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Research Article

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Isolation of natural acid base indicator from the flower sap of *Hibiscus rosa sinensis*

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ABSTRACT

Hibiscus rosa sinensis is a species of family Malvaceae. Indicators are very special chemicals, they change colour of the solution with change in Ph by adding acid or alkali. In the present work acid base titration has been performed by using natural indicators. The natural indicator is prepared from the most commonly occurring flower Hibiscus rosa sinensis . Aqueous and methanolic extract of flower were used as natural indicator. Two acids (H_2SO_4 and CH_3COOH) and two bases (KOH and NH_4OH) were selected for acid base titration. ***1.0N, 0.1N*** *and* ***0.5N*** *strength of these acids and bases were prepared. The results obtained by the natural indicators are almost similar to the results given by the synthetic indicator. Thus natural indicators from flowers can be used for acid base titration at any dilution. Titration with aqueous extract of natural indicator has not yet been done by any research team. Using aqueous extract of flower as indicator is more economical and with the same accuracy of result as that given by synthetic indicator.*

Keywords : Acid base indicator, Natural indicator, Anthocyanins, Titration.

INTRODUCTION

Hibiscus is a genus of flowering plant in the mallow family, malvaceae. It is quite large, containing several hundred species that are native to warm temperate, subtropical and tropical region throughout the world. The flowers are hermaphrodite and are pollinated by insects. The leaves are alternate, ovate and lanceolate, often with a toothed or lobed margin. The flowers are large conspicuous, trumpet shaped, with five or more petals, colour from white to pink, red, orange, purple or yellow and from 4-18cm. broad. The tea of *Hibiscus rosa sinensis* is popular as a natural diuretic; it contains vitamin 'c' and minerals and is used traditionally as a mild medicine. Dieters or people with kidney problems often take it without adding sugar for its beneficial properties and as a natural diuretic.

The flowers have been found to be effective in the treatment of arterial hypertension reported antifertility effect of flowers **[1] [2] [3]**. In the Indian traditional system of medicine, Ayurveda, Hibiscus especially white Hibiscus and red Hibiscus (*Hibiscus rosa sinensis*), is considered to have medicinal properties. The roots are used to make various concoctions believed to cure ailments such as cough hair loss or hair greying. The flower are boiled in oil along with other species to make medicated hair oil for hair treatment **[4]**. The leaves and flowers are ground into a fine paste with a little water, and the resulting latherry paste is used as a shampoo plus conditioner. The red flowered variety is preferred as medicine **[5]**. The leaves and flowers have healing properties **[6]**.

(a) The colour change is due to ionization of the acid base indicator. The unionized form has different colour than the ionized form.
(b) The ionization of the indicator is largely affected in acids and bases as it is either a weak acid or a weak base. In case, the indicator is a weak acid, its ionization is very much low in acids due to common H^+ ions while it is fairly

ionized in alkalies similarly if the indicator is a weak base, its ionization is large in acids and low in alkalies due to common OH^- ions.

Considering two important indicators phenolphthlein (a weak acid) Methyl orange (a weak base), Ostwald theory can be illustrated as follows:

Phenolphthlein can be represented as Hph. It ionizes in solution to a small extent as:

$$HPh \leftrightarrow H^+ + Ph^-$$
Colourless pink

The undissociated molecules of phenolphthlein are colourless while Ph^- ions are pink in colour. In the presence of an acid the ionization of Hph is practically negligible as the equilibrium shifts to left hand side due to high concentration of H^+ ions. Thus the solution would remain colourless. On addition of alkali, hydrogen ions are removed by OH^- ions in the form of water molecules and the equilibrium shifts to right hand side. Thus, the concentration of Ph^- ions increases in solution and they impart pink colour to the solution. The simple Ostwald theory of the colour change of indicators has been revised **[7].** Plant pigments in general are termed flavonoids **[8]**. These include flavone, flavonol, isoflavanol, anthocyanin, anthocyanidin etc. Anthocyanins occur as glycosides and their aglycones i.e. the free pigment are called anthocyanidins.The colour of flowers are due to the presence of anthocyanins. The colours of flower's are due to the presence of anthocyanins. *Hibiscus rosa sinensis* also known as Rakta shalmali, Silk cotton tree, Deokapas, Shimal, Tambdi-savaru, Lal katyan, is a species of the Hibiscus genus, belonging to the family malvaceae. The various shades of colour exhibited by all flowers are due to a very small number of different compounds or pigments. These different compounds contain the same carbon skeleton, and differed only in the nature of the substituent groups.ore of these naturally occurring plant pigments are anthocyanins. These are water soluble and generally occur in the aqueous cell sap, and are responsible for the large variety of colours in flowers. The acid salts of these pigments are usually red, their metallic salts usually blue and in neutral solution anthocyanins are violet **[9]**.

Methanolic plant extracts (Adhatoda rasica, Nyctanthes arbortristis,Phyllanthus amarus, Vitex negundo, Terminalis arjuna and Terminalius chebula) was used as potential antibacterial medicine against staphylococcus aureus and Escherichia coli **[10]**.

Flavones are mainly found in cereals and herbs . In the west, the estimated daily intake of flavones is in the range 20-50 mg per day **[11]**.

Hibiscus sabdariffa is cultivated and used as medicine in Egypt. Calyx and Epicalyx are used as food (Jam and Jelly) and cosmetic industries as a source of natural colouring agent **[12]**.

In recent years, scientific and public interest in flavones has grown enormously due to their putative beneficial effects against atherosclerosis, osteoporosis, diabetes mellitus and certain cancers**[13]** .

Punica granatum fruit extract was used as an indicator in all type of acid base titrations **[14]**. Chloroxylon swietemia flower contain flavonoids which possess antimicrobial activity **[15]**.

EXPERIMENTAL SECTION

Identification and collection of *Hibiscus rosa sinensis*

Hibiscus rosa sinensis was identified from the flora of Botany Department of the Holkar Science College Indore. Flowers were collected during winter and spring season. *Hibiscus rosa sinensis* 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 was isolated from the *Hibiscus rosa sinensis* . Several plants pigment like Anthocyanin, Flavonoids occurs 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 water for 48 hours 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 acidimetry and alkalimetry. The extract was preserved in light closed container and stored away from direct sunlight. Following the similar process methanolic extract of dried pulvarized petals was prepared, filtered and used as natural methanolic indicator. Analytical grade H_2SO_4,KOH, CH_3COOH, NH_4OH,phenolphthlein,methylorange,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, flower 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 the 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 phenolphthlein, methyl orange and phenol red. The results for strong acid-strong base (H_2SO_4 & KOH),strong acid- weak base (H_2SO_4 & NH_4OH), weak acid-strong base (CH_3COOH & KOH) and weak acid –weak base (CH_3COOH & NH_4OH) are listed in table 1 & 2.

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

Titrant	Titrand	Indicator colour changes and PH range		
		Standard	Methanolic floral extract of HRS	Aqueous floral extract of HRS
H_2SO_4	KOH	Colourless to pink (PH)	Pink to green	Pink to greenish yellow
H_2SO_4	NH_4OH	Pink to yellow (MO)	Pink to dark green	Pink to dark green
CH_3COOH	KOH	Colourless to pink (PH)	Pink to yellow	Pink to yellow
CH_3COOH	NH_4OH	Yellow to red (PR)	Pink to green	Pink to green

***PH** = Phenolphthlein, **MO** = Methyl orange, **PR** = Phenol red, **HRS** = Hibiscus rosa sinensis*

The strength of acid and bases (H_2SO_4, CH_3COOH, KOH, NH_4OH) 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 KOH v/s H_2SO_4, NH_4OH v/s H_2SO_4, KOH v/s CH_3COOH, NH_4OH v/s CH_3COOH.

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 sinensis* as natural indicator The standard deviation ranged from ± 0.05 to ± 2.9. The t-value for different titrations are mentioned as under

TABLE –2: Aqueous and Methanolic Floral Extract of *Hibiscus rosa sinensis* as Natural Indicator

Titration Titrant V/s Titrand	Strength in normality	Methanolic floral extract of HRS as natural indicator	t value ± S.D*	Aqueous floral extract of HRS as natural indicator	t value ± S.D*
KOH v/s H_2SO_4	1.0	PH v/s MFE	1.3697 ± 2.92	PH v/s AFE	1.2587±2.91
	0.1	PH v/s MFE	0.0688 ±2.37	PH v/s AFE	1.4264±0.11
	0.5	PH v/s MFE	0.7847 ±0.26	PH v/s AFE	0.2257±0.18
NH_4OH v/s H_2SO_4	1.0	MO v/s MFE	0.3535 ±0.11	MO v/s AFE	1.0615±0.11
	0.1	MO v/s MFE	0.9388 ±0.73	MO v/s AFE	0.4521±0.99
	0.5	MO v/s MFE	0.3538 ±0.11	MO v/s AFE	0.0942 ±0.11
KOH v/s CH_3COOH	1.0	PH v/s MFE	0.5765 ±0.07	PH v/s AFE	1.1265±0.10
	0.1	PH v/s MFE	0.2837±0.09	PH v/s AFE	2.1258±0.05
	0.5	PH v/s MFE	2.1276 ±0.05	PH v/s AFE	0.8977±0.09
NH_4OH v/s CH_3COOH	1.0	PR v/s MFE	0.4045 ±0.20	PR v/s AFE	0.7256±0.22
	0.1	PR v/s MFE	0.0446±0.09	PR v/s AFE	2.1231±0.05
	0.5	PR v/s MFE	0.2426±0.16	PR v/s AFE	2.1231±0.05

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

***H_2SO_4:**Sulphuric Acid, **CH_3COOH:** Acetic Acid, **KOH:** potassium hydroxide, **NH_4OH:** Ammonium hydroxide, **PH:** Phenolphthlein, **MO:** Methyl orange, **PR:** Phenol red, **AFE:** Aqueous floral extract, **MFE:** Methanolic floral extract.*

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 *Hibiscus rosa sinensis* . The standard deviation and t-value for synthetic indicator, methanolic and aqueous extract of natural

indicator shows very less variation in the results. Statistically also the use of natural indicator in acid base titration is proved, Hence aqueous extract can be used with cent percent reliability and accuracy for acid base titration. Thus the use of natural indicators in acid base titration is more beneficial because of their economy, easy to prepare, simplicity, easy availability, pollution free, inert and accurate results.

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