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Research Article

HERBAL INDICATORS AS AN UPCOMING TREND IN TITREMETRIC ANALYSIS

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ABSTRACT
Indicators are very special chemicals, they will change color of the solution with change in pH by adding acid or alkali. Red cabbage is actually blue in color. It will be quite blue when slice it up and add some tap water but if we add some vinegar it will turn red. This is due to the pigment present in red cabbage which acts as pH indicator. The aim of this study is to investigate the activity of flower pigments extracts to replace the synthetic indicators. Synthetic indicator produces chemical hazards, availability problem and having high cost. Methanolic extract of *Antirrhinum majus* belonging to the family Scrophulariaceae and *Dianthus plumaris* belonging to family Caryophyllaceae give sharp and intense color change as compared to phenolphthalein and methyl orange.Herbal indicators are evaluated by different acids and bases. In all these titrations the extract was found to be accurate and useful for indicating the end point (neutralization point). Phytochemical investigation and chemical test of *Antirrhinum majus* and *Dianthus plumaris* shows presence of anthocyanins which are related to the class of flavanoids and may be the main reason for its activity as an indicator. From these investigation new theories of indicators could be established.
KEYWORDS - End point, herbal indicators, methanolic extracts and titrations.

INTRODUCTION

Indicators are the substance that reveals through characteristic color changes, the degree of acidity or basicity of solutions. They are weak organic acids or bases which exist in more than one structural form (tautomers) of which at least one form is colored. Intense color is desirable so that very little indicator is needed; the indicator itself will thus not affect the acidity of the solution. An acid-base indicator is a weak acid having a different color in aqueous solution from its conjugate base[1].

An acid-base titration is the determination of the concentration of an acid or base by exactly neutralizing the acid/base with an acid or base of known concentration. This allows for quantitative analysis of the concentration of an unknown acid or base solution[2]. Acid-base indicators are used to signal the end of acid-base titrations. Synthetic indicators have certain disadvantages like chemical pollution, availability and their high cost[3].

The aim of this study is to enhance the wealth of traditional Indian medicinal system and to bring the use of flower pigments in the market.

Many plants or plant parts contain chemicals from the naturally-colored anthocyanin family of compounds. They are red in acidic solutions and blue in basic. Extracting anthocyanins from red cabbage leaves or the skin of a lemon to form a crude acid-base indicator is a popular introductory chemistry demonstration[4].

Anthocyanins can be extracted from a multitude of colored plants or plant parts, including from leaves (red cabbage); flowers (geranium, poppy, or rose petals); berries (blueberries, blackcurrant); and stems (rhubarb).

Antirrhinum majus belonging to the family Scrophulariaceae. Commonly known as dog-flower in India and snapdragon in other places.

Although technically short - lived perennials, snapdragons are usually grown as annuals. Native originally to North Africa, Spain and along the Mediterranean to Italy, snapdragons have become naturalized in India[5].

Dianthus plumaris belonging to family Caryophyllaceae, Common names include gardens pink, wild pink native mainly to Europe and Asia. The name *Dianthus* is from the Greek words dios (god) and anthos (flower), and was cited by the Greek botanist Theophrastus[6].

The species are mostly perennial herbs while some are low subshrubs with woody basal stems. The leaves are opposite, simple, mostly linear and often strongly glaucous grey-green to blue-green. The flowers have five petals, typically with a frilled or pinked margin, and are (in almost all species) pale to dark pink. *Dianthus* species are used as food plants by the larvae of some Lepidoptera species including Cabbage Moth, Double-striped Pug, Large Yellow Underwing and the lychnis[7].

MATERIALS AND METHODS

Plant Materials

Fresh flowers of ***Dianthus plumarius*** and ***Antirrhinum majus*** were collected from the campus of M.M University Mullana, Ambala and authenticated from the NISCAIR,Delhi.

Reagents

Analytical grade reagents like Hydrochloric acid (HCl), sodium hydroxide (NaOH), acetic acid (CH_3COOH), ammonia (NH_3) and phenolphthalein were procured from M.M College Of Pharmacy, Mullana, Ambala. Reagents and volumetric solutions were prepared as per Indian pharmacopoeia (I.P.1996).

Preparation of Extract

1) ***Dianthus plumarius:*** 1 gm fresh petals of ***Dianthus plumarius*** were macerated for 24h in 10ml of methanol.

2) ***Antirrhinum majus*** : 1 gm of fresh petals of ***Antirrhinum majus*** were macerated for 24h in 10 ml of methanol.

Experimental Procedure

The petals of flower were cleaned by distilled water and cut into small pieces and macerated for 24h in 10 ml of methanol. The extract was preserved in tightly closed glass container and stored away from direct sunlight. The calibration of apparatus like burettes, pipettes and other required instruments and standardization of acids and bases were done as per procedures given in Indian Pharmacopoeia(I.P.1996).

10 ml of titrant with two drops of each indicator *Dianthus plumarius* and *Antirrhinum majus* was titrated against titrates and the color changes for the indicators are listed in the [Table 1] and [Table2]. The results of screening for strong acid-strong base (HCl - NaOH), strong acid- weak base (HCl - CH_3COOH), weak acid-strong base (CH_3COOH - NaOH) and weak acid-weak base (CH_3COOH - NH_3) are listed in [Table 3]. Each titration is carried out five times by using 1N strength of acid and alkali and results were recorded as mean ± SEM.

RESULTS AND DISCUSSIONS

For all type of titrations equivalence point obtained by methanolic extract of ***Dianthus plumarius*** and ***Antirrhinum majus*** either exactly coincided or very closed with equivalence point obtained by standard indicator phenolphthalein. This represents the usefulness of alcoholic flower extract as an indicator in acid base titrations. Its use in strong acid-strong base titration was found to be more significant over standard indicator as it gives sharp color change at equivalence point. It is observed that indicators acts reversibly and gives sharp color change in both directions. The results obtained showed that the routinely used indicators could be replaced successfully by flower extract as they are simple, accurate, precise and can be prepared just before experiment. The proposed herbal indicators can be used as a substitute to synthetic indicators

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Table 1*: Antirrhinum majus* (A.M)

Titrant	Indicator	Color	Titrate	Color (at end pt)
Hcl	A.M	Colorless	NaOH	Pink
CH_3COOH	A.M	Colorless	NaOH	Pink
Hcl	A.M	Colorless	NH_3	Pink
CH_3COOH	A.M	Colorless	NH_3	Pink

Table 2 : *Dianthus plumarius* (D.P)

Titrant	Indicator	Color	Titrate	Color (at end pt)
Hcl	D.P	Colorless	NaOH	Violet
CH_3COOH	D.P	Colorless	NaOH	Violet
Hcl	D.P	Colorless	NH_3	Violet
CH_3COOH	D.P	Colorless	NH_3	Violet

Table 3 :Volume of the titrate with standard indicator

Chemicals		Volume of the titrate required for equivalent pt with titrant (10ml) with indicator		
Titrant (1N)	Titrate (1N)	Std. ind	A.M ind	D.P ind
Hcl	NaOH	10.5 ± 0.3	10.2 ± 0.21	10.4 ± 0.31
CH_3COOH	NaOH	9.5 ± 0.55	9.7 ± 0.25	9.5 ± 0.23
Hcl	NH_3	10 ± 0.52	9.5 ± 0.25	10.2 ± 0.52
CH_3COOH	NH_3	9.5 ± .24	9.7 ± 0.01	9.4 ± 0.25
Std. ind- phenolphthalein indicator, A.M ind- *Antirrhinum majus* indicator D.P ind- *Dianthus plumarius* indicator				

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