge Maharaj College of Science, Karad.

The flowers were collected. The fresh petals were cut into small pieces and were kept at room temperature. The petals were dried to minimize oxidative loss before grinding into fine powder with a mechanical blender. The resulting powder were extracted with methanolic hydrochloric acid and the anthocyanins were converted into their corresponding soluble chlorides. From this solution, anthocyanins were isolated by using ether[17]. Finally extract was filtered and used as indicator.

The experimental work was carried out by using the same set of glasswares for all type of titrations. As the same aliquots were used for both titrations i.e. titration by using standard indicators and flower extract, the reagent were not calibrated. The equimolar titrations were performed using 20 ml of titrant with three drops of indicator. All the parameters for experiment are given in Table **1**. A set of five experiments was carried out and mean and standard deviation were calculated from results.

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

Titrant	Titrate	Indicator Color Change	
		Standard (pH range)	**Flower Extract (pH range)**
HCl	NaOH	Yellow to Red (8.8-3.8)	Green to colorless (9 - 4.16)
HCl	NH_4OH	Pink to Colorless (8-3.5)	Green to colorless (8 -4.50)
Oxalic acid	NaOH	Pink to Colorless (9 -4.5)	Green to colorless (9-5.22)
Oxalic acid	NH_4OH	Blue-green to Orange (7.8-4 .5)	Green to colorless (8-5.12)

HCl: -Hydrochloric Acid, NaOH:-Sodium Hydroxide, NH4OH:-Ammonium Hydroxide.

Table 2: Screening Results of various titrations.

Sr. No.	Titration (Titrant v/s Titrate)	Strength in Moles	Indicator	Readings with S.D. (+/-)
1	**HCl V/S NaOH**	0.1	Methyl red	20.2 +/- 0.15
			Flower extract	20.1 +/- 0.17
		0.5	Methyl red	20.3 +/- 0.11
			Flower extract	20.2 +/- 0.20
		1	Methyl red	20.2 +/- 0.17
			Flower extract	20.1 +/- 0.20
2	**NH_4OH V/S HCl**	0.1	Phenolphthalein	10.2 +/- 0.10
			Flower extract	10.3 +/- 0.20
		0.5	Phenolphthalein	10.3 +/- 0.17
			Flower extract	10.1 +/- 0.20
		1	Phenolphthalein	10.4 +/- 0.17
			Flower extract	10.3 +/- 0.10
3	**Oxalic Acid V/S NaOH**	0.1	Methyl red	20.5 +/- 0.17
			Flower extract	20.6 +/- 0.20
		0.5	Methyl red	20.8 +/- 0.10
			Flower extract	20.6 +/- 0.10
		1	Methyl red	20.6 +/- 0.17
			Flower extract	20.4 +/- 0.17
4	**Oxalic Acid V/S NH_4OH**	0.1	Mixed indicator	9.8 +/- 0.20
			Flower extract	9.7 +/- 0.26
		0.5	Mixed indicator	9.6 +/- 0.20
			Flower extract	9.8 +/- 0.26
		1	Mixed indicator	9.7 +/- 0.10
			Flower extract	9.8 +/- 0.17

HCl: - Hydrochloric Acid, NaOH: - Sodium Hydroxide,
NH_4OH:- Ammonium Hydroxide. S.D.:- Standard Deviation.

RESULT AND DISCUSSION

The flower extract was screened for its use as an acid base indicator in various acid base titrations, and the results of this screening compared with the results obtained by standard indicators methyl red, phenolphthalein and mixed indicator [methyl orange: bromocresol green (0.1:0.2)] for strong acid v/s strong base (HCl and NaOH), Strong acid v/s weak base (HCl and NH_4OH), weak acid v/s strong base (Oxalic acid and NaOH), and weak acid v/s weak base (Oxalic acid and NH_4OH) titrations respectively[18]. All these parameters are shown in Table **1**. For all titrations the equivalence points obtained by the flower extract matched with the equivalence points obtained by standard indicators. The results of screening were listed in Table **2**.

CONCLUSION

Bombax malabaricum flower extract alone 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 colorless end point at the equivalence point. If we add more amount of titrant (acid) it gives pink colored solution.

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 the end point of the titrations. Lastly we can say that it is always beneficial to use Bombax malabaricum flower extract as an indicator in all types of acid base titrations because of its economy, simplicity and availability.

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