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Application of banana flower bracts extract in simple titrimetric techniques as an indicator

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ABSTRACT

Extraction of Anthocyanin based compounds from banana flower bracts (*Musa acuminata*) was successfully carried out. The banana brats were grinded in a mixer with water. After grinding the mixture was filtered using a muslin cloth i.e. X_1. The residue was shaken with methanol several times and the yellow liquid is X_2. Both are used as indicators in various acid-base titrations. Both X_1 and X_2 contains derivatives of Anthocyanin which is responsible for its use as an indicator. It was found that X_1 is not as effective as X_2 as an indicator for neutralization reactions. X_2 showed a distant red color in acidic medium and distant green color in alkaline medium. X_2 showed similar results as phenolphthalein and methyl orange does in acid base titrations. Replicates of these titrations were performed to confirm the result obtained. Different concentrations of the indicator as well as varying concentration of the titrant and titer were used to check for the application of indicator. The experiment was repeated for different neutralization reactions like: 1. Strong acid versus Strong base 2. Strong acid versus Weak base 3. Weak acid versus Strong base. The R.S.D and C.V. was calculated for all the types of titrations. The method proved analytically valid hence, effect of using such natural extracts as indicators for volumetric quantitative analysis as compared with conventional indicators is possible with good agreement.

KEYWORDS

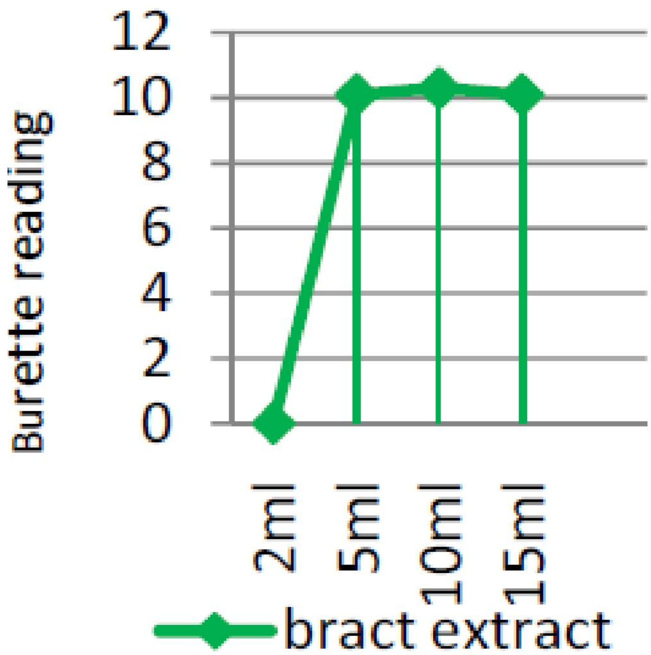
Anthocyanin;
pH-indicators.

INTRODUCTION

Commercial indicators are expensive and some of them have toxic effects on users and can also cause environmental pollution[1-3]. For these reasons there has been an increasing interest in searching for alternative sources of indicators from natural origins. These alternatives would be cheaper, more available, simple to extract, less toxic to users and environmentally friendly. Volumetric analysis is one of the key quantitative techniques used to study analytical interaction between both inorganic and organic acidswith bases in raw materials, intermediates and finished products for quality assurance purposes[1]. This is accomplished via the use of appropriate weak organic dyes or acids pH indicators. Most pH indicators are either weak organic acids or bases dyes which accept or donate electrons. The change in color at a marginal range is attributed to their acidity or basicity properties.

Natural indicators have been extracted from *Hibiscus* (red species), *Bougainvillea* and rose flowers[1]. Several authors have reported on the effectiveness of natural indicators in acid-base titrations e.g. *Neriumodorum,Thespesiapopulnea*extract used as indicators[3]; *Morus alba linn fruit* extract indicator[2] and *Ixoracoccinea, Daturastramonium*, Sun flower (*Helianthus annus*), pride of Barbados (*Caesalpiniapulcherrima*) and rail creeper (*Ipomoea palmate*) flower petal extracts[1]. The natural indicator sources investigated in these papers have been extracted and prepared using ethanol, water, or methanol[1-3].

Banana flower bract are found to contain Anthocyanin based compounds[6,8]. Anthocyanins are water-soluble vacuolar pigments that may appear red, purple, or blue according to pH.[7]. Its extract was prepared using different solvents like acetone and water. On adding few drops in acidic and basic solutions colour changes were observed[4]. It is also



Hence 5ml of bract extract was used for neutralization titrations

proved that banana flower bracts can be used as

Type 1 : Strong acid vs strong base

Parameters studied[9]	Phenolphthalein				
	0.01M each	0.05M each	0.1M each	0.5M each	1M each
Average burette reading	10.1ml	10ml	10.14ml	10.1ml	10.1ml
Average Deviation	57.1×10^{-3}	71.4×10^{-3}	43×10^{-3}	57.1×10^{-3}	71.4×10^{-3}
R.A.D	5.6×10^{-3}	7.1×10^{-3}	4×10^{-3}	5.6×10^{-3}	7×10^{-3}
Standard deviation	226.7×10^{-3}	164.6×10^{-3}	125.3×10^{-3}	92.2×10^{-3}	100×10^{-3}
Variance	51.4×10^{-3}	27.1×10^{-3}	15.7×10^{-3}	8.5×10^{-3}	10×10^{-3}
C.O.V	2244.5×10^{-3}	1646×10^{-3}	1240.5×10^{-3}	912.8×10^{-3}	990×10^{-3}

Parameters studied[9]	Bract extract			
	0.01M each	0.05M each	0.5M each	1M each
Average burette reading	9.9ml	10ml	10.1ml	10.1ml
Average deviation	71.4×10^{-3}	57.1×10^{-3}	42.8×10^{-3}	85.7×10^{-3}
R.A.D	7.2×10^{-3}	5.7×10^{-3}	4.2×10^{-3}	8.4×10^{-3}
Standard deviation	164.6×10^{-3}	151×10^{-3}	146.2×10^{-3}	119.6×10^{-3}
Variance	27.1×10^{-3}	22.8×10^{-3}	21.4×10^{-3}	14.3×10^{-3}
C.O.V	1662.6×10^{-3}	1510×10^{-3}	2088.6×10^{-3}	1183.9×10^{-3}

Theoretical value of pH near the equivalence point and the probable indicator

Volume added from the burette[9]	9.9ml	10ml	10.1ml
pH	3.30	7.0	10.7

Probable indicators[9]	Range
Methyl Orange	3.1-4.4
Phenolphthalein	8.3-10.0
Bract extract	6.3-8.3

Inference: Bract extract is the most suitable indicator.

Type 2 : Strong acid vs weak base

Parameters studied[9]	Methyl orange			
	0.05M	**0.1M**	**0.5M**	**1M**
Average burette reading	10ml	10ml	10.1ml	10.1ml
Average deviation	$14.3x10^{-3}$	$71.4x10^{-3}$	$14.2x10^{-3}$	$42.8x10^{-3}$
R.A.D	$1.4x10^{-3}$	$7.1x10^{-3}$	$1.4x10^{-3}$	$4.2x10^{-3}$
Standard deviation	$164.6x10^{-3}$	$207.1x10^{-3}$	$100x10^{-3}$	$65.5x10^{-3}$
Variance	$27.1x10^{-3}$	$42.9x10^{-3}$	$10x10^{-3}$	$4.3x10^{-3}$
Parameters studied[9]	**Bract extract**			
	0.05M	**0.1M**	**0.5M**	**1M**
Average burette reading	10ml	10ml	10ml	10.1ml
Average deviation	$14.3x10^{-3}$	$71.4x10^{-3}$	$71.4x10^{-3}$	$85.7x10^{-3}$
R.A.D	$1.4x10^{-3}$	$7.1x10^{-3}$	$7.1x10^{-3}$	$8.4x10^{-3}$
Standard deviation	$136x10^{-3}$	$181.1x10^{-3}$	$136.1x10^{-3}$	$106.8x10^{-3}$
Variance	$18.5x10^{-3}$	$32.8x10^{-3}$	$18.5x10^{-3}$	$11.4x10^{-3}$

Theoretical value of pH near the equivalence point and the probable Indicator

Volume added from the burette[9]	9.9ml	10ml	10.1ml
pH	7.265	5.28	3.30

Probable indicators[9]	Range
Methyl Orange	3.1-4.4
Bromocresol Green	3.8-5.4
Bract extract	6.3-8.3

Inference: Bract extract is the most suitable indicator

Weak acid vs strong base

Parameters studied[9]	Phenolphthalein			
	0.05M	**0.1M**	**0.5M**	**1M**
Average burette reading	10ml	10.1ml	10.1ml	10.1ml
Average deviation	$14.27x10^{-3}$	$28.6x10^{-3}$	$57.1x10^{-3}$	$71.4x10^{-3}$
R.A.D	$1.4x10^{-3}$	$2.8x10^{-3}$	$5.6x10^{-3}$	$7x10^{-3}$
Standard deviation	$136x10^{-3}$	$119.5x10^{-3}$	$92.2x10^{-3}$	$100x10^{-3}$
Variance	$18.5x10^{-3}$	$14.2x10^{-3}$	$8.5x10^{-3}$	$10x10^{-3}$
C.O.V	$1360.1x10^{-3}$	$183.1x10^{-3}$	$912.8x10^{-3}$	$990x10^{-3}$
Parameters studied[9]	**Bract extract**			
	0.05M	**0.1M**	**0.5M**	**1M**
Average burette reading	10ml	10.1ml	10ml	10.1ml
Average deviation	$42.9x10^{-3}$	$57.1x10^{-3}$	$71.4x10^{-3}$	$28.5x10^{-3}$
R.A.D	$4.2x10^{-3}$	$5.6x10^{-3}$	$7.1x10^{-3}$	$2.8x10^{-3}$
Standard deviation	$196.2x10^{-3}$	$141.4x10^{-3}$	$164.6x10^{-3}$	$2.8x10^{-3}$
Variance	$38.5x10^{-3}$	$20x10^{-3}$	$27.1x10^{-3}$	$52.9x10^{-3}$
C.O.V	$1962.1x10^{-3}$	$1400x10^{-3}$	$1646x10^{-3}$	$523.7x10^{-3}$

Theoretical value of pH near the equivalence point and the probable Indicator

Probable indicators[9]	Range
Phenolphthalein	8.3-10.0
Thymolphthalein	9.3-10.5
Bract extract	6.3-8.3

Volume added from the burette[9]	9.9ml	10ml	10.1ml
pH	6.74	8.72	10.7

Inference: Bract extract is the most suitable indicator

potential food colorants[5].

MATERIALS

Banana flower from the market, Blender, Beakers, Flasks, Pipettes (2ml to 25ml capacity), Burette, Acid solutions of 1M, 0.5M, 0.1M, 0.05M, 0.01M HCland CH_3COOH, Basic solutions of 1M, 0.5M, 0.1M, 0.05M, 0.01M NaOH and NH_4OH. All the chemicals used are AR grade.

Indicators: Phenolphthalein, Methyl orange

METHODOLOGY

Extraction of Anthocyanin based compounds

Ten-twelve matured banana bracts were blended with a blender using minimum amount of water. The residue is shaken with 100 cm^3 methanol[5] when the yellow extract was obtained (Which was used as an indicator).

Method development steps

Replicates of the above titrations were performed to check the reproducibility. Different concentrations like 1M, 0.5M, 0.05M and 0.01M of the same strong acid and strong base were used in acid-base titration using the banana bract extract as indicator. Weak acid vs strong base titration were performed using phenolphthalein and banana bract as indicators several times having a variation in the concentration of acid and base. Weak base vs. strong acid titrations with varying concentrations of titer and titrant were performed using methyl orange and banana bract as indicators several times.

RESULTS AND DISCUSSION

Standardization of method quantity of indicator

CONCLUSION

The goal of this work was to propose a simple and cheaper indicator from waste material. The selection of natural dyes to indicate specific pH levels based on their color changes is prepared. Acidified methanol extract of banana flower were prepared and used as new indicators in quantitative analysis of standardization of acidic and basic neutralization titrations. Effect of using such natural extracts as indicators gave quantitative results as compared with conventional indicators with good agreement(except when weak acid or weak base is used a lower concentration i.e.0.01M).

REFERENCES

[1] F.O.Nwosu, F.A.Adekola, K.C.Ihedioha; “Simple titrimetric Colour Indicators from Some Natural Flower Petals”, *Centrepoint*(*Science Edition*), **12(1)**, 74-89 **(2004)**.

[2] K.S.Pathade, S.B.Patil, M.S.Kondawar, N.S.Naikwade, C.S.Magdum; “Morus Alba Fruit-Herbal Al- ternative to Synthetic Acid Base Indicators”, *International Journal of ChemTech Research*, **1(3)**, 549-551 **(2009)**.

[3] S.B.Patil, M.S.Kondawar, D.S.Ghodke, N.S.Naikwadeand C.S.Magdum; “Use of flower extracts as an indicator in acid-base titrations”, *Research Journal of.Pharmacy and Technology*, **2(2)**, 421- 422 **(2009)**.

[4] J.A.Castillo; The feasibility of banana bract extract as an acid-base indicator, *The Science and Technology Information Network of the Philippines*, 40 **(2002)**.

[5] E.Alexandra Pazmiño M.G.Durána; Anthocyanins from banana bracts (Musa X paradisiaca) as potential food colorants, *Food chemistry*, 327–332, may, **(2001)**.

[6] P.P.Kitdamrongsont K1; Anthocyanin composition of wild bananas in Thailand, *J Agric Food Chem.*, **56(22)**, 10853-7 **(2008)**.

[7] A.J.Davies, G.Mazza; Separation and characterization of anthrocyanine of monardafistulosa by high performance liquid chromatography, J.Agric.Food Chem., **40**, 1341-1345 **(1992)**.

[8] N.W.Simmonds; Anthocyanins in Bananas, *Annals of Botany*, 471-482, May, **(2015)**.

[9] D.P.K.Raghuraman; *Basic principles in analytical chemistry*, Mumbai: Sheth publishers PVT.LTD, **(2010)**.