ASIAN JOURNAL OF BIOMEDICAL & PHARMACEUTICAL SCIENCES

e-ISSN: 2249-622X

RESEARCH ARTICLE

Boerhavia Erecta Linn. Stem Bark Extract A Natural Acid-Base Indicator

Vinayak S Marulkar*[1] Shrikant S Kavitake, [1]Suresh G Killedar[2] and Dipak P Mali [2]

[1] Arvind Gavali College of Pharmacy, Jaitapur, Gat. No. 261, At-Jaitapur, Post-Chinchner Vandan, Satara - 415 013.Maharashtra.India.
[2]Bharati Vidyapeeth College of Pharmacy, Kolhapur. Near Chitranagari, Morewadi, Kolhapur - 416 013.Maharashtra.India.

Received:
7th Sept 2012
Received in revised form:
12th Sept 2012
Accepted:
1st Oct 2012
Available online:
10th Oct 2012

OPEN ACCESS

Online ISSN 2249–622X
http://www.jbiopharm.com

ABSTRACT

Synthetic indicators have been tried as indicators in acid-base titrations but due to environmental pollution, availability and cost, natural compounds are best alternate. Natural pigments in plants are highly colored substances and may show sharp color changes with variation in pH .An attempt has been made to extract natural indicator by maceration from stem bark of Boerhavia erecta Linn. The equivalence points obtained by the BEI strong acid-strong base, strong acid-weak base, weak acid-strong base and weak acid weak base titrations were coincident with the equivalence points obtained by synthetic indicators. Thus natural indicator was found to be eco-friendly, economical, simple and accurate for all acid-base titrations. Phytochemical analysis and spectral studies confirmed presence of anthocyanins and flavonoids in BEI responsible for accurate and sharp colour change at equivalence point. The present study reports the use of this natural indicator in different acid base titrations.

Keywords: Acid-base titration; anthocyanins; *Boerhavia erecta* L.; natural indicator.

1. INTRODUCTION

Boerhavia erecta Linn. is the pantropical, erect or sub-erect, pubescent herb 20 to 60 cm in height native of tropical America, now found all over India belonging to family Nyctaginaceae. It is commonly called as Shwet Punarnava and used as substitute to Boerhavia diffusa. Punarnava is now official in I.P. 2007 (Dr. Singh GN *et al.*, 2007). Traditional claims for anthelmintic, diuretic, expectorant, emetic, blood purification, scabis, urticaria and in various infections have been reported (Kirtikar K R *et al.*, 1999). *Boerhavia erecta* Linn. reported to contain tannins and saponins (Edeoga HO *et al.*, 2002). Root extract of the plant is reported as anthelmintic (Marulkar V S *et al.*, 2011). Stem bark of the plant have antimalarial activity (Hilou A *et al.*, 2006) and contains betanin (Stintzing FC *et al.*, 2004). As it contains tannins which are pH sensitive (Chatwal GR, 2002); it was hypothesized that the stem extract could be utilized as an indicator for different types of acid base titrations.

2. MATERIAL AND METHOD

The *Boerhavia erecta Linn.* was first located and collected in the month of August at its flowering stage. The herbarium of *Boerhavia erecta Linn.* was identified and authenticated from Dr. S. R. Yadav, Department of Botany, Shivaji University, Kolhapur. Herbarium specimen (No.–VSM 1) was deposited in Department of Pharmacognosy, Bharati Vidyapeeth College of Pharmacy, Kolhapur for further referencing. Reagents and volumetric solutions were prepared referring standard books. Stem bark was separated by using sharp knife. Weighed 100 g of dried stem bark and macerated in methanol for 72 hr. Extract was then filtered and filtrate was dried. Obtained extract was preserved in tight closed container and stored away from direct sun light. *Boerhavia erecta* Indicator (BEI) 1 % was then prepared as per the requirements freshly before titrations by dissolving 1 mg of extract in 10 ml of distilled water.

BEI was screened for phytoconstituents by performing different phytochemical tests. (Khandelwal K R, 2000). BEI

*Corresponding author: **Vinayak S Marulkar*** | Arvind Gavali College of Pharmacy, Jaitapur, Gat. No. 261, At-Jaitapur, Post-Chinchner Vandan, Satara - 415 013.Maharashtra.India.Email: vinayak.marulkar@gmail.com

was characterized by its λmax using Dynamica (DB-20) double beam UV-visible spectrophotometer.

Demonstrated acid-base titrations were performed with different types of acids and bases using BEI and commercially available indicators like methyl red, phenolphthalein and mixed indicator [methyl orange: bromocresol green (0.1:0.2)]. Titrations of strong acid Vs strong base, strong acid Vs weak base, weak base Vs strong acid and weak acid Vs strong base were carried out. The experiment was carried by using the same set of calibrated glassware for all types of titrations. The equimolar titrations were performed using three drops of BEI. The mean and standard deviation for each acid base titration was calculated from results obtained.

3. RESULT AND DISCUSSION

3.1 Phytochemical screening

Preliminary phytochemical screening of BEI showed presence of anthocyanins, flavones, flavonones, isoflavonones, leucoanthocyanins as shown below in **Table No. 1** and **Table No. 2.** Positive Shinoda test and $FeCl_3$ test confirmed presence of Flavonoids and polyphenols respectively.

Phytochemical	Color with aq. NaOH	Color with Conc. H_2SO_4
Anthocyanins	Blue violet	Yellow to orange
Flavones	Yellow	Yellow to orange
Flavonones	Yellow to orange (cold) Red to purple (hot)	Crimson Orange
Isoflavones	Yellow	Yellow
Leucoanthocyanins	Yellow	Crimson

Table 1: Observations of preliminary phytochemical screening

Poly-Phenolic compound		Flavonoid	Anthocyanins		
Color with $FeCl_3$	Color with Lead acetate	Shinoda test	Color with aq. NaOH (Blue violet)	Color with Conc. H_2SO_4 (Yellow orange)	Color with Mg-HCl (Red)
+	+	+	+	+	+

+ Present

Table 2: Observations of Phytochemical screening

3.2 Spectral analysis

Dilute BEI solution showed λ_{max} at 285 nm which is characteristic band of anthocyanins in ultra violet region. Spectra of BEI solution is as shown below in **Spectra No. 1.**Thissuggests the presence of anthocyanins in the extract.

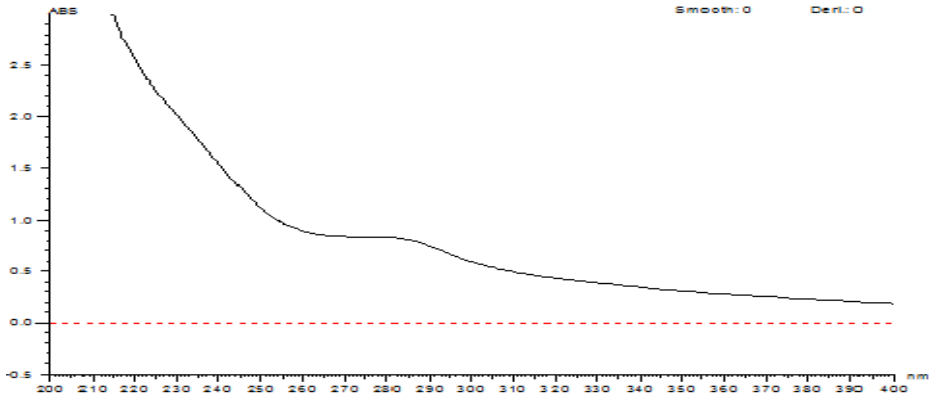

Figure 1: UV spectra of BEI solution

3.3 Titrations of various strengths of acid – base with plant indicator

Results of titrations with BEI were compared with the results obtained by conventional synthetic indicators. Results of titration are presented in Table No. 3 and Table No. 4.The results obtained in all acid-base titrations using BEI are comparable with conventional ones and conclude that, presence of anthocyanins and flavonoids may give sharp color change at the end point of the titrations. We can also conclude that, it is always beneficial to use BEI as an indicator in all types of acid base titrations because of its economy, simplicity and wild availability.

Titration(titrant v/s Titrate)	Strength in moles	Indicator	Mean ± S.D.	Color Change
NaOH v/s HCl	0.1	MR	16.06 ± 0.15	Yellow to Pink
	0.5		15.9 ± 0.16	
	1.0		16.2 ± 0.12	
HCL v/s NH_4OH	0.1	PT	27.4 ± 0.10	Pink to colorless
	0.5		26.8 ± 0.17	
	1.0		27.1 ± 0.16	
CH_3COOH v/s NaOH	0.1	MR	22.30 ± 0.20	Pale yellow to light red
	0.5		22.32 ± 0.23	
	0.1		22.50 ± 0.16	
CH_3COOH v/s NH_4OH	0.1	MI	21.6 ± 0.20	Orange to green
	0.5		21.23 ± 0.18	
	0.1		21.39 ± 0.12	

Table 3: Technological characterization of acid base titration using standard indicator

All values are mean ± S.D. for n=3

HCl: Hydrochloric acid, CH_3COOH: Acetic Acid, NaOH: Sodium Hydroxide, NH_4OH: Ammonium Hydroxide, MR: Methyl red, PT: Phenolphthalein, MI: Mixed Indicator.

Titration(titrant v/s Titrate)	Strength in moles	Indicator	Mean-S.D.	Color
NaOH v/s HCL	0.1	BEI	16.16 ± 0.32	Yellow to pink
	0.5		15.9 ± 0.20	
	1.0		15.7± 0.27	
HCL v/s NH_4OH	0.1	BEI	27.33 ± 0.05	Pale yellow to colourless
	0.5		27.27 ± 0.10	
	1.0		27.23 ± 0.12	
CH_3COOH v/s NaOH	0.1	BEI	22.26 ± 0.23	Yellow to colourless
	0.5		22.2 ± 0.18	
	1.0		22.10± 0.16	
CH_3COOH v/s NH_4OH	0.1	BEI	21.83 ± 0.15	Yellow to colourless
	0.5		21.65 ± 0.12	
	1.0		21.37 ± 0.10	

Table 4: Technological characterization of acid base titration using BEI

All values are mean ± S.D. for n=3

HCl: Hydrochloric acid, CH_3COOH: Acetic Acid, NaOH: Sodium Hydroxide, NH_4OH: Ammonium Hydroxide, BEI: *Boerhavia erecta* Indicator

4. CONCLUSION

The results obtained in all the types of acid-base titrations lead us to conclude that, it was due to the presence of anthocyanins and flavonoids sharp color changes occurred at equivalence point of the titrations. We can also conclude that, it is always beneficial to use BEI extract as an indicator in all types of acid base titrations because of its accuracy, economy, simplicity and wild availability.

5. ACKNOWLEDGEMENT

Our sincere thanks to Principal, Dr. R. V. Savadi for providing facilities required to carry out this work. Authors are also thankful to Dr. S. R. Yadav, Dept. of Botany, Shivaji University, Kolhapur for his kind help in plant collection, identification and authentication.

6. REFERENCES

1- Bothmer R, Poulesen G, Branca F. Origin and Domestication of Cole Crops (Brassica oleracea L.): Linguistic and Literary Considerations. Econo Botany. 2010; 64 (2): 109–123.

2- Kirsh V, Peters U, Mayne S. Prospective study of fruit and vegetable intake and risk of prostate cancer. J of the Nat Can Inst. 2007; 99 (15): 1200–9.

3- Jodeph F. Antidiabetic. Med. Lib. 2003; 5: 5-6.

4- Allison D, Paultre C, Maggio N. The use of areas under curves in diabetes research. Diab Care. 1995; 18:245-50.

5- Nogueira J, Diniz M. In vitro antimicrobial activity of plants in Acute Otitis Externa. Braz J Otorhinolaryngol. 2008; 74(1): 118-124.

6- Soto C, Recoba H, Barron C. Silymarin increases antioxidant enzymes in alloxan-induceddiabetes in rat pancreas. Comp Biochem Physiol Toxicol Pharmacol. 2003; 136: 205-212.

7- Szkudelski T. The mechanism of Alloxan and Streptozotocin action in B cells of the rat pancreas. Physiolog Res. 2001; 50: 536-546.

8- Fukuda T, Yoshida T. Effect of the walnut polyphenol fraction on oxidative stress in type 2 diabetes mice. Biofact. 2004; 21: 251-253.

9-Vaya J, Aviram M. Nutritional antioxidants: Mechanism of action, analyses of activities and medical applications. Current Med. Chemistry-Immunol. Endocrine Metabolic Agents, 2002; 1: 99-117.

10- Bahadoran Z, Tohidi M. Effect of broccoli sprouts sprouts on insulin resistance in type 2 diabetic patients a randomized double-blind clinical trial. International J of Food Sci and Nut. 2012; 63(7):767-771.

11-EunYoung Ko, Chandrama Prakash Upadhyay L, Jang M. Hypoglycemic effects of fruits and vegetables in hyperglycemic rats for prevention of type-2 diabetes. Kor J Hort Sci Technol. 2010; 28(5):117-119.

12- Yanardag R, Bolkent S. The effects of chard (Betavulgaris L. var. Cicla) extract on the kidney tissue, serum urea and cratinine levels of diabetic rats. Phytotherapy. Res. 2002; 16: 758-761.

13- Lee S, Hwang H. Screening of medicinal plant extracts for antioxidant activity. Life Sci. 2003; 73:167-169.

Conflict of Interest: None Declared

