Use of *Terminalia catappa* Fruit Extract as an Indicator in Acid-Base Titrations

L. S. UNTWAL* AND M. S. KONDAWAR

Department of Pharmaceutical Analysis, Appasaheb Birnale College of Pharmacy, South Shivaji-Nagar, Sangli-Miraj Road, Sangli-416 416, India.

Terminalia catappa L. (tropical almond), family Combretaceae, is a large deciduous tree, originally from India. It thrives as an ornamental tree in many tropical cities of the world. The present work highlights the use of the acidified methanol extract of the outer cover of *Terminalia catappa* fruits as an acid-base indicator in different types of acid-base titrations. It is found to be a very useful, economical, simple, and accurate indicator for said titrations.

Terminalia catappa L. belongs to the family Combretaceae. It is commonly called tropical almond, wild almond, Indian almond, Malabar almond, Singapore almond, sea almond, West Indian almond. Tropical almond is a large deciduous stately tree, originally from India. The tree has a characteristic pagoda shape[1,2]. It has large (2-3 inches) nutty fruits that taste very much like commercially grown

***For correspondence**

E-mail: lakshya_untwal@yahoo.com

almonds. The colour of the oval fruit is green, yellow, or reddish[3]. Chemical constituents of fruits are beta carotene, cyanidin-3-glucoside, brevifolin carboxylic acid, glucose, corilagin, ellagic acid, gallic acid, pentosans, and tannins[3,4].

In the traditional medicine, its leaves, bark, and fruits are used in dysentery; for dressing of rheumatic joints; to treat coughs, asthma. Fruits are said to be helpful in the treatment of leprosy, headaches, in reducing travel nausea. Leaves help to get rid of intestinal parasites; treat eye problems, rheumatism, wounds; stop bleeding during teeth extraction. Fallen leaves are used to treat liver diseases, while young leaves are used for colic[1-3].

Analytical grade reagents were procured from Appasaheb Birnale College of Pharmacy, Sangli. Reagents and volumetric solutions were prepared as per I. P.

The fresh fruits and flowering twigs were collected and authenticated at Department of Botany, D. K. A. S. C. College, Ichalkaranji. The fruits were cleaned with water and the pericarp and mesocarp were separated from the whole fruit. The pericarp and mesocarp that were used for further study were cut into small pieces of about 1 cm^2. Fifty grams of these pieces were macerated for 30 min with 100 ml of solution containing 9 parts of methanol and 1 part of dilute hydrochloric acid[5]. After pressing the mark, filtrate (henceforth called as fruit extract) was collected, volume was adjusted to 100 ml with methanol, and preserved in a tightly closed glass container and stored away from direct sunlight.

The experiment was carried by using the same set of glass wares for all type of titrations. As the same aliquots were used for both titrations, i.e., titrations by using standard indicators and fruit extract, the reagents were not calibrated. The titration was performed using 5 ml of titrand with 2 drops of indicator. All the parameters for the experiment are given in Table 1. A set of five experiments was carried out, and mean and standard deviation was calculated from the results.

TABLE 1: PARAMETERS FOR TITRATIONS

Titrand	Titrant	Indicator colour change	
		Standard (pH range)	Fruit extract (pH range)
HCl	NaOH	Red to Yellow (4.0-6.2)	Reddish to Greenish (5.5-8.5)
HCl	NH_3	Colourless to Pink (8.2-10.0)	Reddish to Greenish (5.5-8.5)
CH_3COOH	NaOH	Colourless to Pink (8.2-10.0)	Reddish to Greenish (5.5-8.5)
CH_3COOH	NH_3	Orange-Blue green (4.3)	Reddish to Greenish Brown (5.5-8.5)

The fruit extract was screened for its use as an indicator for acid-base titrations, and the results of this screening were compared with the results obtained by using standard indicators methyl red, phenolphthalein, mixed indicator (methyl orange+bromocresol green 0.1:0.2) for strong acid strong base (HCl and NaOH), strong acid weak base (HCl and NH_3), weak acid strong base (CH_3COOH and NaOH) and weak acid weak base (CH_3COOH and NH_3) titrations. The results of screening are listed in Table 2. The screening was carried out using four different molar strengths of acids and alkalis, viz., 0.1, 0.5, 1.0, and 5.0.

For all titrations, the equivalence point obtained by the fruit extract coincided with the equivalence points obtained by standard indicators; while in case of weak acid and weak base titration, the results obtained by the fruit extract matched with the results obtained by standard indicators, except in case of 0.1 M strength, where it failed to give a sharp colour change. From this result, it may be noted that the fruit extract cannot be used as an indicator in titrations of weak acid and weak base for 0.1 M strength.

The use of fruit extract is beneficial for weak acid and weak base titrations because it involves use of mixed indicator, while the fruit extract can be used alone in such titrations. The results obtained show that the

TABLE 2: MEAN VOLUME (IN ML) AT EQUIVALENCE POINT FOR THE TITRATIONS*

Strength (in M)	Hydrochloric acid v/s sodium hydroxide		Hydrochloric acid v/s ammonia		Acetic acid v/s sodium hydroxide		Acetic acid v/s ammonia	
	MR	FE	PH	FE	PH	FE	MI	FE
0.1	3.62±0.08	3.60±0.07	5.12±0.04	5.14±0.05	3.82±0.08	3.84±0.09	5.14±0.05	-
0.5	3.62±0.08	3.60±0.10	5.10±0.27	5.10±0.27	3.68±0.08	3.66±0.09	5.14±0.05	5.14±0.05
1	5.10±0.27	5.10±0.12	3.58±0.08	3.58±0.08	5.04±0.05	5.04±0.05	4.12±0.13	4.08±0.16
5	3.88±0.08	3.90±0.07	4.14±0.05	4.18±0.08	5.14±0.09	5.12±0.13	5.74±0.05	5.76±0.05

*denotes the mean of five titrations ±S.D.; M is Molar strength; MR, FE, PH, MI represent methyl red, fruit extract, phenolphthalein, and mixed indicator (methyl orange: bromocresol green; 0.1:0.2), respectively

routinely used indicators can be replaced successfully by fruit extract. It is also economic, simple, and widely available throughout India.

ACKNOWLEDGEMENTS

The authors wish to thank Prof. D. D. Chougule, Principal; and Dr. C. S. Magdum, Vice Principal of Appasaheb Birnale College of Pharmacy, Sangli, for their support. Authors also wish to thank all the teaching and non-teaching staff of the college for their cooperation. The authors are grateful to the Department of Botany, D. K. A. S. C. College, Ichalkaranji, for their help.

REFERENCES

1. Kirtikar, K.R. and Basu, B.D., In; Indian Medicinal Plants, Vol. 2., Periodical Experts Books Agency, New Delhi, 1991, 1016.
2. Corner, E.J.H., In; Wayside Trees of Malaya, 4th Edn., The Malayan Nature Society, Malaya, Vol. 1, 1997, 217.
3. Manjunath, B.L., Eds., In; The Wealth of India raw materials, Publications and Information Directorate, CSIR, New Delhi, Vol. 10, 1976, 168.
4. Soepadmo, E., In; The Encyclopedia of Malaysian Plants, Editions Didier Millet, Jakarta, 1998, 16.
5. Wagner, H. and Bladt, S., In; Plant Drug Analysis A Thin Layer Chromatography Atlas, 2nd Edn., Springer-Verlag Berlin Heidelberg, Munchen, 1996, 281.
6. Jeffrey, G.H., Bassett, J., Denny, R.C. and Mendham, J., Eds., In; Vogel's Textbook Quantitative Chemical Analysis, 5th Edn., ELBS, Longman Group, England, 1996, 262.

Accepted 18 June 2006
Revised 8 August 2005
Received 27 January 2005
Indian J. Pharm. Sci., 2006, 68 (3): 399-401