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INVESTIGATION OF PLANT SOURCE AS NATURAL INDICATORS FOR ACID BASE TITRATION TO REDUCE THE USE OF HARMFUL CHEMICALS IN SOME EXTENT

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ABSTRACT

The synthetic indicators are the main preference for acid base titration and qualitative analysis but due to their toxic effect (generally unnoticed) in human being as well as in environment and the higher cost, the use of natural indicator started in the titrimetric assay. The present investigation explores the use of ethanol extract of some plant's flowers as natural indicator in acid base titration. The natural indicator is simple to extract out, non toxic and available easily. The investigation also shows that the natural indicator have great potential and shows promising results when compare to synthetic indicators. In the acid base titration natural indicators gives sharp color change at equivalence point. According to all the evidence obtained after titrimetic analysis that natural indicator shows effective and accurate result in compare to synthetic indicators. The advantage to use natural indicator is they can be prepared freshly, economical as well as ecofriendly.

Keywords: Acid-base titrations, Natural indicator, Synthetic indicator, Ethanol extract

INTRODUCTION

Indicator is basically a constituent which are commonly used to indicate the accomplishment of a chemical reaction during titrimetric analysis, frequently by changing of color. Now a day's commonly available indicators are expensive and shows

some toxic and hazardous effect to the users as well as environment [1]. To overcome the use of these available indicators and avoids there unwanted effects may enhance the attention to searching and produce indicator from natural sources. These natural indicators would be easily available, easy to prepare, simple to extract out, less toxic, inexpensive and eco-friendly. Most of the pH indicators may weak organic acids or bases, which have tendency to accept or donate electrons. The color change in the titrimetric process may attribute to their acidic and basic property. Indicators are the agent needed for the quantitative analysis in research laboratories as well as determination of equivalent point between the reacting species [2]. Analysis carried out by determining the volume of solution of accurately known concentration which is required to react quantitatively with a measured volume of a solution of the substance to be determined with the use of indicator by the color changing property in different(acid and base) medium. The commonly used synthetic indicators have some harmful effects which is generally unnoticed or ignored. For example, a commonly used indicator phenolphthalein is a chemical agent, widely used in acid base titration, having structural formula $C_{20}H_{14}O_{4,}$ is usually dissolved in alcohols for the titrimetric analysis to use as indicator, but phenolphthalein has carcinogenic properties which may cause ovarian cancer, this way it is harmful to human as well as surrounding environment [3]. Methyl orange is also used as indicator, which may cause local skin destruction or dermatitis. The repeated exposure of the methyl orange may cause lung damage and also may produce irritation in eye [4]. Methyl red also can produce cancer, neurological disorder and cause toxic effect. All of these reasons can indicate the harmful effect of the synthetic indicator in human as well as environment [5]. Because of these unwanted and toxic effects the use of naturally produced indicator comes in light.

So the goal of the current study is to synthesize indicator from natural sources i.e. plants, mainly by flowers. These natural indicators are easy to synthesize and didn't show any harmful and toxic effect. Accurateness of the titration mainly depends upon the accuracy in detection of end point. At end point the moles of acid exactly neutralize the moles of base in the solution and this point is detected by some indicator. After present experiments favorable results were obtained when it was compared against standard synthetic indicators.

Here some plants described below are used to prepare natural indicators. The plant *Tagetes eracta* is basically known as Marigold flower belonging to *Asteraceae* family. It is stout branching herb mainly grow in warmer parts of America as well as the tropical and subtropical parts of India and Bangladesh. It is generally used in the preparation of perfumes and essential oils. The different parts of flowers are also used as medicine to treat various type of disease as well as leaves also be used as antiseptic and kidney related disorders, muscle pain etc. *Tagetes Ercata,* plant consisting variety of phytoconstituents responsible for certain medicinal activity are quercetagetin, a glucoside of quercetagetin, phenolics,syringic acid, methyl-3,5-dihydroxy-4- methoxy benzoate, quercetin, thienyl and ethyl gallate also responsible for their different medicinal applications [6,7]. *Impatiens Balsamina* is a species of Impatiensnaive also known as garden balsam, garden jewelweed mainly found in India, Banhladesh and Myanmar. The *Impatiens balsamina* is a plant grown upto height 20-75 cm having thick soft stem and leaves are arranged spirally, 2.5 to 9 cm long and 1 to 2.5 cm broad. The flowers are red, pink, lilac, mauve or white color having 2.5 to 5 cm in diameter [8]. The plant *Impatiens balsamina* is used in treatment of snakebite and skin burn [9]. *Tecoma Stans* is a species of flowering perennial shrub commonly known as yellow bells belonging to family Bignoniaceae, mainly collected from natives of America. It is generally obtained as irregular shape, deciduous shrub, 3 to 6 feet tall. Plant having many medicinal properties and used as diuretic, tonic, antisyphilitic, vermifuge. White rose (*Rosa rugosa var. alba*) This variety has single, papery white blossoms that open from light pink buds and have contrasting yellow stamens. The heavily-scented flowers are followed by reddish-orange hips. The plant grown upto height 6 feet and used as medicinally as astringent, laxative, sedatives, tonic, heart tonic, nutritive, anti-inflammatory and antispasmodic.

'Double Delight' (syn. 'ANDeli') is a hybrid tea rose cultivar bred by Swim & Ellis and introduced in 1977. The flower having diameter of 10 cm and having upto 30 petals. In the presence of sun light the color change obtained from white to carmin red beginning at the edges. The plant having large-medium green foliages grown upto 90 to 150 cm in hight and 2 cm in width [10, 11].

MATERIALS AND METHODS

Plant materials

Fresh flower of *Tagetes Erecta, Impatiens Balsamina, Tecoma Stans, Rosa rugosa var.*

alba and *Rosa Double Delight* was obtained from Herbal Medicinal garden of Department of Chemistry and Pharmacy, Rani Durgavati University, Jabalpur (MP), India.

Reagents

Hydrochloric acid, sodium hydroxide, ammonium hydroxide, acetic acid and ethanol was purchased from Central Drug House, New Delhi, India. The study was performed using Analytical grade reagents and the whole experimental work was carried out using the same set of glassware's used for extraction and titration process.

Method

All the flowers were collected and cleaned separately with distilled water and petals of these flowers were kept in sunlight until to get completely withered. The dried petals were grinded into fine powder with a mechanical blender and then triturated in mortar and pestle and macerated in ethanol for 24 hrs individually. The resulting solution was filtered through muslin cloth and the resulted extract was used as natural indicator for acid-base titration. The extract of different flowers was preserved in amber color glass bottle with tightly closed container and stored in room temperature or in cool place away from sunlight. titrant of 10 ml with 2 to 3 drops of indicator of both natural and standard indicator (Phenolphthalein and Methyl Orange) was titrated against two pair of acid- base. (HCl and NaOH; CH_3COOH and NH_4OH) [12]. The results of titrimetric analysis depicted in the Table 1. Each titration was repeated for 3 times. The results were recorded as mean ± SD.

RESULT AND DISCUSSION

The indicator were synthesized by using natural sources (different flower extract) and screened for acid base titration and the obtained results were compared with synthetic standard indicator i.e. phenolphthalein and methyl orange. The end points of the completion of reaction using natural indictors were near to the ending titration results obtained by standard indicator. The difference and variation in standard deviation between of the end point of the standard and the natural synthesized indicator was very less, which shows that the naturally synthesized indicator may have great potency as compare to standard indicators like phenolphthalein and methyl orange. The result may also be accomplished that the natural indicator may suitable for utilization as acid base titration analysis. The end of the analysis or chemical reaction may basically denoted by the changing the color which usually done by addition of indicator, the change in color shows end point of

titrimetric analysis was due to presence of anthocyanin flavonoid and other chemical constituents. The titrant and titrate with the indicator shows intense and sharp color change, which shows the end of titration. All the evidence shows that the naturally synthesized indicators are equally significant and effective as standard and other chemically synthesized indicator for acid base titrimetric analysis and the chemically synthesized indicators could be replaced successfully by the indicator which synthesized by using flower extract. The flower extract forms easily and the prepared indicator having some characteristics features like economical, nontoxic, not show any harmful effect on human and their surrounding environment, ecofriendly as well as the result obtained by natural indicator was as accurate as chemically synthetic indicators. In the observation we observed that, it is beneficial to use *Tagetes Erecta, Impatiens Balsamina, Tecoma stans* and rosa double delight flowers extract in acid base titrations because they showed Sharpe colour change in end point of the titration. But in case of *Rosa rugosa var. alba,* no color change observed. So we concluded that this is may be because of the presence of benzophenones, quinine, flavones and glycoside presence i*n Tegetes Eracta* is responsible for color changes whereas *Impatienes Balsamina* consist flavonoid pigments anthocyanins and 2-hydroxy-1,4-napththoquinone. Anthocyanin flavonoid which is mainly present in all colored flowers and may be is responsible for their color. So it is important for preparing a natural indicator that the flower we choose be supposed to colored, it means to presence of anthocynin and other flavonoid which provides color changing property in different medium(acid and base) to use it as natural indicators [13, 14].

Table 1: Acid base titration chart

S. No.	Indicator	Titration						
		Titrant Volume in Conical Flask		Titrand (Burette Reading)			± SD Mean	Color Change
					Initial Reading	Final Reading		
Natural Indicator								
1	*Tagetes Erecta*	HCl	10 ml	NaOH	0.0 ml	8.0	8.0	Light yellow to brown
					0.0 ml	8.1		
					0.0 ml	7.9		
		CH_3COOH	10 ml	NH_4OH	0.0 ml	11.3	10.8	Yellow to green
					0.0 ml	10.5		
					0.0 ml	10.7		
2	*Impatiens Balsamina*	HCl	10 ml	NaOH	0.0 ml	8.4	8.4	Light blue to yellow
					0.0 ml	8.3		
					0.0 ml	8.4		
					0.0 ml	11.5		Blue to

		CH_3COOH	**10 ml**	**NH_4OH**	**0.0 ml**	**11.3**	**11.4**	**yellow**
					0.0 ml	**11.5**		
3	***Tecoma stans***	**HCl**	**10 ml**	**NaOH**	**0.0 ml**	**8.3**	**8.1**	**Yellow to colorless**
					0.0 ml	**8.0**		
					0.0 ml	**8.2**		
		CH_3COOH	**10 ml**	**NH_4OH**	**0.0 ml**	**11.5**	**11.4**	**Pink to colorless**
					0.0 ml	**11.3**		
					0.0 ml	**11.4**		
4	***White rose***	**HCl**	**10 ml**	**NaOH**	**0.0 ml**	**-**	**-**	**No colour change observed**
					0.0 ml	**-**		
					0.0 ml	**-**		
		CH_3COOH	**10 ml**	**NH_4OH**	**0.0 ml**	**-**	**-**	**No colour change observed**
					0.0 ml	**-**		
					0.0 ml	**-**		
5	***Rosa double delight***	**HCl**	**10 ml**	**NaOH**	**0.0 ml**	**7.9**	**7.9**	**Pink to colorless**
					0.0 ml	**8.0**		
					0.0 ml	**7.9**		
		CH_3COOH	**10 ml**	**NH_4OH**	**0.0 ml**	**10.2**	**10.5**	**Pink to colorless**
					0.0 ml	**10.5**		
					0.0 ml	**10.5**		
Synthetic Indicator								
6	***Methyl Orange***	**HCl**	**10 ml**	**NaOH**	**0.0 ml**	**8.3**	**8.2**	**Light pink to yellow**
					0.0 ml	**8.2**		
					0.0 ml	**8.2**		
		CH_3COOH	**10 ml**	**NH_4OH**	**0.0 ml**	**11.2**	**11.2**	**Orange to pink**
					0.0 ml	**11.4**		
					0.0 ml	**11.2**		
7	***Phenolpetheline***	**HCl**	**10 ml**	**NaOH**	**0.0 ml**	**7.8**	**8.0**	**Colorless to pink**
					0.0 ml	**8.0**		
					0.0 ml	**8.0**		
		CH_3COOH	**10 ml**	**NH_4OH**	**0.0 ml**	**11.0**	**11.2**	**Colorless to pink**
					0.0 ml	**11.5**		
					0.0 ml	**11.2**		

SD mean; n=3

CONCLUSION

According to the results obtained from acid base titrimetric analysis, it was concluded that the color change produced by natural indicators should be sharp and intense which denote end point of the titrimetric analysis. We also concluded that the plant indicators (*Tagetes Erecta, Impatiens Balsamina, Tecoma stans and* rosa double delight flowers) which give positive results at neutralization can be used as a substitute to synthetic indicators. The chemically synthesized indicators are toxic in nature and have hazardous characteristics which may create problem to human health and environment where as the indicator synthesized from floral extract is more beneficial because of their economical feature, simplicity, easy to prepare, ecofriendly, nontoxic nature and provide accurate result.

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