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### RESEARCH ARTICLE

#### STUDY OF CELOSIA CRISTATA AS NATURAL INDICATOR FOR ACID-BASE TITRATIONS

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#### Abstract

The present work highlights the use of ethanolic flower extract of *Celosia cristata* of family Amaranthaceae as a natural indicator in acid-base titrations. A search for natural, eco-friendly, green indicators has been started due to the reason that synthetic indicators are highly hazardous, cost effective and also cause environmental pollution. Plant pigments are highly colored and may change its color with varied  $p^H$ . When tested against standard synthetic indicators, good results were obtained with the natural indicator. Finally, it was proved that the use of flower extract as natural indicator in acid-base titrations is effective.

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#### Introduction:-

*Celosia cristata* is local plant of South America and now is distributed throughout Asia, especially, Malaysia. It is now considered as ornamental plant and frequently used for landscaping and roadside plants due to the presence of various attractive colours of the flowers [1]. *Celosia cristata* produces purplish or reddish pigment due to the presence of cyanidin, a kind of anthocyanin [2]. The tightly clustered blooms are said to appear as a rooster's comb, thus, the common name "Cockscomb". Flowers are in red, yellow, orange, gold and pink [3].



Figure 1:-

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An indicator is a substance that changes color in solution over a narrow range of  $p^H$  values. Some indicators change from one color to another, while the others change between colored and colorless states.  $P^H$  indicators are usually weak acids or weak bases which are commonly employed to mark the end point of an acid-base titration [4]. Titrimetric analysis remains an important analytical technique in pharmaceutical analysis. It enables keen monitoring of the acid and base contents of raw materials, reaction mixtures, and resulting finished products in the industrial setting [5].

In acid-base titrations, acids are titrated with bases and bases are titrated with acids. They are also called as neutralization reactions, with the end point conformed either by use of colour indicators or potentiometrically with a glass electrode [6,7].

The German chemist Richard Willstatter demonstrated that plant pigmentation is due to the presence of anthocyanins which are glycosides. They exist in all tissues of higher plants including leaves, stems, roots, flowers and fruits which impart different colors. This gives an opportunity to use plants as natural acid-base indicators [8].

The substances that change colour when the acidity of the solution changes are known as acid-base indicators [9].

Acidimetry and alkalimetry deals with the titration of free bases with standard acid and also titration of free acids with a standard base independently. The reactions involve the combination of hydrogen and hydroxyl ions to form water [10].

Halocline chemical compound which is a  $p^H$  indicator is added in little amounts to a solution so  $p^H$  of the solution can be recovered [11].

In present study, we used *Celosia cristata* ethanolic extract as natural acid-base indicators in acid-base titrations. This plant is used as ornamental plant in garden and a parasiticide and poultice. These are used in the treatment of bloody stools, hemorrhoid bleeding, uterine bleeding, leucorrhoea, dysentery and diarrhoea.

### Materials and Methods:-

Analytical grade reagents i.e. Hydrochloric acid (HCl), Sodium hydroxide (NaOH), Acetic acid ( $CH_3COOH$ ), Sodium carbonate ( $NaHCO_3$ ). Phenolphthalein and Methyl orange were taken from Vaageswari College of Pharmacy, Karimnagar. Reagents and volumetric solutions were formulated as per Indian Pharmacopoeia.

The fresh flowers were collected from local areas and were authenticated by BOTANICAL SURVEY OF INDIA, HYDERABAD and Authentication No: BSI/DRC/2019-2020/Identification/743. The flowers were cleaned and cut into small pieces and are shade dried. 100 grams of these pieces were macerated with 150 ml of solution containing 9 parts of ethanol and 1 part of dilute hydrochloric acid for 24 hrs. The extract is filtered using muslin cloth and filter paper and stored in tightly closed container and away from sunlight.

10 ml of titrant and 3 drops of indicator was titrated. All the parameters for the experiment are given in table-1. Each titration was carried for 3 times and the results was recorded. The ethanolic extract of the flower of *Celosia cristata* was screened for its use as an indicator for acid base titrations and the results were compared with the results of standard indicators

### Results and Discussion:-

The extract of *Celosia cristata* flower was tested for its use as an indicator in acid-base titration and the results was compared by using standard indicators like phenolphthalein and methyl Orange. The results of strong acid-strong base (HCL Vs NaOH), weak acid-strong base ( $CH_3COOH$  Vs NaOH), strong acid-weak base (HCL Vs  $NaHCO_3$ ), weak acid-weak base ( $CH_3COOH$  Vs  $NaHCO_3$ ) titrations are listed in the below table- 1.

**Table-1:-** Parameter for titrations.

Titrant	Titrand	Indicator Color changes	
		Standard indicator	Flower extract
HCL	NaOH	Colorless to pink(PH)	Colorless to yellow

CH <sub>3</sub> COOH	NaOH	Colorless to pink(PH)	Colorless to yellow
HCL	NaHCO <sub>3</sub>	Red to yellow(MO)	Yellow to colorless
CH <sub>3</sub> COOH	NaHCO <sub>3</sub>	Red to yellow(MO)	Yellow to colorless

PH =Phenolphthalein; MO =Methyl Orange

The table-2 represents mean of 3 titrations  $\pm$  standard deviation. The experiment was carried out by using the molar strength of acids and alkalis of 1M. For all types of titrations the equivalence point obtained by the flower extract is either exactly or close to the equivalence point obtained by the standard indicators. This constitutes the usefulness of flower extract as an indicator in acid base titrations. Its use in strong acid and strong base was found to be more potent when compared to other titrations. The results obtained shows that flower extract of celosia cristata can be used as an alternative for standard indicators.

**Table-2:-** Mean and Standard deviation values of standard indicator and flower extract

Titrand	Titrand	Mean values of standard indicator	Mean values of flower extract
HCL	NaOH	9.66 $\pm$ 0.27 (PH)	10.33 $\pm$ 0.33
CH <sub>3</sub> COOH	NaOH	10.0 $\pm$ 0.04 (PH)	11.8 $\pm$ 0.07
HCL	NaHCO <sub>3</sub>	10.03 $\pm$ 0.06 (MO)	12.43 $\pm$ 0.56
CH <sub>3</sub> COOH	NaHCO <sub>3</sub>	10.1 $\pm$ 0.21 (MO)	12.57 $\pm$ 0.59

PH =Phenolphthalein; MO =Methyl Orange

### Conclusion:-

The overall results obtained from all types of acid base titrations in the present study shows that the celosia cristata flower extract could be productively used as an acid base indicator due to the presence of anthocyanins and owing to the factors like wild availability of the flower, easy preparation and accurate and precise results and therefore it is used as an alternative to standard indicators.

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