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EXTRACTION AND EVALUATION OF ECO-FRIENDLY ACID-BASE INDICATOR

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ABSTRACT

The present research work based on extraction and evaluation of a natural environment friendly source of acid-base indicator, *Lagerstroemia* species. Giant crape myrtle petals were freshly collected from local medicinal garden and were thoroughly washed with distilled water, cut in small pieces and macerated by using mortar & pestle. The whole macerated material was transferred into a 250 ml iodine flask containing methanol. It was kept away from light for 24 hours to permit appropriate extraction after which the solution was sifted and the filtrate was gathered for the titrations. The filtrate from the extraction was used as natural indicator, while the synthetic indicator phenolphthalein and methyl orange were used as standard. This natural indicator is easily available as well as easy to extract. Promising results were observed when it was analyzed against standard indicators. Titration indicates sharp color change at the equivalence point. This indicator observed to be valuable in all kinds of acid-base titrations. It found very helpful, affordable, suitable and fundamental indicator for acid-base titrations.

KEYWORDS: Extraction, Acid-base indicator, *Lagerstroemia speciosa*, Phenolphthalein.

INTRODUCTION

In the seventeenth century scientist Robert Boyle, depicted markers separated from roses and other plant materials in his book "The Experimental History of Colors" published in 1664.[1] Writing overview uncovered that, numerous analysts have directed investigations on isolation, separation and characterization of compounds present in plants and animals and they additionally contemplated the extractions procedures, optimization of extraction

conditions to get unadulterated and most extreme yield of naturally occurring compounds from various parts of plants.[2]

The family Lythraceae comprises of around 24 genera and almost 500 species wide spread in the temperate regions. In India, it is represented by 11 genera and around 45 species. This information demonstrates that *Lagerstroemia speciosa* shown in fig. 1 and fig. 2 which is a member of the family Lythraceae, is spread everywhere throughout the world. The genus *Lagerstroemia* was first depicted via Carolus Linnaeus. The name *Lagerstroemia* was perceived by Magnus von Lagerstroem a Swedish naturalist who gave examples from the east to Linnaeus. Indians regularly called it as "Pride of India" and furthermore called as Giant crape myrtle, queen's crape myrtle and banaba by Philippines. The flower extract of the species has some pharmacological properties like antioxidant and anti-microbial property.[3]

Figure 1: Flower of *Lagerstroemia speciosa.*

Figure 2: Plant of *Lagerstroemia speciosa*.

Acid - Base indicators (also called pH indicators) are substances which change colour with pH. They are divalent weak acids or bases, associated with protolytic water acid-base equilibrium and form two types of coloured ions as Bronsted-Lowry protolytic pairs.[4]

Acid-base titrations rely upon the neutralization between an acid and a base when added in solution. In addition to the sample, a proper indicator is added to the titration chamber, reflecting the pH range of the equivalence point. The acid-base indicator shows the endpoint of the titration by changing color. A careful determination of the indicator will reduce the indicator error.[5]

Numerous natural plants contain coloured anthocyanin exacerbate that are red in acidic solution and green in basic solution. Dyes extracted from plants are natural substances normally utilized as acid-base indicator.[6]

MATERIALS AND METHODS

Reagents and Chemicals

The reagents utilized for this work were of analytical grade and were procured from S.D. Fine Chemicals, (Mumbai, India). A digital pH meter with glass electrode, Whatman filter paper No.41, the apparatus such as volumetric flasks (100 ml, 500 ml and 1000 ml), pipettes (1 ml, 10 ml), conical flask with volume size of 250 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.[7]

Plant material

Flower petals of *Lagerstroemia speciosa,* (Family Lythraceae) were collected from medicinal plant garden of department of Pharmacy, Shri Ram Murti Smarak College of Engineering and Technology, Bareilly (U.P.). The plant material was identified and authenticated by Dr. Gulrez Nizami, Professor and Head, Department of Botany, Mohammad Ali Jauhar University, Rampur, U.P.(Ref. No. MAJU/Bot./091, dated-30.11.19). A voucher specimen of the collected plant sample was deposited in the Department for future reference.

Preparation of solutions

0.1N HCl, 0.1N NaOH, 0.1N NH_4OH and 0.1N CH_3COOH solution were prepared according to Indian Pharmacopoeia.[8] Phenolphthalein and methyl orange indicator were also prepared according to Indian Pharmacopoeia.

Preparation of extract

The flowers were thoroughly washed with distilled water, cut in small pieces and placed in a mortar and then macerated using the pestle. It was transferred into a 250 ml iodine flask containing 100 ml absolute methanol and was kept in a cupboard away from light for 24 hrs for proper extraction. After which the content was filtered and the clear filtrate was collected for the titration. The clear filtrate from the extraction was used as natural indicator, while phenolphthalein and methyl orange like synthetic indicators were used as standard.

Experimental procedure

Qualitative phyto-chemical analysis of the flower extract of *Lagerstroemia speciosa* was performed by different chemical test. The acid-base titrations were performed between a strong acid (HCI) against a strong base (NaOH), strong acid (HCI) against weak base (NH_4OH), weak acid (CH_3COOH) against strong base (NaOH) and weak acid(CH_3COOH) against weak base (NH_4OH).[6]

All the apparatus and instruments required for the present research work were calibrated before use.[9]

The titrations were conducted between 10 ml each of the acid within conical flask and the base which was filled in burette and using two drops each of phenolphthalein and methyl orange indicators and 1 ml each of the extracted *Lagerstroemia* natural indicator transfer into the conical flask before the titration. For each acid-base titration, four sets of the titration were conducted using the three sets of indicators, *Lagerstroemia speciosa* extract (eco-friendly acid-base indicator), phenolphthalein, and methyl orange. The average volume of each were calculated and presented.[6]

RESULTS AND DISCUSSION

The results of qualitative phyto-chemical analysis of the flower extract of *Lagerstroemia speciosa* was shown in Table 1. The flower extract indicated presence of flavonoid, tannin, terpenoid, alkaloid, phenolic compound, lignin and steroid.

Table 1: Qualitative phyto-chemical analysis of flower extract.

TEST	***Lagerstroemia speciosa* Extract**
Flavonoid	++
Tannin	+
Saponin	-
Terpenoid	++
Alkaloid	++
a) Mayer' reagent	+
b) Dragondorff's reagent	+
c) Wagner's reagent	+
Phenolic Compound	++
Lignin	++
Steroid	+

Colours of the indicators in acidic, basic medium as well as their color at end point were given in Table 2, which showed contrast colour and can be visualized very easily.

Table 2: Colour of indicators in solutions.

Indicator	Colourof indicator	Colour of indicator in acid	Colour of indicator in base	Colour of indicator at end point
*Lagerstroemia speciosa*Extract	Red	Red	Green	Light Green
Phenolphthalein	Colorless	Colorless	Pink	Pale pink
Methyl Orange	Orange	Red	Yellow	Yellow

Fig.3 and Fig. 4 represented the color of natural indicator before end point and after end point respectively.

Figure 3: Colour before end point.

Figure 4: Colour after end point.

The results of the titration between strong acid and strong base were reported in Table 3, the natural flower extract with average volume of base, 9.0 ml competes with phenolphthalein with average volume of 8.8 ml and methyl orange with average volume of 9.1 ml.

Table 3: Titration results for strong acid (HCI) against strong base (NaOH).

Titration	Titre value (ml)		
	***Lagerstroemia speciosa* Extract**	**Phenolphthalein**	**Methyl Orange**
1st	8.9	8.8	8.9
2nd	9.0	8.9	9.3
3rd	9.1	8.7	9.1
Average volume (ml)	9.0	8.8	9.1

The results were supported by pH graph between strong acid and strong base in Fig.5.

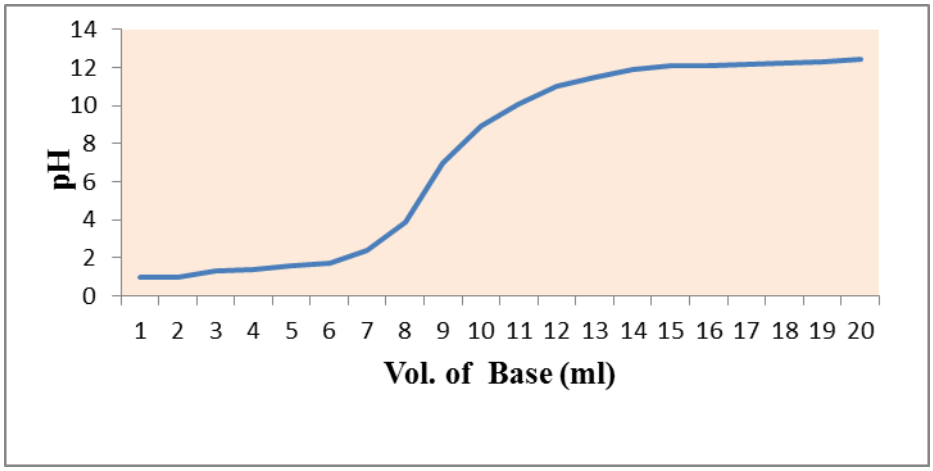

Figure 5: Titration curve between 0.1N HCl and 0.1N NaOH.

The results of titration of strong acid against weak base as showed in table 4, that natural flower extract with average volume of base 18.9 ml competes with phenolphthalein with average volume of 19.7 ml and methyl orange with average volume of 19.1 ml. It was supported by drawing pH graph between strong acid and weak base shown in Fig.6.

Table 4: Titration results for strong acid (HCI) against weak base (NH_4OH).

Titration	Titre value (ml)		
	***Lagerstroemia speciosa* Extract**	**Phenolphthalein**	**Methyl Orange**
1st	18.8	20.0	19.0
2nd	19.0	19.4	19.3
3rd	18.9	19.7	19.0
Average volume (ml)	18.9	19.7	19.1

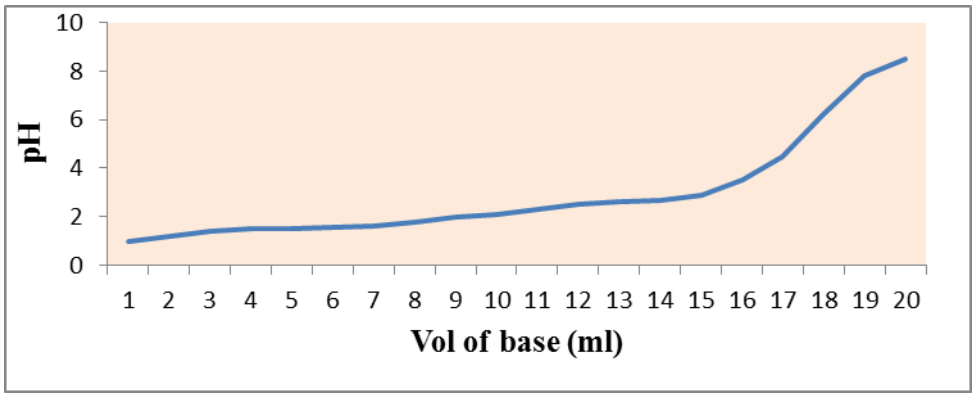

Figure 6: Titration curve between 0.1N HCl and 0.1N NH_4OH.

Titration results between weak acid and strong base as shown in table 5, that natural flower extract with average volume of base, 10.1 ml competes with phenolphthalein with average

volume of 10.6 ml but did not compete with methyl orange with average volume of 5.5 ml. It was supported by drawing pH graph between weak acid and strong base shown in Fig.7.

Table 5: Titration result for weak acid (CH_3COOH) against strong base (NaOH).

Titration	Titre value (ml)		
	***Lagerstroemia speciosa* Extract**	**Phenolphthalein**	**Methyl Orange**
1st	10.5	10.2	5.6
2nd	9.9	10.8	5.4
3rd	9.9	10.8	5.5
Average volume (ml)	10.1	10.6	5.5

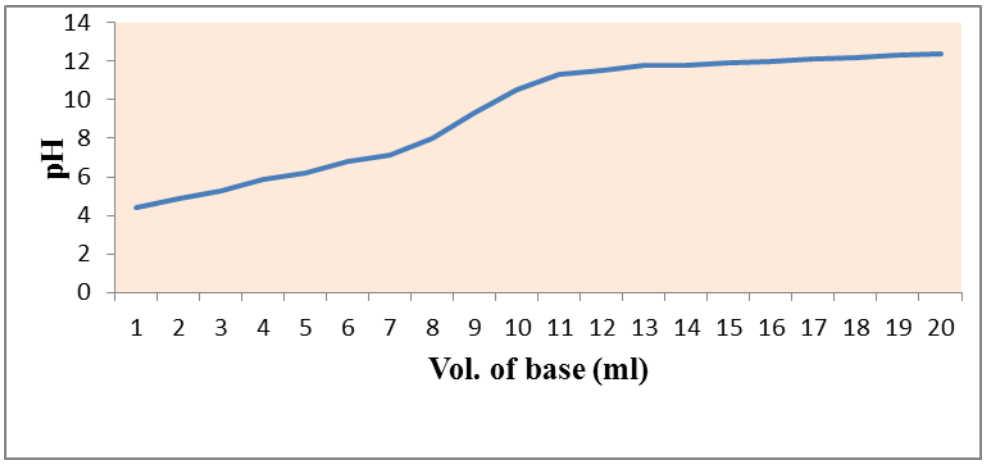

Figure 7: Titration curve between 0.1N CH_3COOH and 0.1N NaOH.

Titration results between weak acid and weak base as shown in table 6, did not shown proper end point. The pH graph between weak acid and weak base was shown in Fig.8 which did not have sharp end point.

Table 6: Titration results for weak acid (CH_3COOH) against weak base (NH_4OH).

Titration	Titre value (ml)		
	***Lagerstroemia speciosa* Extract**	**Phenolphthalein**	**Methyl Orange**
1st	17.6	24.5	15.5
2nd	16.9	24.1	15.2
3rd	17.3	24.3	15.8
Average volume (ml)	17.2	24.3	15.5

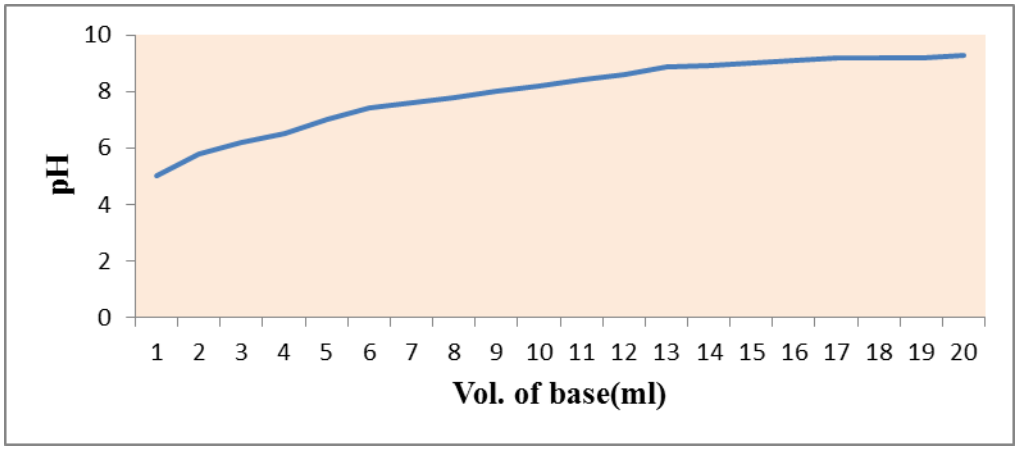

Figure 8: Titration curve between 0.1N CH_3COOH and 0.1N NH_4OH.

CONCLUSION

The conclusion of the present research work is that the synthetic indicators phenolphthalein and methyl orange are very hazardous to health and are not eco-friendly, causes pollution therefore to solve this problem eco-friendly natural flower extract has been selected as a source of indicator for acid base titration. The accuracy of results has been judged by performing different acid base titration and by plotting their pH graphs. From the result it was concluded that eco-friendly natural flower extract obtained from *Lagerstroemia speciosa* may be a cheap and fast workable substitute of phenolphthalein and methyl orange for titration between strong acid/ strong base, strong acid/ weak base and weak acid/ strong base. In the case of weak acid/ weak base titration, the natural indicator has not sharp end point like synthetic indicators. Thus, it concludes that the use of eco-friendly natural indicator in acid base titration is more beneficial as compare to synthetic indicators because of their economic value, simplicity, eco-friendly nature, inert and accurate results.

RECOMMENDATION

Based on the finding of this research, we recommend the use of *Lagerstroemia speciosa* extracts as indicators for acid-base titration as a substitute to the hazardous synthetic indicators thereby it is protecting and preserving the environment from pollution and contamination.

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