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USE OF ALLIUM CEPA (RED ONION SKIN) EXTRACT AS INDICATOR ALTERNATE IN ACID – BASE TITRIMETRIC ANALYSIS

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ABSTRACT

Today synthetic dyes are the choice of acid – base titrimetric analysis, but due to environmental pollution, availability, ease of preparation and cost effectiveness, the search for natural compounds as acid – base indicator started. Uche et al (2014). Allium cepa (Red Onion) skin is one of these compounds being investigated in this study. The ethanolic skin extract of red onion bulb was used as indicator in titrating 0.1M and 0.5M HCL and 0.1M and 0.5M NaOH solutions respectively. The result of the mean equivalent point obtained was compared with that of Methyl Orange and Phenolphthalein indicators. The mean equivalent point of titration of 0.1M HCL and 0.1M NaOH using two drops of red onion skin extract indicator agreed significantly with that of Phenolphthalein indicator with a standard deviation difference of 0.01cm^3. Therefore, the ethanolic skin extract of red onion bulbs can substitute or compliment Phenolphthalein indicator for strong acid – strong base titrations. It was also observed that the mean equivalent point of titration of 0.5M HCL and 0.5M NaOH using two drops of ethanolic skin extract of red onion bulbs indicator and two drops of Phenolphthalein and Methyl orange coincided to a great extent with a standard deviation differences of 0.30cm^3 for Methyl orange and ethanolic skin extract of red onion bulbs and 0.60cm^3 for that of Phenolphthalein and ethanolic skin extract of red onion bulbs respectively. Thus from the results obtained, ethanolic skin extract of red onion bulb can be conveniently employed as indicator in teaching and learning acid – base titrimetric analysis. It is environmentally friendly, easily available, and cost effective and can be prepared with great ease.

KEYWORDS: Red Onion (Allium Cepa) Skin, Standard Indicators, Ethanolic Extract, Anthocyanins

INTRODUCTION

Acid – base indicators are commonly used in titrimetric analysis to determine the end point of a particular neutralization reaction, or the pH of a system. Musoke (2002) and Graden (2000).

The dyes/pigments in plants commonly referred to as anthocyanins, are natural substances used as acid – base indicators. These are usually weak acids and bases (George et al, 1987, Okoye and Oforka, 2009). Many of these indicators can be extracted from plants and can be employed as pH indicators. Fuleki, (1979).

Akpuaka et al, (1998) and Osabohien, (2002) reported that local plants like can wood, red wood, henna, kola, banana, turmeric and ginger all contain different type of dyes that can be extracted for acid – base indicator in titration. Another plant that will make a beautiful and useful dye according to Akpuaka,(1998) is onions skin. Wood and Eddy (1996) reported that onion juice has been used as a novel indicator in acid – base olfactory titrations for the visually impaired. It has not been used as a visual indicator in acid – base titration. Hence, the quest for this work is to investigate whether red onion (Allium Cepa) skin can be used in the chemistry laboratory as a substitute or a compliment indicator to the standard acid – base indicator in titrimetric analysis.

Today synthetic dyes are the choice of acid – base titrations, but due to environmental pollution, availability, ease of preparation and cost effectiveness, the search for natural compounds as acid – base indicators started. Uche et al (2014).

Onion (Allium Cepa) is a very popular and edible vegetable which is grown in at least 175 different countries. It is a member of the lily family Liliaceae, and Scallions, known to have been cultivated in Eqypt. Onions were used as currency to pay Egyptian workers who built the pyramids. The Romans used onions for therapeutic applications in treatment of dog bites, ulcers of the mouth and alopecy.

The chemical formula of onion (Allium Cepa) is C_3H_6SO

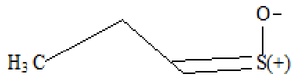

Figure 1

I – Sulpinylpropane

Syn – Propanethial – S – Oxide

The onion bulbs have anthocyanins pigments which can be used as an indicator. The red onion skin indicator changes color from pale red in acid solution and green in basic solution. Fuleki (1979). (http://en.m.wikipedia.org/wiki/onion).

MATERIALS AND METHODS

Analytical grade reagents were obtained from the Chemistry laboratory in College of Education Zing, Taraba State. Reagents and volumetric solutions were prepared as per prescribed in Jaffrey et al (1996).

The fresh red onion bulbs were purchased from the local students' market outside the College of Education Zing gate. Five red bulbs were obtained the allium cepa was authenticated by a botanist in Biology Department in College of Education, Zing.

The Allium cepa bulbs were cleansed with water and the red bulbs peeled and put into a mortar and grinded into small pieces with a pestle. The grinded pieces were extracted with 10ml of ethanol and water. The solid parts were filtered off. The filtrate was used as acid – base indicator. (Henceforth called the ethanolic fruit extract) was collected and preserved in a tightly closed glass container and stored away from direct sunlight.

The experiment was carried out by using the same set of glass wares for all types of titrations. The reagents were not calibrated as same aliquots were used for both titration involving standard indicators and the ethanolic skin extract of red onion bulb (ESEROB).

10ml of titrant and 2 drops of indicator were titrated. Each titration was carried three times and results were recorded in tables 1 to 6. The mean and standard deviations were calculated from the results. The result is shown in Table

7.

The ethanolic skin extract of the Allium cepa (Red Onion bulbs (ESEROB)) was screened for its use as indicator for acid – base titration and the results of this screening were compared with the results obtained by using methyl orange and Phenolphthalein indicators.

The screening was carried out using two different molar strengths of HCL and NaOH, viz 0.1M and 0.5M.

RESULTS AND DISCUSSIONS

Table 1: 0.1M HCL – 0.1M NaOH titration results using 2 drops of ESEROB indicator

Burette reading	1st Aliquot (cm^3)	2nd Aliquot (cm^3)	3rd Aliquot (cm^3)
Final reading	23.30	46.50	23.20
Initial reading	0.00	23.30	0.00
Vol. of 0.1M HCL used	23.30	23.30	23.20

Mean titre value X: $\sum \frac{23.20+23.20+23.30}{3} = \frac{69.70}{3}$

$\overline{X} = 23.23cm^3$

Table 2: 0.5M HCL – 0.5M NaOH Titration Result Using 2 Drops of ESEROB Indicator

Burette Reading	1st Aliquot (Cm^3)	2nd Aliquot (cm^3)	3rd Aliquot (cm^3)
Final reading	16.90	33.70	16.80
Initial reading	0.00	16.90	0.00
Vol. of 0.5M HCL used	16.90	16.80	16.80

Mean titre value $\overline{X}$: $\sum \frac{16.80+16.80+16.90}{3} = \frac{50.50}{3}$

$\overline{X} = 16.83cm^3$

Table 3: 0.1M HCL – 0.1M NaOH Titration Results Using 2 Drops of Methyl Orange Indicator

Burette Reading	1st Aliquot (Cm^3)	2nd Aliquot (Cm^3)	3rd Aliquot (Cm^3)
Final reading	24.10	48.30	24.20
Initial reading	0.00	24.10	0.00
Vol. of 0.1M HCL used	24.10	24.20	24.20

Mean titre value X: $\sum \frac{24.10+24.20+24.20}{3} = \frac{72.50}{3}$

$\overline{X} = 24.17cm^3$

Table 4: 0.5M HCL – 0.5M NaOH Titration Results Using 2 Drops of Methyl Orange Indicator

Burette reading	1st Aliquot (cm^3)	2nd Aliquot (cm^3)	3rd Aliquot (cm^3)
Final reading	16.70	33.30	49.80
Initial reading	0.20	16.17	33.30
Vol. of 0.5M HCL used	16.50	16.60	16.50

Mean titre value X: $\sum \frac{16.50+16.50+16.60}{3} = \frac{49.10}{3}$

$\overline{X} = 16.53cm^3$

Table 5: 0.1M HCL – 0.1M NaOH Titration Result Using 2 Drops of Phenolphthalein Indicator

Burette Reading	1st Aliquot (Cm^3)	2nd Aliquot (Cm^3)	3rd Aliquot (Cm^3)
Final reading	23.20	46.10	23.20
Initial reading	0.00	33.20	0.00
Vol. of 0.1M HCL used	23.20	23.10	23.20

Mean titre value X: $\sum \frac{23.10+23.20+23.20}{3} = \frac{69.50}{3}$

$\overline{X} = 23.17cm^3$

Table 6: 0.5M HCL – 0.5M NaOH Titration Results Using 2 Drops of Phenolphthalein Indicator

Burette Reading	1st Aliquot (Cm^3)	2nd Aliquot (Cm^3)	3rd Aliquot (Cm^3)
Final reading	16.20	32.20	16.30
Initial reading	0.00	16.20	0.00
Vol. of 0.5M HCL used	16.20	16.20	16.30

Mean titre value X: $\sum \frac{16.20+16.20+16.30}{3} = \frac{48.70}{3}$

$\overline{X} = 16.23cm^3$

Table 7: Mean equivalent point, Standard deviation ESEROB, Methyl Orange and Phenolphthalein Indicators Used for Titration of 0.1M and 0.5M HCL and NaOH Respectively

S/No.	Titration Titrant Vs Titrand	Strength M	Indicator	Reading with $\overline{X}$ S.D
1	HCL Vs NaOH	0.1	Methyl Orange	24.17± 0.05cm^3
			ESEROB	23.23± 0.06cm^3
			Phenolphthalein	23.17± 0.05cm^3
2	HCL Vs NaOH	0.5	Methyl Orange	16.53± 0.05cm^3
			ESEROB	16.83± 0.01cm^3
			Phenolphthalein	16.23± 0.05cm^3

HCL – Hydrochloric Acid, NaOH – Sodium Hydroxide, ESEROB – Ethanolic Skin Extract of Red Onion Bulbs, S.D. – Standard Deviation, X – Mean equivalent point.

Table 1 and Table 5 shows that the mean equivalent points of titration of 0.1M HCL and 0.1M NaOH using two drops of ethanolic skin extract of red onion bulb indicator, 23.23cm^3 and that using 2 drops of Phenolphthalein, 23.17cm^3 agree to a great extent with a standard deviation difference of 0.01cm^3.

Therefore ethanolic skin extract of red onion bulb can substitute or compliment Phenolphthalein indicator in a strong acid – strong base titrimetric analysis. Table 2, Table 4 and Table 6 shows that the mean equivalent points of titration of 0.5M HCL at 0.5M NaOH using two drops of ethanolic skin extract of red onion bulb indicator, two drops of Phenolphthalein and Methyl orange respectively are $16.83cm^3$, $16.23cm^3$ and $16.53cm^3$.

Again Methyl orange and ethanolic skin extract of red onion bulbs agree significantly with a standard deviation difference of $0.30cm^3$. The standard deviation of Phenolphthalein and ethanolic skin extract of red onion bulb is $0.60cm^3$, This result agreed with that of Osabohien, E. (2002).

Thus these two standard indicators can be conveniently substituted or complimented with the ethanolic skin extract of red onion bulbs indicator in strong acid – strong base titrimetric analysis.

CONCLUSIONS

The results obtained from all the titration of strong acid and strong base indicates that the ethanolic skin extract of red onion bulbs can substitute or compliment the routinely used standard indicators in acid – base titrimetric analysis.

The ethanolic skin extract of red onion bulbs is environmentally friendly, easily available and very cheap. It can easily be improved as an indicator substitute from local material for synthetic indicators that pollutes the environment and are expensive.

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