



COMPARATIVE ASSESSMENTS OF *IPOMOEA* AND *CAESALPINIA* EXTRACTS USED AS POTENTIAL ACID-BASE INDICATOR AS REPLACEMENT TO SYNTHETICS

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ABSTRACT

Environmental pollution becomes a topic of discussion because of the excessive spillage of synthetic acid-base indicator. Due to its hazardous effect and cost, scientist embark in search of substitutes which are less or even nontoxic and eco-friendly source of indicator for acid-base titration. So many natural plants were tested and found suitable. In this research, *Ipomoea cairica* and *Caesalpinia pulcherrima* extracts were tested and can effectively serve and substitute synthetic indicators because of roughly having the same mean titre value (24+ 0. - -). *Ipomoea* can replaces methyl orange and phenolphthalein in HCl vs NH₃ coupling been with the same standard deviation (± 0.125). while *Caesalpinia pulcherrima* is the most preferable with the lowest standard deviation (± 0.0 - -).

KEYWORDS: *Ipomoea cairica*, *Caesalpinia pulcherrima*, titrimetry, gravimetry and p^H.

1.0 INTRODUCTION

Environmental pollution becomes free dominant aspect of discussion by both scientist and nonscientist scholars nowadays. Use of chemicals in different field of studies and industrial application played major roles in making a set back of the conducive atmospheric whether condition for both living and nonliving. The chemicals that use to cause all these set back may either be acidic or basic. Some plant use to proliferate very well in acidic soil and poorly grow in basic conditions. The same happened for the plants which prepare basic conditions. There are methods employed to access acidity and basicity of a condition. A number of conventional analytical techniques presently in use today include the gravimetry and titrimetry.^[1] In these methods, indicator was used to differentiate P^H of the acidic-basic solutions. An acid-base indicator is a substance that changes color as the p^H of a solution change.^[2] Hence a P^H indicator is a chemical detector for hydronium ions (H₃O⁺) or Hydrogen ions (H⁺) in the Arrhenius model). Normally, the indicator causes the color of the solution to change depending on the P^H.^[3] Commercial indicators are expensive and some of them have toxic effects on users and can also cause environmental pollution.^[4]

Researchers are working in the field of natural products extensively as they are less hazardous, low cost, easily available, and eco-friendly.^[5] Based on the literature survey so far, there were many plant extract used as natural acid-base indicators. Some of these are: *allium cepa*^[6], *Cola acuminata*^[7], *aspilia africana*^[8], *ipomoea*

biloba^[9], *acalypha wilkesiana*^[10], *nerium odoratum*^[11], *dianthus plumarius* and *antirrhinum majus*^[12], *argyrea cuneata*^[13], *phyllanthus reticulatus*^[14], *gerbera jamesonii* and *tagetes erecta*^[15], *delonix regia*^[16], *basella alba*^[17], *hibiscus rosa sinensis*^[18], *clitoria ternatea*^[19], *rheo syathacea* and *allamanda cathartica*^[20], *jacaranda acutifolia*^[21], *Nerium indicum*^[22], *District bannu*^[23], *Gerbera jamesonii* and *Tagetes erecta*^[24], *Dahlia pinnata*^[25] and *Ipomea nil*.^[26]

Two plants used for these studies were *Caesalpinia* and *Ipomoea*. *Caesalpinia pulcherrima* L. Swartz (Caesalpinaceae) is an ornamental plant due to its variety of flowers, which appear yellow, pink, off-white, and red with yellow margins.^[27] *Ipomoea* is a large and diverse genus in the flowering plant family, *Convolvulaceae*. It is known to have about 500 species. The most popular common name is morning glory. The *Ipomoea* genus is widely spread among the tropical and subtropical regions of the world. It is pink in colour.

The main reason for this research was to test whether the plants extracts can effectively be used as acid-base indicator and as well substitutes the synthetics. Also compare their results to see which is the most suitable and at what coupling of acid base solutions.

2.0 MATERIALS AND METHODS

All reagent used for this study were analar grade such as hydrochloric acid (HCl), sodium hydroxide (NaOH), ethanoic acid (CH₃COOH) and aqueous ammonia (NH₃). Distilled water was used for their preparations.

2.1 Collection and Identification of Flower

Fresh flowers of *Ipomoea cairica* and *Caesalpinia pulcherrima* were collected on 6th oct, 2015 from Jodhpur National University environment and identified by a botanist Dr. N.L Vyas faculty of applied science Jodhpur National University, India.

2.2 Extraction of the flower

The *Ipomea* and *Caesalpinia* flower were cut into smaller pieces, washed with distilled water and soaked in 100ml ethanol each for 48hrs. The p^H of the extracts appeared to be 6.5 and 6.7 respectively.

2.3 Titration Techniques

2-3 drops of the flower extract was added into the alkali (base) solutions which was titrated against acidic solution to test for its efficiency as Acid-base indicator and compare the result obtained with that of synthetic indicator (phenolphthalein and methyl orange). The acid base solutions used were strong acid strong base (HCl vs NaOH), strong acid weak base (HCl vs NH₃), weak acid strong base (CH₃COOH vs NaOH) and weak acid weak base (CH₃COOH vs NH₃). The experiments were carried

out three times for each in order to have the average titre value.

3.0 RESULT AND DISCUSSION

The flowers were screened for their used as an acid-base indicator for titrimetry and the results obtained by standard indicators methyl orange and phenolphthalein are presented in table 1&2. The results of the screening for strong acid strong base(HCl vs NaOH) strong acid weak base (HCl vs NH₃) weak acid strong base(CH₃COOH vs NaOH) weak acid weak base (CH₃COOH vs NH₃) were carried out using standard indicators and the flower extracts . The results obtained for the flower extracts were given in table 3&4. The screening was carried out using two different molar strength of acid and base of 0.5M and 1M. For all type of titration, equivalent point obtained by the two flower extracts either coincide exactly or very close to the equivalent point obtained by standard indicators. These represent the usefulness of the extracts as indicator and also serve as substitutes to synthetics.

Table 1. Titrimetric Screening parameters of acid-base titration using methyl orange as indicator

Titrant/titrant	Indicator used	Mean (ml)± S.D values
	Methyl orange	
0.5M HCl/NaOH		24.70±0.170
1M HCl/NaOH		24.90±0.149
0.5 HCl/NH ₃		24.83±0.125
1M HCl/NH ₃		24.87±0.125
0.5M CH ₃ COOH/NaOH		24.83±0.125
1M CH ₃ COOH/NaOH		24.90±0.082
0.5M CH ₃ COOH/NH ₃		24.83±0.125
1M CH ₃ COOH/NH ₃		24.83±0.170

Table 2. Titrimetric Screening parameters of acid-base titration using phenolphthalein as indicator

Titrant/titrant	Indicator	Mean(ml)± S.D values
	Phenolphthalein	
0.5M HCl/NaOH		24.93±0.047
1M HCl/NaOH		24.97±0.047
0.5 HCl/NH ₃		24.90±0.082
1M HCl/NH ₃		24.83±0.125
0.5M CH ₃ COOH/NaOH		24.87±0.125
1M CH ₃ COOH/NaOH		24.80±0.096
0.5M CH ₃ COOH/NH ₃		23.93±0.092
1M CH ₃ COOH/NH ₃		24.90±0.082

Table 3. Titrimetric Screening parameters using *Ipomoea cairica* flower extract

Titrant/titrant	Indicator	Mean (ml) ± S.D values
	<i>Ipomoea cairica</i>	
0.5M HCl/NaOH		24.83±0.169
1M HCl/NaOH		24.97±0.115
0.5M HCl/NH ₃		24.87±0.125
1M HCl/NH ₃		24.83±0.125
0.5M CH ₃ COOH/NaOH		24.90±0.082
1M CH ₃ COOH/NaOH		24.95±0.069
0.5M CH ₃ COOH/NH ₃		24.90±0.082
1M CH ₃ COOH/NH ₃		24.83±0.149

Table 4. Titrimetric Screening parameters using *Caesalpinia pulcherrima* flower extract

Titrant/titrant	Indicator	Mean(ml) \pm S.D
	<i>Caesalpinia pulcherrima</i> extract	
0.5M HCl/NaOH		24.87 \pm 0.094
1M HCl/NaOH		24.93 \pm 0.082
0.5M HCl/NH ₃		24.90 \pm 0.082
1M HCl/NH ₃		24.83 \pm 0.125
0.5M CH ₃ COOH/NaOH		24.83 \pm 0.099
1M CH ₃ COOH/NaOH		24.95 \pm 0.069
0.5M CH ₃ COOH/NH ₃		24.93 \pm 0.093
1M CH ₃ COOH/NH ₃		24.83 \pm 0.149

Similarly, in comparing the result obtained for 1M HCl vs NH₃ coupling, it shows that, the same standard deviation was obtained for both the synthetics and extracts. This shows that, the extracts can effectively substitute the synthetic indicators. *Ipomoea* extract is the most preferable substitutes in 0.5M and 1M HCl vs NH₃ couplings been with the same standard deviation (\pm 0.125). *Caesalpinia* extract record to have the lowest standard deviation 0.0_) as such show the best indicative property.

3.1 CONCLUSION

From the various titration results obtained, it shows that, the extract can effectively be used as acid-base indicators because of the similar mean values for all the couplings of acid-base. For 1M HCl vs NH₃ coupling, the same standard deviation was obtained for both the synthetics and extracts. This shows that, the extracts can effectively be used and substitute to synthetic indicators. *Ipomoea* extract is the most preferable substitutes in 0.5M and 1M HCl vs NH₃ couplings been with the same standard deviation (\pm 0.125). But *Caesalpinia* is the most effective indicator due it small standard deviation values as indicated in table 4.

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- Authors' Contributions
The Research Was Conducted In Collaboration Of All The Authors And Thoroughly Goes Through The Manuscript, Authenticated Before Send For Publication.