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Herbs as Natural ph Indicator

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ABSTRACT: The quest for sustainable, eco-friendly, and cost-effective alternatives to synthetic chemicals has sparked renewed interest in natural products, particularly in analytical applications. This review highlights the potential of herbs as natural pH indicators, offering a green alternative to synthetic dyes traditionally used in acid-base titrations and pH detection. Various herbs contain naturally occurring pigments such as anthocyanins, flavonoids, and betalains, which exhibit visible color changes over a range of pH values. This manuscript systematically explores the phytochemical basis of these color changes, methods of extraction, stability profiles, and comparative effectiveness with conventional indicators. Additionally, it examines the applications of herbal indicators in educational, industrial, and environmental contexts. The use of herbs not only aligns with the principles of green chemistry but also promotes local biodiversity utilization and low-cost analytical practices. This review aims to provide a comprehensive understanding of the current status, challenges, and future prospects of herbal pH indicators in analytical chemistry.

KEY WORDS: Herbal indicator, Equivalence point, Titration, Anthocyanin.

I. INTRODUCTION:

Indicator is a chemical compound that undergoes color changes when exposed to basic and acidic substances. Structure, pH, light, and temperature all affect these pigments' color and stability.[1]

The acid-base indicators that are now on the market, such as methyl orange and phenolphthalein, are synthetic and can cause chemical dangers, as well as issues with availability and cost.

The goal of this study is to simply introduce the use of flower pigments to the market, increase the wealth of the traditional Indian medicinal system, which is primarily plant-based, and assist farmers with plant cultivation and collection as well as industry with the preparation of the aforementioned indicators, all of which will provide financial support to both the industry and farmers. [2]

The colors of various substances contribute to the beauty and diversity of the natural world. Due to their vibrant hues and distinct structures, flowers, plants, animals, and minerals each exhibit unique characteristics. A wide variety of organic and inorganic compounds are responsible for these natural colors. Among the organic compounds that impart color to flowers are flavonoids, flavonols, acylated flavonoids, anthocyanins, glucosylatedacylated anthocyanins, quinones, imines, polymethines, naphthoquinones, anthraquinonoids, indigoids, dihydropyrans, diarylmethanes, and carotenoids. Among these, anthocyanidins and flavones are the most prominent.

Flavonoids are pH-sensitive colored pigments that may be extracted from a variety of plant components, including fruits and flowers. Because flavonoids exhibit striking color changes in response to pH variations, they can be used as an acid-base titration indicator instead of more traditional synthetic indicators.[3]

Chemicals from the naturally occurring anthocyanin family are found in many plants or plant components. They are blue in basic solutions and crimson acidic ones.

One common introductory chemistry demonstration is the extraction of anthocyanins from red cabbage leaves or lemon skins to create a primitive acid-base indicator.

Numerous colored plants or plant parts, such as leaves (red cabbage), flowers (geranium, poppy, or rose petals), berries (blueberries, blackcurrant), and stems (rhubarb), can have their anthocyanins removed. Antirrhinum majus is a member of the Scrophulariaceae family. Commonly referred to as snapdragon elsewhere and dog-flower in India [4]

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Anthocyanin are produced through the phenylpropanoid pathway and are members of the parent family of chemicals known as flavonoids. They can be found in the stems, roots, leaves, fruits, and flowers of higher plants. Anthocyanins, which turn blue in bases and red in acids, are frequently used as a natural pH indicator because of the variation in chemical structure that results from pH changes.[5]

FLAVONES:

Flavones, along with flavonols and their glycosides, continue to attract the interest of biologists due to their presence in numerous food plants and widely used medicinal herbs. Currently, they are receiving significant attention for their anti-inflammatory and antioxidant properties.

Flavones are soluble in both water and alcohol and can be extracted by chopping and macerating the plant material, then either soaking it in hot water for a few minutes or rubbing it with alcohol. These yellow pigments are found in the plant kingdom, either in their free form or as glycosides.

These compounds are also known as anthoxanthins. Chemically, they are hydroxylated derivatives of flavone (2-phenylchromen-4-one).

In most flavones, the 5 and 7 positions are hydroxylated, and one or more of the 3′, 4′, and 5′ positions are also typically hydroxylated. Additionally, the 3′ and 5′ positions are often methylated.

Flavonoids' primary characteristic is "Venoactivity," which refers to their capacity to reduce capillary permeability and fragility in animal models; in other words, they can lessen the symptoms of experimental vitamin C insufficiency. They were first known as "vitamin P" because to this characteristic. Because they are not vitamins (no specific syndrome is caused by flavonoid insufficiency).

"P factors" or "vitamin P factor" were the latter names given to them. These words were unclear, though, and are seldom ever used anymore; instead, "venoactive" is the term that is currently used to describe these natural compounds and their derivatives. Numerous scientists have identified, isolated, and studied the various uses of flavonoids and similar chemicals found in flowers. Yellow flavonoids from Cocuschrysanthusbiflorus "Eye-catcher" and "Spring Pearls" Iridaceae family by RikkeNorback [23], from KalanchoeBlossfeldiana varieties by Allan Holmi [24] et al., from Bassicarapa as the UV absorbing nectar guide by KatsunoriSasaki , and from Centaurearuthenica by Tamaki Mishio [25].

While Melanie K. [26] and her colleagues were successful in reporting yellow-pink inter-specific hybridization between Dianthus plumarius and yellow flowers, TadigoppulaNarender [27] extracted furano flavonoids and investigated antidyslipidemic efficacy.

In all known flavonoid glycosides, glucose is found in the α-D-pyranose form, as observed in herbacetin 3-glucofuranoside isolated from Jungiapaniculata [28]. However, the NMR data supporting the presence of the furanose form of the sugar are not entirely conclusive.

Flavonoid sulfates have also been reported, including gossypetin 7,8-dimethyl ether 3,3’-disulfate from the flowers of Erica cinerea [29], and isorhamnetin 3-(4”-sulfatorutinoside) from Zygophyllumdumosum [30].

Additionally, acylated derivatives of flavones and flavonols are well known. These modifications can convert normally water-soluble flavonoid glycosides into more lipophilic (fat-soluble) compounds.

ANTHOCYANINS

Chemically, anthocyanins are glycosides, and their sugar-free counterparts are known as anthocyanidins. Various anthocyanins share the same basic carbon skeleton and differ only in the nature of their substituent groups. The fundamental structure is 2-phenylchromenylium chloride, also known as flavylium chloride.

All anthocyanins are regarded as derivatives of 3,5,7-trihydroxyflavylium chloride. They vary based on the number, type, and position of additional hydroxyl and methoxy groups, as well as the attached sugar residues. The most commonly found sugars in anthocyanins include glucose, galactose, and rhamnose. In some cases, these pigments exist in acylated forms, where the sugar residues are modified by the addition of organic acid groups.

The key anthocyanidins, which are the aglycone forms of anthocyanins, include pelargonidin, cyanidin, peonidin, delphinidin, malvidin, and petunidin. These compounds differ in the number and placement of hydroxyl and methoxyl groups on the B-ring of the flavylium ion.

Anthocyanins can also undergo acylation with organic acids, which are attached to their sugar units through ester bonds. These acids are typically aromatic phenolic acids, aliphatic dicarboxylic acids, or a mixture of both. The acyl groups are most often linked to the 6-position of the sugar molecule, though substitutions at the 2-, 3-, and 4-positions have also been identified, as reported by Cabrita [31].

Among the most common phenolic acids found in anthocyanins are derivatives of hydroxycinnamic acids, such as p-coumaric, ferulic, caffeic, and sinapic acids, as well as hydroxybenzoic acids like gallic acid. Common aliphatic acids present in anthocyanin structures include malonic, acetic, malic, succinic, and oxalic acids [32].

Anthocyanins are highly unstable and prone to degradation. Their stability is influenced by several factors, including pH, storage temperature, exposure to enzymes, light, oxygen, their chemical structure and concentration, as well as the presence of other compounds such as flavonoids, proteins, and minerals.

Due to their complex behavior and important biological roles, researchers have shown great interest in isolating, characterizing, and studying the physical, chemical, and physiological properties of anthocyanins. For example, FumiTatsuzawa and his team [33] isolated cyanidin glycosides from the flowers of Corydalis species. Toshio Honda et al. [34] obtained acylated anthocyanins from the violet-blue flowers of Orychophragonus violaceus. KosakuTakeda and his collaborators [35] isolated and characterized the components of protocyanin, a blue pigment found in Centaureacyanus flowers. Additionally, Ana Paula et al. [36] studied the effects of photoperiod and temperature on the in vitro growth and flowering of epiphytic orchids.

Jamal Uddin [37] and his team successfully studied the seasonal variations in pigmentation and anthocyanidinphenetics in commercially grown Eustoma flowers. Kaung Liang Huang et al. [38] investigated flower colors and pigments in hybrid tuberose, while Kenjiro Toki [39] and his colleagues isolated anthocyanins from the scarlet flowers of Anemone coronaria. Moshe Reuveni et al. [40] examined the decrease in vacuolar pH during the opening of petunia flowers, and Y. Ben Tal [41] explored the environmental factors affecting flower coloration in Kangaroc Pan.

Numerous researchers have focused on the isolation and characterization of anthocyanins from various flowers. KjellTorskangerpoll [42] and his team isolated anthocyanins from tulips; Tomio Ishikawa [43] extracted them from the blue petals of Salvia uliginosa; RikkeNorbæk [44] studied them in Crocus flowers; and Ben-Erik van Wyk et al. [45] identified anthocyanins in Lobostemon. Many other scientists continue to explore the use of natural plant-based dyes.

The practice of making dyes from common plants is not new; in fact, it's how humans first discovered colorants. Our ancestors understood that specific plants could yield specific colors—for example, goldenrod for yellow and berries for purple.

INDICATORS

An indicator is a substance used to identify the end point of a titration. Examples of commonly used indicators in acid-base titrations include phenolphthalein, methylene blue, methyl red, and methyl orange.

Classification of Indicators:

Indicators are classified into two main types: external indicators and internal (or self) indicators. External indicators are substances added separately during the titration to signal the end point. Internal or self-indicators, on the other hand,are not added externally; instead, one of the reacting solutions itself acts as the indicator by undergoing a visible change.

Furthermore, indicators are categorized based on the type of titration in which they are used:

Redox indicators – used in oxidation-reduction (redox) titrations

Precipitation or adsorption indicators – used in precipitation titrations

Complexometric indicators – used in complexation (or complexometric) titrations

Acid-base or pH indicators – used in acid-base titrations to detect changes in pH.

pH INDICATORS

pH indicators, also known as acid-base indicators or neutralization indicators, are substances that exhibit distinct color changes in response to variations in pH levels. Typically, these indicators are weak acids or bases whose conjugate forms possess different colors due to variations in their absorption spectra. For simplicity, an acidic indicator can be represented by the formula HIn, and its ionization in solution is expressed by the equilibrium:

In this equilibrium, the undissociated form (HIn) and the ionized form (In^-) have different colors, allowing the indicator to signal changes in

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pH. Similarly, basic indicators can be represented by the formula InOH.
Common indicators used in acid-base titrations, along with their pH transition ranges and associated color changes.

Natural indicators

Natural indicators have been used for centuries, long before the invention of synthetic acid-base indicators by modern chemists. In the 17th century, chemist Robert Boyle documented the use of natural indicators derived from roses and other plants in his book The Experimental History of Colours.

He noted that one of the key properties of acids was their ability to turn plant juices red.

While red cabbage is a well-known natural indicator that changes color across a range of pH levels, it is far from the only one. Many plant-based substances also exhibit noticeable color changes depending on the acidity or alkalinity of their environment. For example, cherry juice can appear red at a pH of 2.5, orange at pH 4.5, brown at pH 7, and green at pH 10.

A wide variety of plant materials—such as rose and violet petals, turnip and radish skins, hydrangeas, rhubarb, cherries, red grapes, beets, red wine, curry powder, geranium and pansy petals, tea, tulips, thyme, turmeric, peonies, petunias, blueberries, and grape juice concentrate—can act as natural indicators. These substances change color in acidic or basic environments, making them useful for identifying pH levels. In fact, almost any vividly colored fruit, vegetable, or flower has the potential to serve as a natural acid-base indicator.

Quisqualis indica

Synonyms **:**Chinese honeysuckle,Rangoon Creeper, Drunken Sailor, Akar Dani, AkarSuloh, Dani, Ara Dani, Akar Pontianak, Red Jasmine

Family **:**Combretaceae

Biological source **:**It is commonly known as Rangoon Creeper and is a woody climber found in tropical and subtropical regions. The seeds of Quisqualis indica are traditionally used as an anthelmintic, especially against roundworms and pinworms, due to the presence of the active constituent quisqualic acid.

Chemical constituent :The chemical constituents found in Quisqualis indica are alkaloids , flavonoids, tannins, saponins, terpenoids, aminoacids.

Fig no . (01)

Pentas lanceolata

Synonyms :Pentas, Star flower, Star cluster,Mussaendaaegyptiaca, Mussaendalanceolata
Family: Rubiaceae (coffee family)
Biological source :Egyptian starcluster or Pentas, is the entire plant, particularly the flowers and leaves, which are native to tropical Africa and the Arabian Peninsula
Chemical constituent : phenols, terpenoids, coumarins, phytosterols and quinines.

Fig no .(02)

Melastomamalabathricum

Synonyms :Malabar melastome, Indian rhododendron, Singapore rhododendron, planter's rhododendron ,senduduk
Family: Melastomataceae
Biological source :Melastomamalabathricumis a flowering plant in the family Melastomataceae native to Seychelles, tropical and subtropical Asia to Australia and western Pacific islands
Chemicalconstituents:ursolicacid,hydroxyursolicacid,Asiaticacid,flavonoids,tannins,phenolic compounds.

Fig no (03)

Impatientsacaulis
Synonyms: Rock balsam,impatientsbulbosa,impatientsgracilis
Family:Balsaminaceae
Biological source :Impatiens acaulis is a species of flowering plant in the family Balsaminaceae. The species is endemic to most of India and Sri Lanka
Chemical constituents :naphthoquinones, flavonoids, phenolic acids, and anthocyanidins, some of which have potential antioxidant and antimicrobial properties.


Fig no (04)

Antirrhinum Majus
Synonyms:Snapdragon, Dog Flower, Shwanmukh
Family: Plantaginaceae.
Biological source:commonly known as the common snapdragon or garden snapdragon, is the entire plant, including its leaves, flowers, and seeds, which belong to the Plantaginaceae family.
Chemical Constituents:Anthocyanidins ,Flavonols, Aurones ,Amino acids ,Oils, Cinnamic acids.


Fig no. (05)

Dianthus plumaris
Synonyms: common pink, garden pink, wild pink or simply pink.
Family: Caryophyllaceae (pink or carnation family).
Biological source : Dianthus is a genus of about 340 species of flowering plants in the family Caryophyllaceae, native mainly to Europe and Asia, with a few species in north Africa and in southern Africa, and one species (D. repens) in arctic North America.
Chemical constituents: triterpenes, alkaloids, coumaruns, cyanogenic glycoside, cyanidin, pelargonidin, the yellow isosalipurposide, essential oil, volatile oil.


Fig no (06)

Impatientsbulsamina
Synonyms**:** garden balsam, rose balsam ,touch me not , spotted snapweed.
Family:Balsaminsaceae
Biological source: The plant in impatiens balsamin.linn, belonging to the family balsaminsaceae .the parts used include flowers leaves and seeds.
Chemical constituents:Flavonoids, Anthrocyanins, Lawsone, Essential oils, Tannis ,saponins ,Alkaloids.


Fig no(07)

Bauhinia purpurea
Synonyms:Purple Bauhini , Butterfly tree ,Orchid ,tree Kachnar.
Family: Fabaceae (Leguminosae)
Biological Source:The dried or fresh bark, leaves, and flowers of the plant Bauhinia purpurea Linn., belonging to the family Fabaceae.
Chemical Constituents: Flavonoids (e.g., quercetin, kaempferol, apigen Flavonoids (e.g., quercetin, kaempferol,apigenin),Tannins,Steroids,Terpenoids, Phenoliccompounds,Glycosides,Saponins,Alkaloids.

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Fig no .(08)

Rosa indica

Synonyms: Guinea corn leaves, Punicagranatum, Tageteserecta, Dahlia pinnata, Acalyphawilkesiana, Morus alba, Citrulluslanatu, Caesalpiniasappan, and Beta vulgaris.

Family : Rosaceae.

Biological source: A rose is either a woody perennial flowering plant of the genus Rosa in the family Rosaceae or the flower it bears.

Chemical constituents : flavonoids, tannins, phenolic acids, polysaccharides, fatty acids, organic acids, carotenoids, and vitamins.

Fig no .(09)

Citrullus lanatus:

Synonyms : Citrullus vulgaris, Cucurbita citrullus, and Momordica lanata.

Family: Cucurbitaceae .

Biological source : A scrambling and trailing vine-like plant, it is a highly cultivated fruit worldwide, with more than 1,000 varieties.

Chemical constituents : lycopene, citrulline, and other polyphenolic compounds. Watermelon acts as vital source of l-citrulline, a neutral-alpha amino acid which is the precursor of l-arginine, an essential amino acid necessary for protein synthesis.

Fig no .(10)

INDICATOR PROPERTIES :

Nature is rich in color, largely due to the vibrant hues of flowers and other naturally colored materials. The intensity of these colors depends on several factors, including the chemical composition of the substances involved. In plants, these colors arise from naturally occurring organic compounds such as flavones, flavonols, xanthins, anthocyanins, and azo compounds.

Many of these pigments—particularly flavones, flavonols, and anthocyanins—are sensitive to pH changes. They display distinct color variations when exposed to acidic or basic environments. These natural compounds often produce clear, stable, and sharp color changes when transitioning between acidic and alkaline conditions, making them suitable for use as acid-base indicators in volumetric analysis.

Some natural substances exhibit distinct color changes at various pH levels—such as pH 2, 4, 6, 8, 10, and 12—making them excellent tools for educational experiments in laboratories. These natural indicators offer a simple and cost-effective alternative to expensive pH meters and synthetic indicators.

One widely studied example is the aqueous extract of red cabbage, which shows a noticeable range of color changes depending on the pH: red at pH 2, purple at pH 3, violet at pH 5, blue at pH 7, blue-green at pH 9, and green at pH 12 [61–62]. This variation is believed to be due to the presence of specific color-producing compounds, primarily anthocyanins. The composition of these pigments can vary from one plant to another; for instance, red cabbage contains a single type of anthocyanin [63], while blueberries have three—delphinidin, petunidin, and malvidin.

Flavones and anthocyanins in plants are often found in glycosidic forms, and upon acid hydrolysis, they release their carbohydrate components. In red cabbage, the primary anthocyanin is a diglycoside. Some of these flavones and anthocyanins are also esterified with organic acids. These compounds tend to display

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one color in acidic conditions and another in basic environments.

Because of their distinct and reliable color changes at different pH levels, many of these natural compounds can serve as effective indicators in titrations. For use in analytical chemistry, these natural indicators must meet certain criteria: they should show a sharp, clear, and stable color change at the equivalence point and remain stable for several hours. Some naturally occurring compounds meet these conditions and can be successfully used in titrimetric analysis.

The goal of the present study aligns with this idea—to identify new natural indicators that can replace traditional synthetic ones. This shift not only supports greener chemistry but also helps reduce water pollution caused by synthetic dyes. Since natural dyes are biodegradable and break down under aerobic or anaerobic conditions, they can be easily removed from the environment.

General procedure for extraction of anthocyanins:

The maceration technique is commonly employed to extract anthocyanins. A suitable amount of powdered material is macerated in a closed vessel, and the solution is let to stand for a few hours while being shaken occasionally. Filtration is used to remove the liquid and make it clear. Acidified methanolic solution is a frequently used solvent. Because of its low boiling point, which enables quick extract concentration, methanol is a frequently utilized extraction solvent.(8)

Take required quantity of water or methanol according to the nature/polarity of the constituents present in herb, in a beaker. Add herbal plant or part into that beaker. Now, put the beaker for heating until active phytoconstituents (Anthocyanin) comes out from the herbs and mixed fully with water. After that cool the solution and filter out it. Now, collect the filtrate into another beaker so pH indicator is ready to use. [1]

Reagenets used:

Standardized 0.1N HCl, 0.1N NaOH, 0.1N CH3COOH and 0.1N NH4OH were used for the acid-base titrations. In acid-base titrations equivalence point obtained by ethanolic or water extracts of herbal plants.

Indicators were found to exhibit reversible behavior and to exhibit a dramatic color shift in both directions. In acid-base titrations, this demonstrated the value of alcoholic floral extract as an indicator. Because it produces a dramatic color shift at the equivalency point, it was shown to be more significant than the standard indicator when used in all four forms of acid-base titration.[3]

Experimental procedure:

After being cleansed with distilled water, the flower petals were chopped into tiny bits and macerated in 10 milliliters of methanol for 24 hours. The extract was kept out of direct sunlight in a glass jar that was properly sealed. The standardization of acids and bases and the calibration of equipment such as burettes, pipettes, and other necessary instruments were completed in accordance with Indian Pharmacopoeia I.P 1996's. [4]

10 ml of titrant with two drops of each indicator was titrated against titrates and the color changes for the indicators are recorded.

The results of screening for

- strong acid-strong base (HCl - NaOH),
- strong acid- weak base (HCl - CH3COOH),
- weak acid-strong base (CH3COOH - NaOH) and
- weak acid-weak base (CH3 COOH ñ NH3) are noted.

Each titration is carried out five times by using 1N strength of acid and alkali and results were recorded as mean ± SEM.[2]

II. RESULT:

Table: Rosa indica colour change with titrant and titrate

Titrant	Indicator	Colour	Titrant	Colour
HCL	Rosa indica	Pink	NaOH	Red
CH_3COOH	Rosa indica	Pink	NaOH	Dark pink
HCL	Rosa indica	Pink	NH_3	Red
CH_3COOH	Rosa indica	Pink	NH_3	Dark pink

Table no. (01)

Table: Antirrhinum majus and Dianthus plumaris colour change with titrant and titrate

Titrant	Indicator	Colour	Titrate	Colour(End	Indicator	Colour(End
HCL	Antirrhinum manjus	Colourless	NaOH	Pink	Dianthus plumaris	Violet
CH3COOH	Antirrhinum manjus	Colourless	NaOH	Pink	Dianthus plumaris	Violet
HCL	Antirrhinum manjus	Colourless	NH_3	Pink	Dianthus plumaris	Violet
CH3COOH	Antirrhinum manjus	Colourless	NH_3	Pink	Dianthus plumaris	Violet

Table no .(02)

Table: Comparision of Dahlia pinnata with synthetic indicator

Chemical used		Volumes of titrates required for equivalence point with titrant (25 ml) with indicator	
Titrant	Titrate	Standard Indicator	Dahilia indicator
HCL	NaOH	25.1±0.2	24.4±0.43
CH_3COOH	NaOH	24.5±0.3	24.8±0.28
HCL	NH_3	24.8±1.02	
CH_3COOH	NH_3	25.0±0.40	

Table no. (03)

Table : Titration results of flower extract and commercially available indicator

Indicator	Titrant	Colour change	Required volume of Titrant
Phenolphthalein	NaOH/HCl NH,OH/HCI CH,COOH/NaOH	Pink to colourless tink to colouriess Colourless to pink	8.87 ± 0.0577 14.57 ± 0.0577 12.07 ± 0.0577
sMethyl orange	NaOH/HCl NH,OH/HCI CH,COOH/NaOH	Yellow to red Yellow to red Red to yellow	9.17 ± 0.0577 15.6±0.1155 5.27 ±0.0577
Methyl red	NaOH/HCl NH,OH/HCI CH,COOH/NaOH	Yellow to red Yellow to red Red to yellow	8.97± 0.0577 16.13 ± 0.0577 12.13 ± 0.0577
Bougainvillea glabra	NaOH/HCl NH,OH/HCI CH,COOH/NaOH	Brownish yellow to red Brownish yellow to red Red to brownish yellow	8.97 ± 0.0577 15.17 ± 0.0577 12.23 ± 0.0577
Impatiens balsamina	NaOH/HCl NH,OH/HCI CH,COOH/NaOH	Brownish yellow to red Brownish yellow to red Red to brownish yellow	9.07 ±0.0577 15.3 ± 0.1 12.13± 0.057

Table no .(04)

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For all types of titration, the equivalency point achieved using herbal plant's water extract either exactly matched or was extremely near to the equivalent point obtained using phenolphthalein, a common synthetic indicator.

This demonstrates the value of the watery floral extract as an acid-base titration indicator. Its usage in strong acid-strong base titration was discovered to be more significant than that of the conventional synthetic indicator because it produces a noticeable color change at the equivalency point.

If indicators were seen to exhibit reversible behavior and produce a dramatic color shift in both directions. The results showed that flower extracts can successfully replace commonly used indicators since they are easy to use, less harmful to people, affordable, easily accessible, environmentally friendly, accurate, precise, and can be made right before the experiment.[1]

III. CONCLUSION:

Floral extract has been chosen as an indicator source for acid-base titration in order to address the issue of synthetic indicators being extremely harmful to health and causing pollution. A range of acid-base titration procedures have been used to assess the accuracy of the results. Herbal flower and plant's methanolic and aqueous extracts were used to get the results. Because natural indicators are inexpensive, simple to make, readily available, environmentally friendly, pollution-free, inert, and yield precise results, their use in acid-base titration is therefore more advantageous.

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