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ISOLATION IDENTIFICATION CHARACTERIZATION AND P^H STUDIES OF PLUMBAGIN FROM

Plumbago rosea. Linn.

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Abstract
Acid- Base or pH indicators are chemical compound that is added in small amounts to a solution so that the pH (acidity or basicity) of the solution can be determined visually.The present investigation showed that plumbagin can be used as a good natural acid-base indicator. On the basis of acid-base titration and P^H determination it is concluded that, the action of plumbagin indicator is similar to that of synthetic phenolphthalein indicator. From the experiments conducted, it was found that plumbagin showed stable color change at P^H range 8 to 10. The indicator showed sharp color change for strong acid against strong base titration, and weak acid against strong base titration, and failed to show the sharpness in the case of strong acid against weak base and weak acid against weak base titration.

1. Introduction

Titration is the most common laboratory method of quantitative chemical analysis that is used to determine the concentration of analyte.Acid- Base or pH indicators are chemical compound that is added in small amounts to a solution under analysis so that the pH (acidity or basicity) of the solution can be determined visually during a titration. Otherwise, the indicator causes the color of the solution to change depending on the pH during an acid base titration.Many artificial acid-base indicators like phenolphthalein, methyl orange etc have been used in chemical laboratories for a long period. These chemical substances possess an apparent change in colour of the analyte and titrant reacting mixture very close to the point in the ongoing titration known as indicator, which helps to examine and determine the equivalence point in acid-base titrations [1, 2].

Natural plant pigments can act as acid-base indicators.Natural dyes and pigments in plants are highly coloured substances and may show colour changes with variation of pH [3]. Colours of the parts of the plants express their unique character. Several organic and inorganic compounds are responsible for the colour property of parts of the plant such as flavonoids, flavonols, acylated flavonoids, anthocyanins, glucosylated acylated anthocyanin, quinines, imines, polymethines, napthaquinones, anthraquinonoids, indigoids, dihydropyrans, diarylmethanes, and carotene. [4]. Some of these compounds show different colours in different pH, and thus, this property can be applied to use as a natural indicator. A pH indicator is just a weak acid-weak base with differently coloured acid and conjugate base forms. Many indicators can be extracted from plants some natural acid-base indicators are:

- Alizarin is an orange dye present in the root of the madder plant. It is used to dye wool in ancient Egypt, Persia, and India. In an 0.5% alcohol solution alizarin is yellow at P^H 5.3 and red at P^H 6.8. several synthetic modifications of alizarin are also used as acid-base indicators.

- Curcumin, or turmeric yellow, is a natural dye found in curry powder. It turns from yellow at P^H 7.4 to red at P^H 8.6.

- Anthocyanin is probably the most readily available acid-base indicators, in the plant pigment at makes red cabbage purple, cornflowers blue, and poppies red. It changes colour from red in acid solution to purplish to green in mildly alkaline solution to yellow in very alkaline solution [5].

- Litmus is a blue dye extracted from various species of lichens. Litmus is red at P^H 4.5 and blue around P^H3.3.

Each compound which can act as indicator has specific pK_a value, and it is an important physical parameter to indicate the acidity of molecules. The objective of this work was to identify the eco-friendly natural indicator from the root extract of root culture of

Plumbago rosea.

Plumbago rosea. Linn. (syn. Plumbago indica. Linn.), commonly known as red chitrak of the family Plumbaginaceae, is a highly reputed Indian medicinal plant mentioned in Ayurvedic literature.

Figure1: Plant *Plumbago rosea. Linn.*

2. Materials and Methods

Solvents such as petroleum ether, ethanol, methanol, chloroform, acetic acid, acetone. For TLC silica gel-G-In corperating $CaSO_4$ about 13%, glass plate, using methanol as solvent. IR spectra were recorded in Shimabzu FTIR-8400S Spectrophotometer using 8000 DRS reflectance attachment for solid sample are fixed thickness cell (0.1mm) with NaCl windows for solutions. For P^H analysis ELICO-L1-615 P^H meter, 90-260V 50/60Hz, Acids and bases of various concentration, plumbagin indicator solution.

Collection of the Plant

The tuberous roots of **Plumbago indica** was collected from 'Anjanam Agro Farm', Pathiriyad, Kannur during March 2009. A voucher specimen was kept in the herbarium for future reference. The collected material was then dried in the shade and coarsely powdered in the mixer grinder.

Extraction

The precise mode of extraction naturally depends on texture and water content of the plant material being extracted and on the type of substance that is being isolated. The dried plant tissue was powdered in the mixer grinder. The powder material was continuously tracted using both methanol or ethanol as solvent. After about 24 hour the solution is filtered to remove the remaining of roots material and the filtrate was collected in a clean beaker. Compound plumbagin gets separated from methanolic extract, which was again filtered and washed with water for several times and dried.

Study of plumbagin as natural acid-base indicator:

The compound plumbagin was found to show color change in acidic and alkaline solution at different P^H. This change in the color was then compared with color change shown by synthetic acid base indicator such as phenolphthalein and methyl orange.

Preparation of indicator solution:

The plumbagin indicator solution was prepared by dissolving about .5g of plumbagin in 50ml of methanol.

Method

Aids like hydrochloric acid, nitric acid, sulphuric acid, oxalic acid, acetic acid and bases like sodium hydroxide, potassium hydroxide, ammonium hydroxide of various concentrations was prepared and volumetric acid-base titrations was carried out using two-three drops of plumbagin indicator, to obtain the equivalence point. Similar titration was performed using synthetic indicators like phenolphthalein and methyl orange. The titre values are then compared.

Potentiometric titration of acid and base was carried out, using standard glass electrode, and P^H value of the solution was measured by balancing the potential difference using P^H meter. Strong acid was titrated against strong base, and weak acid against strong base and P^H value of the solution was measured after each addition of acid (or base) to titrating solution. From the values, P^H of the solution during titration was plotted against amount of alkali (or acid) added from burette, to obtain neutralization curve [6].

Titration of strong acid against strong base:

For this titration, reaction of hydrochloric acid and sodium hydroxide was considered. 10ml of about 0.1M sodium hydroxide was titrated against about 0.1M hydrochloric acid, using 2-3 drops of plumbagin indicator. The P^H values at different neutralisation was obtained from P^H meter. P^H values at equivalence point was also determined. The P^H value of solution at different stages was plotted graphically against the increasing amount of the acid added. Similar titration was performed with phenolphthalein indicator.

Titration of weak acid with strong base:

About 10ml of weak oxalic acid(~0.1M) was titrated against strong base (~0.1M) sodium hydroxide, using two-three drops of plumbagin indicator. The P^H value of the solution at different stage of titration was obtained using P^H meter. The P^H value of solution at different stages of neutralization are plotted graphically against the increasing amount of alkali added. Similar titration was performed with phenolphthalein indicator [7].

Results and Discussion

The present investigation showed that plumbagin can be used as natural acid base indicator. It shows yellow color in acid and reddish pink color in base, and this was studied from acid-base titrations carried out volumetrically and potentiometrically [8]. The volumetric titrations, revealed that indicator is suitable for strong acid-strong base, weak acid-strong base titrations, and stable color change was not observed for strong acid-weak base and weak acid-weak base titrations.

From potentiometric titration, P^H values for the solution at different stage of neutralisation was determined using plumbagin and phenolphthalein indicators (Table 1 & 2). The comparison of P^H value revealed that P^H range of plumbagin indicator is from 8-10. It was found that plumbagin indicator gives full acid color, yellow in solution of P^H 8 or less and full basic color reddish pink in solution of P^H 10 or above.

P^H values obtained for various titrations was plotted against, the volume of alkali or acid added to the titrating mixture, to obtained the nuetralisation curve.

Volume of HCl(ml)	P^H
2	11.827
4	11.431
6	11.121
8	10.321
8.1	9.921
8.3	9.841
8.5	9.671
8.6	9.424
8.7	9.163
8.8	8.710
8.9	**8.101**
9.0	7.950
9.1	7.690
9.2	6.811
9.3	6.637
9.5	6.059
10	3.322

Table.1 P^H changes during titration of (~ 0.1M) NaOH with (~0.1M) HCl using plumbagin indicator.

Volume of HCl(ml)	P^H
2	11.927
4	11.732
6	11.397
8	10.681
8.1	10.409
8.2	10.342
8.3	10.232
8.4	10.150
8.5	10.106
8.6	10.012
8.7	9.301
8.8	9.023
8.9	8.812
9	**8.040**
9.1	7.555
9.2	7.290
10	3.593

Table 2. P^H changes during titration of (~ 0.1M) NaOH with (~ 0.1M) HCl using phenolphthalein indicator.

Volume of NaOH (ml)	P^H
2	2.154
4	2.569
6	3.051
8	3.841
10	4.535
11	5.331
11.5	6.013
11.6	6.812
11.7	7.218
11.8	7.674
11.9	8.023
12.0	**8.453**
12.1	8.719
12.2	8.969
12.3	9.302
13.4	9.614
14.5	10.013

Table 3. P^H changes during titration of (~0.1M) $H_2C_2O_4$ with(~0.1M)NaOH using plumbagin indicator.

Volume of NaOH(ml)	P^H
2	2.210
4	2.308
6	2.709
8	3.549
10	4.143
11	4.886
11.8	5.994
11.9	6.714
12.0	7.934
12.1	**8.234**
12.2	8.324
12.3	8.475
12.4	8.6719
12.5	9.107

Table 4.pH change during titration of (~0.1M) $H_2C_2O_4$ with(~0.1M) NaOH using phenolphthalein indicator.

From potentiometric titration, P^H values for the solution at different stage of neutralisation was determined using plumbagin and phenolphthalein indicators. The comparison of P^H value revealed that P^Hrange of plumbagin indicator is from 8-10. It was found that plumbagin indicator gives full acid color, yellow in solution of P^H 8 or less and full basic color reddish pink in solution of P^H 10 or above.

P^H values obtained for various titrations was plotted against, the volume of alkali or acid added to the titrating mixture, to obtained the nuetralisation curve.

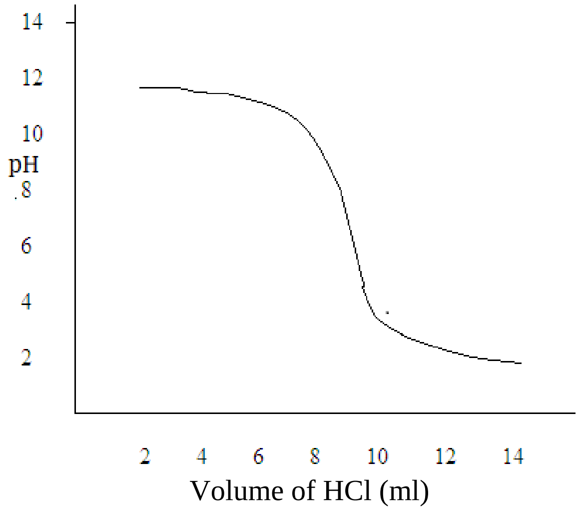

Figure 2. Neutralisation Curve for (~0.1M) NaOH with (~0.1M) HCl using plumbagin indicator

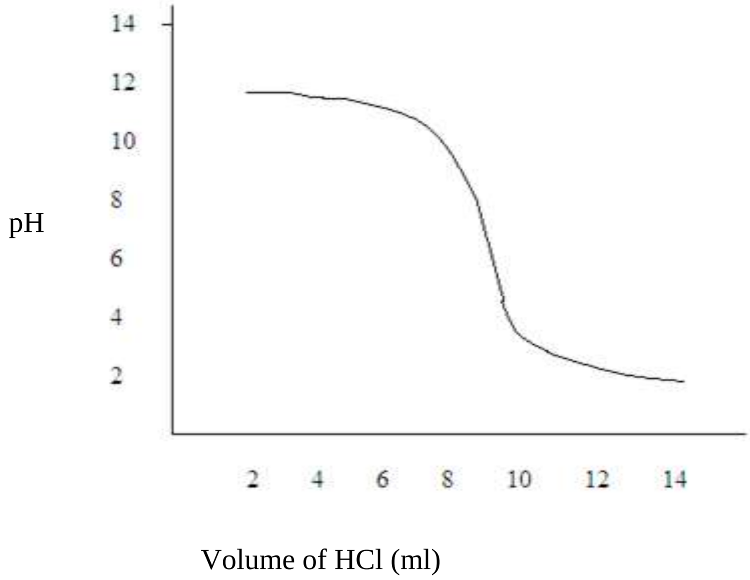

Figure 3. Neutralisation Curve for (~0.1M) NaOH with (~0.1M) HCl using phenolphthalein indicator

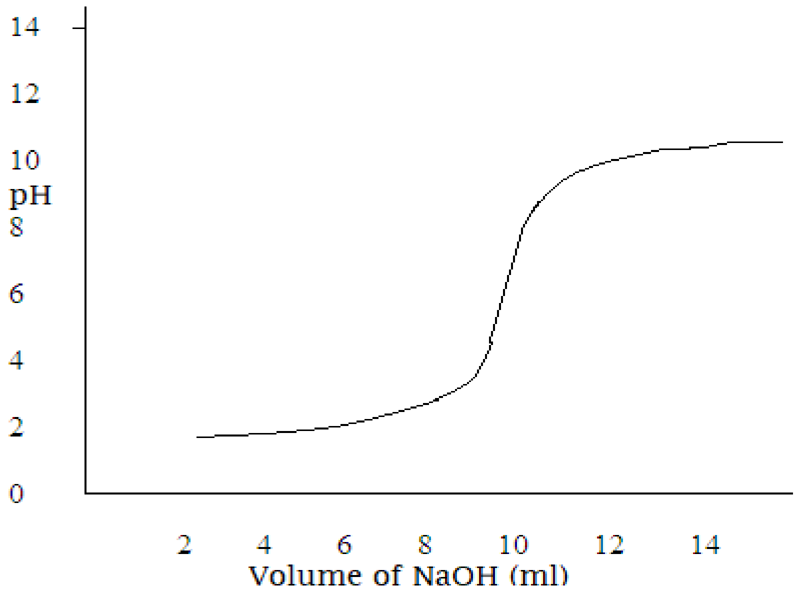

Figure 4: Neutralisation curve for (~0.1M) $H_2C_2O_4$ with (~0.1M) NaOH using plumbagin indicator

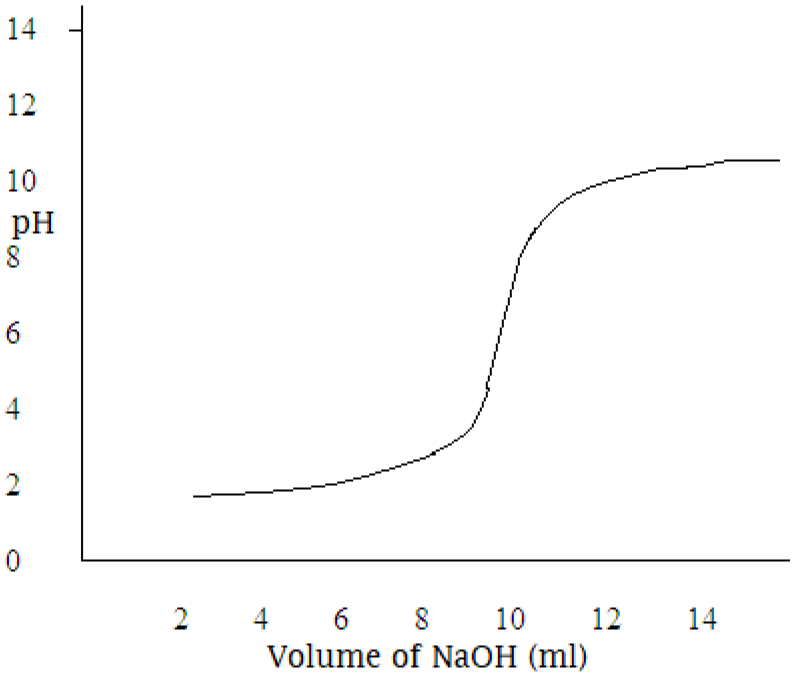

Figure 5.Neutralisation curve for (~0.1M) $H_2C_2O_4$ with (~0.1M) NaOH using phenolphthalein indicator

The present investigation showed that plumbagin can be used as a good natural acid-base indicator. On the basis of acid-base titration and P^H determination it is concluded that, the action of plumbagin indicator is similar to that of synthetic phenolphthalein indicator. From the experiments conducted, it was found that plumbagin showed stable color change at P^H range 8 to 10. The indicator showed sharp color change for strong acid against strong base titration, and weak acid against strong base titration, and failed to show the sharpness in the case of strong acid against weak base and weak acid against weak base titration.

Action of plumbagin indicator can be represented by equilibrium reaction.

H□ Plumbagin In + OH^- → H_2O + Plumbagin In^-

(yellow) (reddish pink)

If the solution is acidic, the hydrogen ions furnished by the acid suppress the dissociation of plumbagin, shifting the equilibrium towards the left. The solution, therefore, remains yellow (the original color). In presence of an alkali, the hydroxyl ions combine with the H^+ ions furnished by the indicator to form undissociated water. The equilibrium, therefore, shifts towards the right giving reddish pink anions. The Solution, therefore, turns reddish pink color. Thus, the indicator appears yellow in acidic and reddish pink in alkaline solution.

On the basis of the P^H values obtained for different titrations, it is concluded that plumbagin gives full acid color yellow in solution of P^H 8 or less and full basic color reddish pink in solution of P^H 8 or above.

Conclusions

The present study showed that, plumbagin can be used as a natural acid-base indicator for many reactions. The colour of plumbagin is yellow in acidic medium and reddish pink in basic solution. It show yellow colour below pH 8.1 and then reddish pink colour. It can be used as a natural substitute for Phenolphthalein indicator.

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