IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Preparation Of Hidden Natural Indicators

Kanchan Jadhav *, Sanket Chilgar, Pratik Ghadage

Department of Pharmacy, Shantiniketan College of pharmacy,Dhotre (BK), Ahamednagar 414304

Abstract:

Natural indicators are substances that can be used to determine the pH of a solution by changing color. In this study, we investigated the use of some natural substances, namely *Hibiscus rosa sinensis*, onion (*Allium cepa*), beetroot (*Beta vulgaris*), and turmeric (*Curcuma longa*), as indicators in acid-base titration, their antibacterial activity, as a milk freshness indicators and as a pH paper. In this study, we propose a novel application of *hibiscus rosa sinensis* as a milk freshness indicator. Additionally, the article evaluates the advantages of using a natural indicator, such as its low cost, availability, and eco-friendliness, as well as its sensitivity to environmental factors such as temperature and light. Overall this article provides valuable insights into the use of natural indicator and highlights its potential for future research and applications in various fields.

Keywords: *allium cepa,beta vulgaris, hibiscus rosa sinensis*, natural indicators.

Introduction:

Indicators are subtances that change the color when they are added to solution and there is a change in pH of that solution. pH measures acidity or basicity of solution which is based on the concentration of hydrogen and hydroxide ions present in solution. Indicators work by change in their structure in response to changes in pH,which alters their absorption of visible light,resulting in change in color of solution. In chemistry indicators used to determine the pH of solution or rection,such as in titrations.[1,8]

Synthetic indicators used in acid base titration have some negative impacts on environment, not easily available, and expensive to produce[10]. So this negative impacts can be overcome by use of eco-friendly, easily available and cost effective natural indicators, pH paper derived from plants or other natural sources. PH paper is a type of indicator paper that changes color when dipped into a solution, providing an estimation of the solution's pH level. There are several alternatives to synthetic indicators that can be used in acid base titration. By using these alternatives , we can reduce the negative impact on the environment and also make the process more cost effective [2,7,9]

Indicators are dyes\pigments that can be isolated from a variety of sources including plants, fungi and algae. Anthocyanins are water-soluble pigments that are responsible for the red , blue and purple colors of many fruits , flowers and leaves. They belongs to a larger class of pigments called flavonoids which are synthesized by plants for a variety of functions , including attracting pollinators and protecting against UV radiations . Anthocyanins have the unique property of changing color depending on the pH of their environment. In acidic conditions they appears red , while in basic conditions , they appear blue or purple.

This makes them valuable as natural pH indicators in scientific experiments and in everyday applications , such as in testing the pH of soil, water or food.[3,9]

In present study, we use china rose (*Hibiscus rosa sinensis),* Onion (*allium cepa*),and Beetroot (*beta vulgaris*) and turmeric (*curcuma longa*) as a natural and effective indicator for acid-base titration. Also made the natural pH paper and Litmus paper by using fresh flowers of china rose (*Hibiscus rosa sinensis)* and natural turmeric paper by using ethanol water extract of turmeric (*curcuma longa*).These selected natural plants contains specific pigments which having similar properties as synthetic indicators.

Hibiscus rosa sinensis belongs to malvaceae family. This plant is native to east Asia which is also known as china rose, hawaiian hibiscus. This plant widely cultivated for its showy flowers , which are used for ornamental purposes and in traditional medicine.[4,5,8,11,12]

Allium cepa, commonly known as onion, which is used as natural indicator in era of various scientific and educational settings. The outermost thin and transparent layer of the onion contain pigment called anthocyanin, which is sensitive to change in pH. This property of anthocyanin pigment can be used to estimate the change in pH of solution.[14]

Beta vulgaris, commonly known as beet or beetroot, which can be used as a natural indicator. Beet contain a pigment called betalain, that causes change in color of solution as change in pH.[15,16]

Curcuma longa, commonly known as turmeric, commonly used spice. turmeric contain pigment called curcumin, which has been found to have several properties that make it usefull natural indicator.[17]

Materials and Methods:

1)Sample collection:

Fresh samples were collected from botanical garden in shantiniketan college of pharmacy. Samples were authenticated by Radhabai kale mahavidyalaya Ahamednagar.

2)Sample preparation

For *Hibiscus rosa sinensis*:

To extract the active compounds from Hibiscus Rosa Sinensis, the petals were carefully harvested and dried at room temperature. The weight of each sample was monitored regularly to ensure that they were completely dried. Once the petals were completely dry, they were ground into a fine powder using a mortar and pestle.To extract the active compounds from the powdered petals, each sample was filtered and weighed to obtain a 20-gram sample. Distilled water and methanol were used to extract the active compounds. The extraction process was carried out by soaking the powdered petals in the solvents for a specific period of time, followed by filtration to obtain the extract. The extracted samples were then stored in separate containers for further analysis and experimentation.[6,13]

For *allium cepa:*

Allium cepa samples were collected, washed, and dried. A 10-gram sample of air-dried Allium cepa was weighed and macerated with methanol and acetone separately. The extracts were filtered using Whatman filter paper after 24 hours, and the resulting filtrates were used for titration to assess their indicator properties.[18]

For *beta vulgaris*:

To extract the indicator from beetroot, 100 grams of chopped beetroot were added to a solution containing Ethanol-Hydrochloric acid (v/v ratio 99:1) and Ethanol-Water (v/v ratio 1:1). The mixture was allowed to sit for 45 minutes. After cooling for 15 minutes, the boiled beetroot was squashed, and the liquid was filtered. The residue was squeezed again, and the liquid was then evaporated to obtain a highly concentrated portion of the indicator. The concentrated extract was then stored in a tightly closed container away from sunlight to prevent any degradation of the active compounds.[15,16]

For *curcuma longa:*

Turmeric rhizomes were cut and dried for 48 hours, then ground into a powder. 100 g of the powder was extracted with 132 ml of 70% ethanol in a soxlet extractor. The resulting extract was concentrated in vacuum at 50˚C and dried in a desiccator to remove residual water. The yield of the crude extract powder obtained was 15g (18.67%).[19]

Preparation of natural pH paper and litmus paper:

After washing the Hibiscus rosa sinensis petals, grind them into a smooth paste and add distilled water to make a solution. Filter the solution to remove any solid particles and cut the filter paper into small rectangular pieces. Dip the filter paper pieces into the Hibiscus rosa sinensis solution for a few minutes, then remove and air dry them on a Petri dish. To remove any moisture, place the filter paper pieces in an oven at 60°C for 30 minutes. After the formation of pH paper the paper is dipped into the acidic as well as basic solutions for making acidic and basic litmus paper respectively.

3) Experimental methodology:

In the experimental procedure, the extract from each sample was utilized separately. Additionally, another experiment was conducted using a standard synthetic indicator i.e. phenolphthalein. To begin, 10ml of the acid was measured into a conical flask and 1.0ml of the phenolphthalein indicator was added using a 1.0ml dropper. A 50ml burette was then filled with the base and titrated against the acid until a clear color change was observed, indicating the end of the titration reaction. The first titration was performed using the standard synthetic phenolphthalein indicator. Each subsequent titration was carried out using either the plant extract or the standard indicator, and the titration was repeated thrice while recording the endpoint values. The mean value was subsequently calculated for each set of values.

Indicators Used:

Phenolphthalein

Methyl red

Prepared natural indicators

Acid Base Titration Procedures:

1) Strong Acid VS base (Sulphuric acid and sodium hydroxide)-

In order to perform a precise titration, 10ml of Sulphuric acid 0.1N solution was carefully transferred into a clean conical flask. To indicate the endpoint of the reaction, 3 drops of phenolphthalein indicator were added to the solution. Sodium hydroxide 0.1N was then slowly added from a burette until a permanent faint pink color appeared, indicating that the reaction was complete. To ensure accuracy, the titration was repeated multiple times until concordant values were obtained. This meticulous approach helps to minimize errors and

ensures reliable results. Same procedure is carried out by using natural indicators instead of phenolphthalein indicator and noted the end point.

2) Strong Acid VS Weak Base (Sulphuric acid and Sodium Carbonate)

In order to perform a precise titration, 10ml of Sulphuric acid 0.1N solution was carefully transferred into a clean conical flask. To indicate the endpoint of the reaction, 3 drops of phenolphthalein indicator were added to the solution. Sodium carbonate 0.1N was then slowly added from a burette until a permanent faint pink color appeared, indicating that the reaction was complete. To ensure accuracy, the titration was repeated multiple times until concordant values were obtained. This meticulous approach helps to minimize errors and ensures reliable results. Same procedure is carried out by using natural indicators instead of phenolphthalein indicator and noted the end point

3) Weak Acid VS Strong Base (Acetic acid and sodium hydroxide)

In order to perform a precise titration, 10ml of Acetic acid 0.1N solution was carefully transferred into a clean conical flask. To indicate the endpoint of the reaction, 3 drops of phenolphthalein indicator were added to the solution. Sodium hydroxide 0.1N was then slowly added from a burette until a permanent faint pink color appeared, indicating that the reaction was complete. To ensure accuracy, the titration was repeated multiple times until concordant values were obtained. This meticulous approach helps to minimize errors and ensures reliable results. Same procedure is carried out by using natural indicators instead of phenolphthalein indicator and noted the end point

Observation-

Table 1: Titration of H_2SO_4 against NaOH-

Sr. No.	Indicator	Constant burette reading(ml)	Color Change
1)	Phenolphthalein	10.3	Colorless to faint pink
2)	*Hibiscus rosa sinensis*	11	faint pink to green
3)	*allium cepa*	10.4	faint pink to pale yellow
4)	*beta vulgaris*	10.5	faint pink to Colorless

Table 2: Titration H_2SO_4 against Na_2CO_3

Sr. No.	Indicator	Constant burette reading(ml)	Color Change
1)	Methyl Orange	11.3	Colorless to faint pink
2)	*Hibiscus rosa sinensis*	10.6	faint pink to green
3)	*allium cepa*	10.9	faint pink to pale yellow

Table 3: Titration of CH_3COOH against NaOH

Sr. No.	Indicator	Constant burette reading(ml)	Color Change
1)	Phenolphthalein	11.3	Colorless to faint pink
2)	*Hibiscus rosa sinensis*	11.7	faint pink to green
3)	*allium cepa*	11	faint pink to pale yellow
4)	*beta vulgaris*	11.2	faint pink to Colorless

Result:

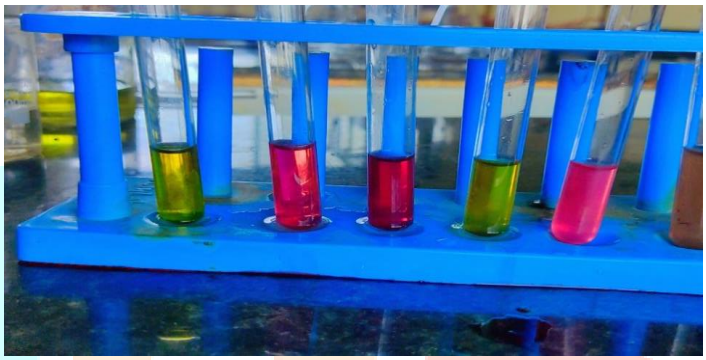

Fig.1:Tubes showing color change at end point.

Fig.2: Before Titration

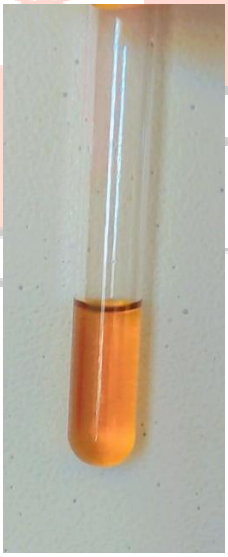

Fig.3:After Titration

Fig.4: Natural pH paper

Discussion:

Environmental concerns have led to a growing interest in finding natural alternatives for synthetic indicators in acid-base titrations. The high cost and limited availability of synthetic dyes have made it necessary to search for eco-friendly and sustainable options. This study focuses on the use of plant extracts as natural indicators for acid-base titrations. The extracts from different plants i.e. *Beta vulgaris* , *Hibiscus rosa sinensis, allium cepa* were tested for their effectiveness in indicating the endpoint of strong acid-strong base, strong acid-weak base, and weak acid-strong base titrations.

Conclusion:

The results demonstrated that the plant extracts provide sharp and intense color changes, which shows same results as synthetic indicators. Additionally, the use of plant extracts as indicators is simple, accurate, and economical. Hence, plant extracts could be a promising alternative to synthetic indicators in acid-base titrations, and their utilization could be an environmentally friendly and cost-effective solution.

References:

1) Sudarshan Singh.2011.Preliminary Pharmaceutical characterization of some flowers as natural indicator , acid base titration . Pharamacognosy journal ,3(22):39-43.

2)Daniel A . Abugri.2012. investigation of simple and cheap source of Natural indicator for acid base titration ,Effects of system conditions system on natural indicators .green and sustainable chemistry.2(3):117-122.

3) Swarup Roy , Jong-whan Rhim . 2020. Anthocyanin food colorant and its application in pH responsive color change indicator film . Critical Reviews in food science and nutrition,61(14): 2297-2325.

4)Raj Bala.2022.*Hibiscus Rosa Sinensis* Linn:A phytochemical and pharmacological review. International journal Health Sciences; 6(53):5165-5193.

5)Anil kumar,Ashatha singh.2012. review on *Hibiscus rosa sinensis*. International journal of Research in pharmaceutical and Biomedical sciences,3(2):534-538.

6) Maizatulnisa Othman.2018.Bio-polymer chitosan and corn starch with extract of Hibiscus rosa sinensis as pH indicator for visually smart food packaging . American institute of physics,185(1).

7) Siti Nuryanti. . 2013. Corolla of Roselle(*Hibiscus Sabdariffa* L.)As acid- base indicators. European Journal of chemistry,4(1): 20-24.

8) Gupta poonam ,Jian pushpa ,PK jain. 2012. Isolation of natural acid- base indicator From the flowers Sap of *Hibiscus rosa sinensis.* Journal of chemical and Pharmaceutical Research,4(12) .

9) Pathan mohd, Arif khan, Mazehar Farooqui.2011 .Analytical Applications of plant extract as a Natural pH indicator. journal of Advanced Scientific Research,2(4).

10) Shivaji H. Burungale, Ankush V.Mali. 2014.Natural indicator as a eco-friendly in acid base titration. Journal of chemical and Pharmaceutical Research,6(5):901-903.

11)Anusha Bhaskar, Nithya and Vidhya. 2011. Phytochemical Screening and in vitro antioxidant activities of Ethanolic extract *of Hibiscus Rosa sinensis L.* Scolars Research library,2(5):653-661.

12)Shaymaa Khudhl Al-Alak.2015. Antibacterial activity of Hibiscus sinensis extract and synergistic effect with amoxicillin against some human pathogen . American journal of phytomedicine and clinicte therapeutics,3(01).

13))Stanley I.R.Okuduwa.2015. comparative analysis of the properties of Acid –Base indicator of Rose (Rosa setigera), Allamanda (Allamanda cathartica) and Hibiscus *(Hibiscus Rosa sinensis*) flowers . Biochemistry research International journal .

14) SOFEME R GEBSON , ANDY N MOSES .2015. Use of *allium cepa* (Red onion skin) extract as indicator alternate in acid base titrimetric analysis . International Journal of Research in Applied , Natural and social Science, 3(7): 17-22.

15) Prashant Thote .2015. Green chemistry Study of acid base indicator property of Golden Beetroot . International Journal of Research : Granthaalayah,3(9):1-6.

16) B . Bhuvaneshwari.2015. Natural Dyes as acid base indicators from *beta vulgaris.* Research Journal of Pharmacognosy and phytochemistry,7(2): 65-68.

17) Rolando M Caraballo.2021.Turmeric and RGB analysis:a low cost experiment for teaching acid base equilibria at home . Journal of Chemical Education,98(3): 958-965.

18) A.O.Odiongengi . Evaluation of potential of dissotis Rotundifolia, centrosema Pubescens and allium cepa extract as indicator for Acid-Base titration . International Journal of advanced and Innovative research ,5(3):2278-7844.

19) Onyekachi Onyinyechi Nnorom.2023. Comparative study on Acid- Base Indicator properties of natural dye , turmeric rhizomes (*curcuma longa*)And synthetic dyes .Journal of Textile Science and Technolog,9(1).