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RESEARCH ARTICLE

ACID BASE INDICATOR PROPERTY OF *LAWSONIA INERIMES* LEAVES

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ABSTRACT

Indicators used in titration show well-marked changes of color in certain intervals of pH. Most of these indicators are organic dyes and are of synthetic origin. The environmental pollution caused by chemical industries in the synthesis of organic dyes had made the scientist in the developing country to enter in to an era, in which plant product serve as an alternative to synthetic products. Natural pigments in plants are highly colored substances and may show color changes with variation of pH. *Lawsonia inermis (henna plant)* has been used in herbal medicine for ages. However, the medical benefits of this plant have been discussed in only a few publications. the study helped to realize that the leaves pigment of *hina* could be effectively used as a substitute to the presently existing indicators owing to the factors like simple preparation, good performance and accurate and precise results. It was found that the extract changes the color at different pH and can be used successfully as indicator.

INTRODUCTION:

Heena or Hina *(Lawsonia inermis) i*s a flowering plant, tall shrub/small tree, about 2-5 m in height. It is the sole species in the genus *Lawsonia* in the family *Lythraceae* [**1**]. *Lawsonia inermis,* also known as hina, the henna tree, the mignonette tree, and the Egyptian privet. native to tropical and subtropical regions of Africa, southern Asia, and northern Australaia in semi-arid zone and oases in the Sahara. Presently the Pali district of Rajasthan is the most heavily cultivated henna production area in India [**2**]. Henna have coloring properties is due to lawsone (hennotannic acid), a burgundy organic compound/ red-orange dye. lawsone has an affinity for bonding with protein. Henna will stain skin when the lawsone molecules are released from the henna leaf [**3**]. Main chemical components are lawsone, mannite, tannic acid, mucilage and Gallic acid d. About 0.5-1.5% of henna is made of lawsone. Use of Henna are astringent, cooling agent, anti- microbial(anti-fungal and bacterial),dye and preservative for hair, skin.

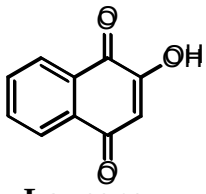


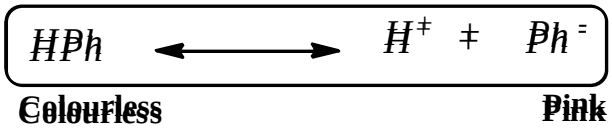
Figure 1: Structure of Lawsone

An acid base titration is the determination of concentration of an acid or base by exactly neutralizing the acid or base with an acid or base of known concentration. This titrations can also be used to find percentage purity of chemicals. Acid base titration allows for quantitative analysis of the concentration of unknown acid and base solution.[**4**]

(a) The colour change is due to ionization of the acid base indicator. The unionized form has different colour than the ionized form.

(b) The ionization of the indicator is largely affected in acids and bases as it is either a weak acid or a weak base. In case, the indicator is a weak acid, its ionization is very much low in acids due to common H+ ions while it is fairly ionized in alkalies similarly if the indicator is a weak base, its ionization is large in acids and low in alkalies due to common OH^- ions **[5]**.Considering two important indicators phenolphthlein (a weak acid) Methyl orange (a weak base), Ostwald theory can be illustrated as follows:

Phenolphthlein can be represented as HPh. It ionizes in solution to a small extent as:



Indicator is a substance (as litmus) used to show visually (as by change of color) the condition of a solution with

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respect to the presence of a particular material (as a free acid or alkali). The most common method to get an idea about the pH of solution is to use an acid base indicator. Acid base indicators are also known as pH indicators. A Acid base indicator is a chemical compound that is added in small amounts to a solution so that the pH (acidity or alkalinity) of the solution can be determined easily. pH indicators are usually weak acids or bases themselves. They detect the presence of hydronium ions (H_3O^+) or hydrogen ions (H^+) [**6,7**].

Sources of PH indicators:

1. Natural
2. Synthetic

Many acid base indicators are synthesized in laboratory. Eg-bromothymol blue, phenolphthalein etc. Plant pigments can act as Natural Indicator. Eg- Red cabbage, Black berries appears purple etc [**8**].

METHDOLOGY:

Collection and Identification of leaves:

The leaves were collected from local market of Mandsaur whose Botanical name is Lawsonia *inerimes.* The plant material was identified and authenticated by Dr. Gyanendra Tiwari (Scientist from K.N.K. College of horticulture, Mandsaur) and herbarium was submitted in Department of Pharmacognosy at Mandsaur Institute of Pharmacy, Mandsaur, India.

Analytical grade reagents were made available by Mandsaur Institute of Pharmacy, Mandsaur. Reagents and volumetric solutions were prepared as per standard books [**9, 10]**.

Preparation of Extract:

200 gm of powered Henna were packed into a thimble and transferred into soxhlet extractor with 1:1 of 95% ethanol for about 72 hrs untill there was no colour change in the ethanol, including the end point of extractor completion. The extract was harvested and concentrated in a rotatary evaporator separating the ethanol from the real extract. However, the remanant ethanol in extract was removed by placing the extract in porcelain dishes in the oven at 80oC untill the weight remained constant. The extract weighed 4.98 gm and was then collected in air tight plastic container and stored in the refrigerator at 4°C ready for use.

Titrations:

0.1 ml of the extract was added as indicator for each titration type - strong acid against strong base, strong acid against weak base and strong base against weak acid. strong acid against strong base, strong acid against weak base and strong base against weak acid and titration were repeated three times to check the precision [**11**]. The equinormal titrations were performed using 10 ml of titrant with five drops of natural indicator. A set of three experiments each for all the types of acid base titrations were carried out. The t-value and standard deviation for each type of acid base titrations were calculated from the results obtained are depicted in the tables 1.

RESULTS AND DISCUSSION:

The equivalence point of the titrations using the Henna extract either coincided or almost reached close to the equivalence point using the standard indicator, phenolphthalein for all the titrations. In several cases it proved to be more reliable than the standard indicator and gave sharp color change at equivalence point. It was also observed that the extract act reversibly and gave sharp color change in both the directions.

Table 1: Comparison of colour change and screening results of titration

Sr. No.	Titration (Titrant v/s Titrate)	Strength in Normality	Indicator	Indicator (Reaction colour)	End point (Mean±SD)	pH
1	Na_2CO_3 *v/s* HCl	0.1	Phenolphthalein	Colour less to pink	29.03±0.60	7.0
	H_2SO_4 *v/s* NaOH	0.1			29.63±0.30	
	Oxalic acid *v/s* NaOH	0.1			27.90±0.63	
2	Na_2CO_3 *v/s* HCl	0.1	Henna	Green to dark brown	27.23± 0.17	6.8
		0.5			27.10± 0.14	6.8
		1.0			27.93 ± 0.69	7.0
3	H_2SO_4 *v/s* NaOH	0.1	Henna	Green to dark brown	25.70 ± 0.72	7.0
		0.5			27.16 ± 0.33	7.0
		0.1			29.06 ± 0.20	6.9
4	Oxalic acid *v/s* NaOH	0.1	Henna	Green to dark brown	26.16 ± 0.16	7.2
		0.5			27.06 ± 0.24	6.7
		0.1			27.23 ± 0.23	7.1

CONCLUSION:

The synthetic indicators are very hazardous to health and cause pollution therefore to solve this problem floral extract has been selected as a source of indicator for acid base titration. The accuracy of results has been judged by performing a variety of acid base titration. The results were obtained by methanolic and aqueous extract of lawsonia inermis. The standard deviation and t-value for synthetic indicator, methanolic and aqueous extract of natural indicator shows very less variation in the results. Statistically also the use of natural indicator in acid base titration is proved, Hence aqueous extract can be used with cent percent reliability and accuracy for acid base titration.

Thus the study helped to realize that the leaf constituent Lawsone of lawsonia inermis could be effectively used as a substitute to the presently existing indicators owing to the factors like simple preparation, good performance and accurate and precise results.

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