Use of Various Floral Extract in Acid Base Titration – A green approach

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Abstract – Green chemistry is considered as a significant tool to mitigate the use of hazardous chemicals. Synthetic chemicals which are used as internal indicator in acid- base titration being hazardous can be substituted by using a natural indicator which gives the result of same accuracy. In this study, it is indicated that ethanolic extract of Aster and Carnation flower are good replacements to phenolphthalein in acid- base titration. It is also concluded that the use of Aster and Carnation flower extract as an indicator in all types of acid- base titration is beneficial because of its economy, eco-friendly nature, ease preparation, availability, simplicity, non- carcinogenicity, precision and accuracy result.The accuracy of the observed results has been examined by performing titration between different acids and bases.

Aster and Carnation flower, titration, ethanol, natural indicator, anthocyanins, flavonoids.

INTRODUCTION

Natural acid-base indicators are greener alternatives to synthetic ones as they are the demand of contemporary chemistry with regards to solving the problems of environmental pollution, cost and human health. There is an increasing need for the development of green indicators as effective substitutes for synthetic acid-base indicators used in chemistry laboratory.[1-3]

A change in colour during acid-base titrations with variation in pH is due to presence of coloured pigments that are used in acid base titrations to show sharp end point. Commonly used indicators for such titrations are manmade and costly. Besides, some of them have toxic effects on users and can also cause environmental pollution. For these and other reasons, there have been increasing concerns in searching for greener sources of acid-base indicators. These greener and eco-friendly alternatives would be cheaper, more available, simple to extract, less toxic to users and environmentally viable. Some highly coloured pigments obtained from plants are found to exhibit colour changes at various pH values. In the Present study, we prepared ethanolic and acidified ethanol Aster and Carnation flower extract as a natural indicator for acid-base titration.[4]

Synthetic chemicals which are used as internal indicators in acid-base titrations being hazardous can be substituted by using the natural indicators which gives results with the same accuracy. Natural indicators are easy to prepare and are easily available. Flower petals are the substitute for such hazardous internal indicators. Flowers are the miracle of the nature, by God. Biochemists have developed a variety of methods for the purification and analysis of bio molecules. Severals of these techniques will be used in his laboratory exercise in order to isolate and study the photosynthetic pigments, chlorophyll ,anthocyannis, and carotenoids.[5]

Aster have starry-shaped flower heads that range in colour from white to blue to purple. The heart of the flower is bright yellow to orange. The leaves are divided into slips and are usually bright green, but they can be brownish too. The plant itself is a sturdy clump that can grow up to two meters.

Dianthus caryophyllus commonly known as the carnation is a species of Dianthus native to the Mediterranean region. It's extract natural range is uncertain due to extensive cultivation over the last 2,000 years. Carnation are prized for their vibrant colors, delicate fringed petals, and enchanting fragrance.[6-7]

Colour changes of natural indicators at different pH values have been attributed to the presence of anthocyanins and flavonoids which are pH sensitive. Anthocyanins are organic compounds that are usually found in the aqueous sap of the vacuole of the epidermal plant cells. These compounds have a complex structure consisting of an aromatic three-

ring molecular structure, one or more attached sugar molecules and sometimes acyl groups attached to the sugar molecules. Anthocyanins are water soluble and are usually more stable in acidic media than in alkaline solutions. A general structure of an anthocyanin is shown in Figure 1. Almost any plants that have blue, violet, purple or red flowered colours contain organic pigments, anthocyanins that changes colour with change in pH. The colour stability of anthocyanins depends on structure of the anthocyanins, pH, temperature, oxygen, and light and water activity. They tend to be red in a more acidic solution and blue in basic solution.

Anthocyanins have several physiological activities which include antioxidant, anti-hepatocarcinogenic, anti-inflammatory, anti-tumour, hypolidemic, cardioprotective and cancer chemopreventive, hence they are safe to use in acid-base titration.

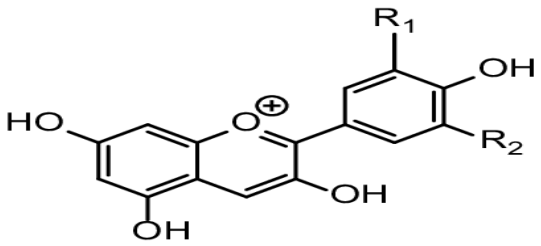


Fig 1. General structure of anthocyanin

MATERIAL AND METHOD

Ethanol, Hydrochloric acid,Sodium hydroxide, Acetic acid, Succinic acid Phenolphthalein indicator.

One kilogram of fresh Aster and Carnation flowers were collected. The fresh flower petals of Aster and Carnation were separated from the whole flower by hand and washed with distilled water to remove dirt. The fresh Aster and Carnation petals were air dried for three weeks without exposure to direct sunlight to minimize oxidative loss before pounding into fine powder at room temperature. The dried flower petals were ground into fine powder with grinding machine and stored in a polyethylene bag before use.[8-9]

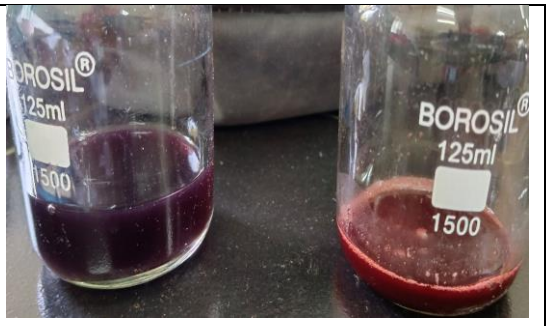
Carnation flower petals

Dried petals of carnation flower

Dried petals of Aster flower

METHODOLOGY

20 grams of dried powder of Aster and Carnation flower were separately mixed with 100 mL of 97 % ethanol in 250 milliliter Erlenmeyer flask and then the mixture was stirred by using a magnetic stirrer for 2 hours to disperse the powder completely. The mixture was kept at room temperature for 24 hours and then triturated in mortal and pestle and resulting solution were filtered by using whatman filter paper to remove the remaining plant matter. The extract was preserved in tightly closed container and stored away from direct sunlight to prevent photolysis and decomposition.[10]



Indicators Aster and Carnation

Standard chart for phytochemical identification:

Phytochemicals	Colour with aq. NaOH	Colour with conc. H_2SO_4	Colour with Mg-HCl
Anthocyanins	Blue violet	Yellow orange	Red(fads to pink)
Flavones	Yellow	Yellow to orange	Yellow to red
Flavonols	Yellow to orange	Yellow to orange	Red to magenta
Flavononeș	Yellow to orange(cold) Re to purple (hot)	Crimson orange	Red, magenta, violet, blue
Is flavones	Yellow	Yellow	Yellow
Leucoanthocyanins	Yellow	crimson	Pink

RESULT

Acid –base titration

1.strong acid and strong base –HCl and NaOH

Indicator	Mean	Colour change
Phenolphthalein	4.6 cm^3	Colourless to pink
Aster	4.6cm^3	Light purple to yellow
Carnation	4.5cm^3	Light orange to yellow

2.Weak acid and Strong base- Acetic acid and NaOH

Indicator	Mean	Colour change
Phenolphthalein	9.9 cm^3	Colourless to pink
Aster	10.0cm^3	Light purple to yellow
Carnation	10.2cm^3	Light orange to yellow

3. Weak acid and Strong base- Succinic acid and NaOH

Indicator	Mean	Colour change
Phenolphthalein	15.0 cm^3	Colourless to pink
Aster	15.6cm^3	Light purple to yellow
Carnation	15.4cm^3	Light orange to yellow

Table 1, 2 and 3 showing the end point obtained by using the indicator.

The results significantly match with the standards match the standards with showing color changes at various burette readings. Tables showing color change after addition of indicator which showing there should be the reaction is ongoing after some interval of adding titrant we observe the end point indication a definite color to the solution. The process is repeated thrice and the mean reading is obtained and enlisted in the table. Here we used a type of titrimetric titration. i.e. acid- base titration.

DISCUSSION

From the experimental data, it was observed that plant pigments / dyes are quite easy to extract and

quite stable to heat and external environmental condition. The various extracts of flower petals in different solvent can be used for making of indicator and it can give a significant changes.

CONCLUSION

The synthetic indicators like phenolphthalein are not only hazardous to health but are also prominent pollutants. The fundamentals of Green Chemistry prove that these unsafe chemicals can be substituted by the petal extract as an indicator for acid base titration. The accuracy of the observed results has been examined by performing titration between different acids and bases. The results are also supported by less variation in the mean value and titer value from that of synthetic indicators. Thus, the use of natural indicator in the acid base titration is statistically proved. The natural indicator prepared from Aster and Carnation flower petals is neither harmful to the environment nor it causes any health hazard. This ethanolic extract is equally effective as the other synthetic indicator and provides reliable and accurate results. Therefore, of natural indicator like petal extract is more economical, simple, harmless, pollution free and inert. So by this work it can be concluded that the proposed herbal indicators can be used as a substitute to synthetic indicators.

REFERENCE

[1] Georgiev V, Ilieva M, Bley T, Pavlov A, et al. Betalain production in plant in vitro systems. Acta Physiologiae Plantarum. 2008; 30(5):581-593.

[2] Bhagat VC, Patil RD, Channekar PR, Shetty SC, Akarte AS, et al. Herbal indicators as a substituent to synthetic indicators. International Journal of Green Pharmacy. 2008; 2(3):162–163.

[3] Singh S, Bothara SB, Singh S, Pateln R, Ughreja R, et al. Preliminary pharmaceuticals characterization of some flower as natural indicators. The Pharmaceutical Research. 2011:213-220.

[4] Jaspreet S, Kanika R, Perminder N, Geet D,et al. Herbal indicators as an upcoming tread in titrimetric analysis. International Research Journal of Pharmacy.2011;2(4):177-179.

[5] Agarwal OP, Chemistry of organic natural products. Vol II. Goel Publishing house, Krishana Prakashan media Ltd,Meerit, p.no. 210-213.

[6] Francesco G E B , Paolo C , Marcello D and Virginia L, Flavanoid from Carnation (Dianthus Caryophyllus) and their anti fungal activity, Phytochemical letters, 2008, 1(1), 44 – 48.

[7] Rasheed U O, Mohammed A U and Lateef A A, Fatai A A, Chinazom,M U and Abiola J K, An Investigation of the Analytical Potentials of Flower Extracts as Bio-Indicators in Acid Base Titration, SEU Journal of Science and Engineering, 2018, 12(2), 20-26.

[8] Vaishnavi S and Sukhada A, Acid-base titration using plant extracts as natural pH indicators, International Journal of Advance Research, Ideas and Innovations in Technology, 2023, 9(2), 252-256.

[9] Mahadi D G and Abubakar S, Flower extract as an improvised indiator in acid – base titration, Chemsearch Journal. 2012, 3(1), 17 – 18.

[10] Dahiru A G, Jibrin S S and Ibrahim M I, Extraction and application of some natural flower pigments and acid base indicators, FUDMA Journal of Sciences (FJS), 2023, 7(4), 157 – 162.