Research Article

Study of Nerium Odoratum as Natural, Economical and Effective Alternative to Synthetic Indicator and Litmus Paper

Vaibhav G. Nikam, Vishal B. Kulkarni, Prashant D. Nikam, Ganpatrao N. Mulik, Suresh T. Salunkhe and Ashish S. Sartape*

Department of Chemistry, Balwant College, Vita Dist. Sangli-415 311, Maharashtra, India.

ABSTRACT

Natural alternatives to synthetic chemicals are the demand of contemporary chemistry regarding environmental pollution crisis. There is need to develop green indicator as effective alternative for synthetic indicator used in laboratory. In present study we introduced natural alternative indicator to acid base titration: Nerium odoratum ethanolic extract. The material was characterized with FTIR technique. Various solvents were used to extract to get better color change. This indicator gave pink color in Acidic medium with λmax-530±5nm while yellow color in basic medium with λmax-400±5nm .The indicator was tested for all type of titration. The extract was also used to develop the pH indicator strips which showed color change as good as litmus paper which was applied to test pH of beverages, various water samples and soil. Finally it may concluded that, the Nerium odoratum ethanolic extract is best alternative as green, economical and effective alternative to litmus paper and as indicator acid base indicator.

Keywords: Nerium odoratum, Natural and green indicator, FTIR study of indicator.

1. INTRODUCTION

The chemistry is mother of many amenities. Chemistry raised our day today life expectations by affording inventions related with chemicals. We use synthetic indicator for regular acid base titrations and for primary pH determination, we use litmus paper. An indicator is a substance that reveals through characteristic colour changes, the degree of acidity or basicity of solutions. Intense colour is desirable so that very little indicator is needed; in turn the indicator itself will not affect the acidity of the solution. Acid-base indicators are commonly employed to mark the end point of an acid-base titration or to measure the existing pH of a solution. The indicator range is the pH interval of colour change of the indicator[1].

The German chemist Richard Willstätter made the first breakthrough towards the understanding of the chemical structure of plant pigments and how colors could vary from plant to plant. He demonstrated that anthocyanins are glucosides, which are responsible for pigmentation. He also showed that the color of a plant doesn't depend only on the pigment's structure but also the plant's sap or precisely its pH and the concentration of the pigments. Rose flower color is primarily composed of structurally simple cyanidin 3, 5-diglucoside[2].

Acid-base indicators are commonly employed to mark the end point of an acid-base titration or to measure the existing pH of a solution. Anthocyanins show remarkable change in color with the change in pH due to this property it gives an opportunity to use it as an acid base titration indicator rather than the conventional indicators like Phenolphthalein and methyl orange which are chemical based and may cause health hazards. The ethanolic extracts of narium flower petals can be used as indicators in acid base titrations. The isolation of pure compounds responsible for indicator activity can facilitate better understanding of the underlying principle of indicators and new theories of indicators could be established[3]. Some scientist has successfully tried to invent the herbal indicator such as methanolic extract of the flowers of Tagetes erecta[1], petal extract of Rosa hybrida cv. Menu Pearl and cv. Cri Cri[2] fresh flowers of Dianthus plumarius and Antirrhinum majus[4], Morus alba[5], waakye leaves[6], Methanolic extract of Rosa indica[7], Methanolic fruit extract of Punica granatum[8], Hibiscus rosa sinensis[9], Napoleona Vogelii[10], methanolic extract of Catharanthus roseus and Hibiscus rosa-

sinensis[11], Dahlia pinnata[12], Rosa damascena mill L. commonly known as rose[13], Butea monosperma[14],Boerhavia erecta L[15], Fresh flowers of Thespesia populnea Sol., Thumbergia alata Bojer, Helianthus annus Linn.[16], Hibiscus sabdariffa[17].

In present study, we used Nerium odoratum ethanolic extract as natural and effective indicator for acid-base titration. The nerium plant has use as only ornamental plant in garden and at roadside. Its flowers are beautiful but don't have any other use so we decided to develop its herbal indicator which will be the economical alternative to synthetic indicators. The prepared indicator was characterized with FTIR spectroscopy and checked for various applications. Also developed pH strips for mobile use an effective and economical choice to litmus paper.

2. EXPERIMENTAL

2.1. Preparation of Nerium odoretum indicator

The petals of nerium flowers were collected and air dried. Then these petals were crushed and grinded. The grinded powder was dissolve in ethanol. The extract was stirred for few minute and filtered with muslin cloth and then with Whatman filter paper number one. The extract was then diluted with ethanol and the indicator is ready to use.

3. RESULT DISSUASION

3.1. Characterization with FTIR

The Narium powder has characterized with Fourier transform infrared spectroscopy (FTIR) spectroscopy (Fig. 1). From the spectrum we got the idea about the presence of some of the functional groups in the material such as, 1596 cm^{-1} peak indicates that N-H bending may present, also 1249, 2915, 3409 and 3548 cm^{-1} indicated may be presence of C-C stretching, C-H stretching , O-H stretching and N-H stretching respectively.

3.2. Solvent study

The Narium petals were extracted with various solvent which are water soluble as we prepare acid base indicator for regular laboratory titration. To investigate the effect of solvent, we studied solvents like ethanol, methanol, acetone, distilled water and ethanol:distilled water(1:1). To this parameter, we got the result to all solvents but ethanol was finally confirmed better solvent to all extraction as it gave maximum absorbance at various λ values with spectrophotometer.

3.3. Color change at various pH

The color change has invented for pH range from 1 to 12 (Fig. 2). The color change has differed λ values. Mainly at acidic range it showed λ values 530±5nm while basic pH range showed λ value 400 ±5nm. Its spectrum has been taken with UV-VIS spectrometer (Analytik Jena Specord 210 plus) is given in Fig. 3. The color change in various media is given in table 1. The spectrum of acidic and basic pH solution is showed in Fig. 3. The colour change can observed wit naked eye only, which may reveals indicator sensitivity towards pH.

3.4. Titrations

The developed indicator tested for all three types of acid base titration viz. strong acid vs. strong base (HCl Vs NaOH), weak acid vs. strong base (CH_3COOH Vs NaOH) and strong acid vs. weak base (HCl Vs. NH_4OH). The sharp end pint was observed for all types.

3.5. Preparation of pH paper indicator

The extract was not only developed and used as indicator but also generated pH indicator strip. Whatman filter paper 1 and 41 were soaked in concentrated extract in ethanol for 24hr and tested for the developing the strips as pH indicator alternative to litmus paper. Only for the whatman filter paper number 1 we got the better result and it was exercised for various applications. In acidic medium it showed light pink colour while in basic medium it showed yellow color to strip (Fig. 4).

3.6. Application of pH paper

The application for titration was used in regular manner in laboratory along, with this our developed the pH paper strip was used for various applications and confirmed the results with litmus paper as below

(a) pH of hard water (synthesized at laboratory) and soft drinking water
(b) pH of beverages i.e. soft drinks
(c) pH of fruit and its juices
(d) pH of Lassi
(e) pH of soil
(f) pH of industrial waste water

4. CONCLUSION

In the present study, narium alcoholic extract was used as natural indicator for acid base titration and pH indicator strip as best alternative for litmus paper. The preparation of indicator and pH strip is very easy and student friendly which can easily applied in college laboratory. The color change in acidic and basic condition for extract and strip is pink and

yellow having about λmax-530nm and λmax-400nm respectively. The pH strip can use for various applications as primary determination. Finally it may be conclude that, the prepared indicator is green, natural, economical and better alternative to synthetic indicator and litmus paper.

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Table 1: Color change at various

Substance	Nature	Original Color	After extract addition
1 M HCl	Acidic	Colorless	Pink
1 M NaOH	Basic	Colorless	Yellow
Commercial Vinegar	Acidic	Colorless	Pink
Commercial baking soda	Basic	Colorless	Yellow
Soap	Basic	Colorless	Yellow

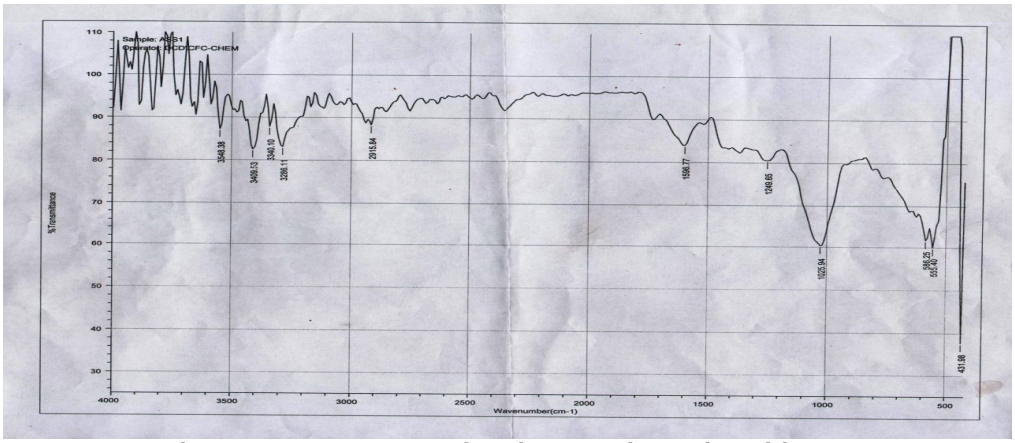

Fig. 1: FTIR spectrum of narium petal powder with KBr

Fig. 2: Color change with respect to pH

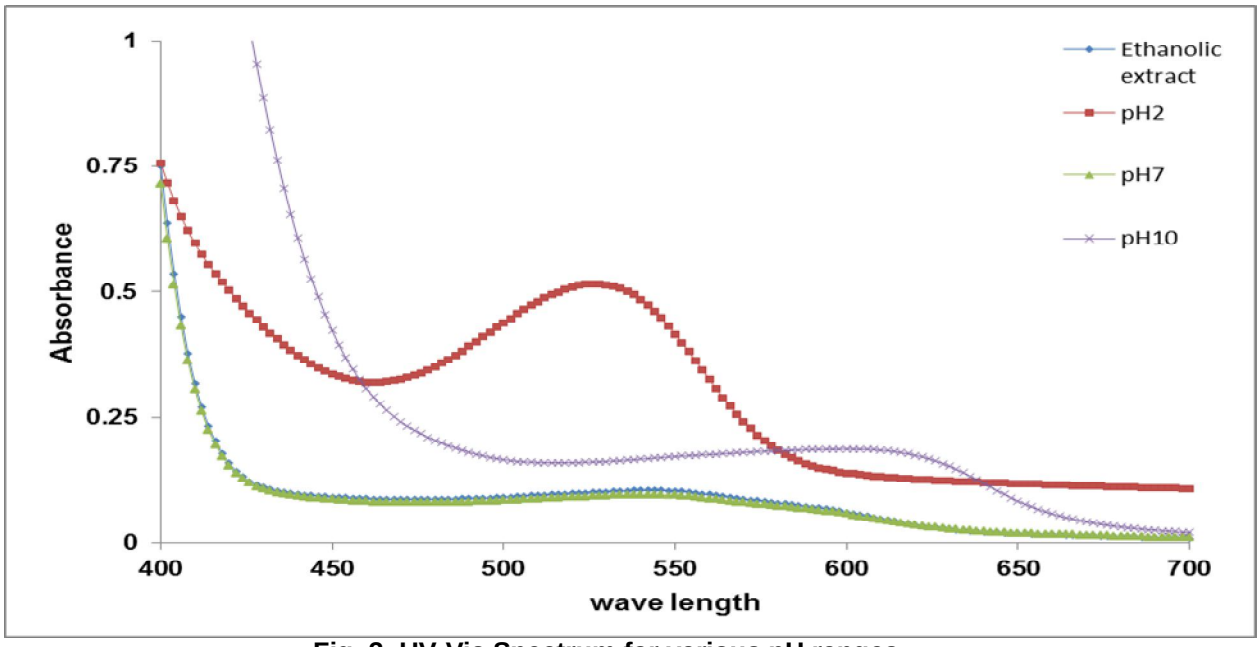

Fig. 3: UV-Vis Spectrum for various pH ranges

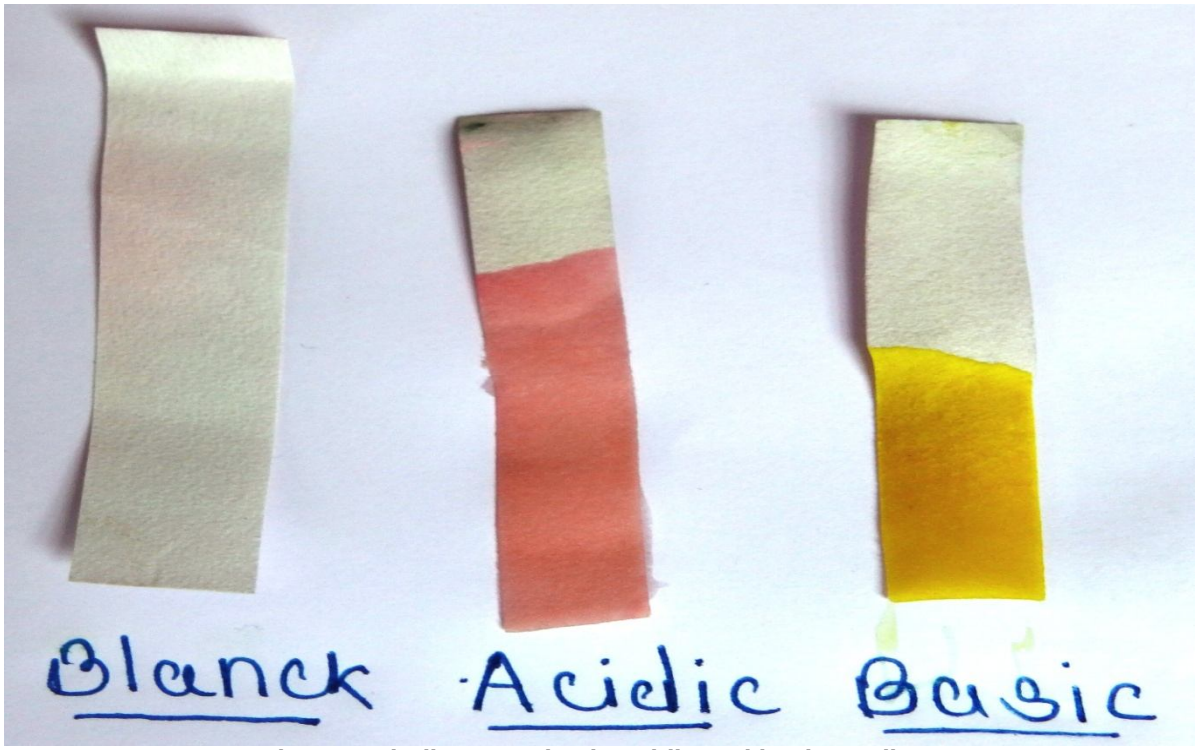

Fig. 4: pH indicator strips in acidic and basic medium

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