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LEAVES EXTRACT OF *PHYLLANTHUS MUELLERIANUS* USED AS A NATURAL INDICATOR IN ACID BASE TITRATION

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Abstract
The ability of indicator to show wee-marked changes of colour in certain ranges of pH qualifies it as an acid-base titration indicator. The Phyllanthus muellerianus extract was screened for its use as an acid base indicator in various acid base titrations, and the results of this screening compared with the results obtained by standard indicators methyl red, phenolphthalein and mixed indicator [methyl orange: bromocresol green]. For the titration of strong acid and base (HCl and NaOH) and weak acid and weak base (CH_3COOH and NH_4OH) the equivalence points obtained by the extract of P. muellerianus plant leaves marched with the equivalence points obtained by the two standard indicators (methyl red and mixed indicator) respectively. The extract alone can serve the purpose of indicator in strong acid and strong base titration and weak acid and weak base titration and it is beneficial to use anthocyanin extract of P. muellerianus plant leaves as an indicator in strong acid and strong base, and weak acid and weak base titrations because of its economy, simplicity and availability.
Keywords: Phyllanthus muellerianus, anthocyanins, acid base indicator, titrations

Introduction

Phyllanthus muellerianus (Kuntze) Exell belong to the family of plant called *Euphobiaceae* and is a small often stunted tropical plant that bear small fruits with different colours on maturity, found all over West Africa (Hutchinson and Daziel, 1954).

Most plant kingdom especially in vegetables, fruits and flowers are rich in Anthocyanins that is responsible for many of their colours, particularly orange, red, blue and purple (Strack and Wray, 1994).

Anthocyanins are natural flavonoid colourants which have raised a growing interest due to their extensive range of colour. Chemically, anthocyanin's were known to possess the same carbon skeleton and differed only in the nature of substituents groups (Pathan et al., 2011).

Anthocyanin's can be found in different chemical forms which is dependence on the pH of the solution. At different pH, different colours are observed (Ummi et al., 2011) (red, under very acidic conditions; to purple-blue, in intermediate pH conditions; until yellow-green, in alkaline conditions) more especially at pH values higher than 7, the anthocyanin's are degraded depending on their substituent groups (Cooper-Driver, 2001; Davies, 2004; Archett et al., 2009). This is explained by the behavior of the sugar molecules that avoid the degradation of instable intermediaries into phenolic acid and aldehyde compounds (Fleschhut et al., 2006).
Anthocyanin's stability and the colour variations with pH were more significant in the alkaline region due to their instability (Cabrita et al., 2000).

In this study the acid-base indicator property of the plant anthocyanin was investigated and compered to those obtained from standard indicators as cheap, readily available, user and environmentally friendly indicator that could be an excellent replacement for standard indicators.

Material and methods

Plant sample collection

Phyllanthus muellerianus leaves were collected from Agbani near Faculty of Applied Natural Sciences of Enugu State University of Science and Technology.

Anthocyanins extraction

About 150 g of fresh Phyllanthus muellerianus leaves were cold dried in a freezer for 2hours and ground into a fine pasty form. This was extracted with 1 % HCl in methanol to convert anthocyanin into their corresponding soluble chlorides. The anthocyanin was extracted with petroleum ether and concentrated.

Determination of pH indicator activity as described by Savita et al, Malvajan et al and Vyas et al.
This was used as an indicator in comparison with standard indicators (phenolphthalein, methyl red and mixed indicator) in various concentrations (0.1, 0.5 and 1 M) of strong acid and base, strong acid and weak base, weak acid and strong base and weak acid and base (HCl, NaOH, NH_4OH and CH_3COOH). .
The extract of ***P. Muellerianus*** plant leaves was screened for its use as acid base indicator in various acid base titration and the results of this screening compared with the results obtained by standard indicators. The standard indicators are methyl red for strong acid v/s strong base (HCl and NaOH), and strong base v/s weak acid (NaOH and CH_3COOH); Phenolphthalein for strong acid v/s weak base (HCl and NH_4OH) and mixed indicator [methyl orange: bromocresol green] (0.1:0.2)] for weak acid v/s weak base (CH_3COOH and NH_4OH) titrations respectively All these parameters are shown in Table 1.

Table 1: Screening results of various titrations

S/No.	Titration (titrant v/s titrand)	Strength in moles	Indicator	Reading with S.D. (±)
1.	HCl v/s NaOH	0.1	Methyl red	28.9 ± 0.13
			Plant extract	28.6 ± 0.05
		0.5	Methyl red	29.5 ± 0.05
			Plant extract	29.5 ± 0.05
		1.0	Methyl red	29.23 ± 0.04
			Plant extract	29.27 ± 0.05
2.	HCl v/s NH_4OH	0.1	Phenolphthalein	9.3 ± 0.08
			Plant extract	10.5 ± 0.08
		0.5	Phenolphthalein	10.1 ± 0.33
			Plant extract	10.5 ± 0.13
		1.0	Phenolphthalein	9.5 ± 0.05
			Plant extract	10.3 ± 0.08
3.	CH_3COOH v/s NaOH	0.1	Methyl red	55.3 ±0.17
			Plant extract	51.5 ± 0.13
		0.5	Methyl red	56.4 ± 0.05
			Plant extract	53.6 ± 0.15
		1.0	Methyl red	56.4 ± 0.05
			Plant extract	54.2 ± 0.24
4.	CH_3COOH v/s NH_4OH	0.1	Mixed indicator	23.3 ± 0.47
			Plant extract	24.4 ± 0.09
		0.5	Mixed indicator	22.7 ± 0.40
			Plant extract	22.3 ± 0.24
		1.0	Mixed indicator	23.5 ± 0.41
			Plant extract	23.7 ± 0.62

All values are mean ± S.D. n=3HCl: Hydrochloric acid, NaOH: Sodium hydroxide, NH_4OH: Ammonium hydroxide, CH_3COOH: Acetic acid, S.D: Standard deviation.

All this parameters are shown in Table 1. For the titration of strong acid and base (HCl and NaOH) and weak acid and weak base (CH_3COOH and NH_4OH) the equivalence points obtained by marched with the equivalence points obtained by the two standard indicators (methyl red and mixed indicator) respectively. The colour observed for all the dilute acids tested was tint yellowish colour.

Conclusion

The extract alone can serve the purpose of indicator in strong acid and strong base titration and weak acid and weak base titration respectively where generally methyl red and mixed indicators were employed. Another benefit of this titration study is that it gives nearly colourless end point at the equivalence point in strong acid and strong base titration. While in weak acid and weak base titration it gives tint yellowish colour at the equivalence point. Lastly it is beneficial to use anthocyanin extract of ***P. muellerianus*** plant leaves as an indicator in strong acid and strong base, and weak acid and weak base titrations because of its economy, simplicity and availability.

References

1. Hutchinson, J. and Dalziel, J. M. (1954). Flora of West Tropical Africa. 2nd edition, Vol. 1; Part 1 Crewn agents for oversea Government and administration, Mill Bank, London: 384.

2. Vyas, A. D., Shah, B. N., Modi, D. C. and Lambole, V. (2012). Screening and development of herbal acid-base pH indicator from traditional flowers. *Pharma Science Monitor* **3(3):** 2211-2221.

3. Savita, H. B., Namdeo, G. S., Bhagyashree, S. S', Nayana, V. P. and Sanobar, S. S. (2014). Acalyphawilkesiana as natural pH indicator. *International Journal of Natural Products Research* **4(1):** 33- 35.

4. Mahajan, N. S, Jahlav, R. L., Pimpodkar, N. V., Dias, R. J. and Karande, P. P.(2008). Use of *Canna.indica* flower extract as a natural indicator in acid base titration. *Journal of Pharmacy Research***1(1):** 84-87.

5. D. Strack, V. Wray, The flavonoids, in: J.B. Harborne (Ed.), Advances in Research Since 1986, Chapman and Hall, London, 1994, P. 1.

6. Pathan M., Arif K. and Mazahar F. (2011). Analytical Applications of Plant Extract as Natural pH Indicator: A Review. *Journal of Advanced Scientific Research* 2**(4)*: 20-27***

7. Cabrita, L., Fossen, T., and Andersen, O. M. (2000). Colour and stability of the six common anthocyanidin 3-glucosides in aqueous solutions. *Food Chemistry*, 68(**1**), 101–107.

8. Cooper-Driver, G. A. (2001). Contributions of Jeffrey Harborne and co-workers to the study of anthocyanins. *Phytochemistry*, 56(**3**), 229–236.

9. Ramling P., Namdev G. and Dhanraj J. (2010). Flower Extract of Jacaranda acutifolia Used as a Natural Indicator in Acid Base Titration. *International Journal of PharmTech Research* 2 (**3**): 1954-1957**.**

10. Fleschhut J., Kratzer F., Rechkemmer G., Kulling S.E. (2006). Stability and biotransformation of various dietary anthocyanins in vitro. *European Journal of Nutrition* 45(**1**):7-18.

11. Davies, K. M. (2004). Plant pigments and their manipulation. Wiley-Blackwell. P. 6.

12. Archetti, M., Döring, T. F., Hagen, S. B., Hughes N. M., Leather, S.R., Lee, D.W., Lev-Yadun, S., Manetas, Y., Ougham, H.J., Schaberg, P.G., Thomas, H. (2009). "Unravelling the evolution of autumn colours: an interdisciplinary approach". *Trends in Ecology & Evolution*. **24**(**3**): 166–73.

13. Ummi, K.I., Ida, I.M. and Ruzita, M.S. (2011). The effect of pH on color behavior of *Brassica oleracea* anthocyanin. *Journal of Applied Sciences*, 11: 2406-2410