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THE USE OF *Cassia sieberiana DC* FLOWER EXTRACT AS AN INDICATOR IN ACID-BASE TITRATION

Umar Mohammed[1], El-Hassan Aliyu[1], Umar Dahiru[2], Abubakar Saidu[3]

[1] Department Science Laboratory Technology, Gombe State Polytechnic, Bajoga

[2] Department of General Studies, Federal Polytechnic, Daura

[3] Department Science Laboratory Technology, Federal Polytechnic, Damaturu

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Abstract: **An Indicator is an organic substance which shows a wide range of colour changes depending on the relative proportion of hydrogen or hydroxide ions present in solution of that substance. In long search for less hazardous and eco-friendly chemical substances from natural products several scientists had extensively work on the use of flower extract as indicators and has proof to be effective. About 40g each of the flower petals were washed and grounded in a mortar with a pestle, and transferred into two different beakers one containing 400cm^3 of ethanol and the other 400cm^3 of distilled water and macerated carefully for about 48hours. The colour from the petals in the extract was cooled and filtered into a clean, labeled bottles with a stopper. The aqueous and ethanolic flower extract were tested with acid and base solutions to determine their colours in different media. Drops of the extracts were added into each 25cm^3 of 0.1M NaOH and 0.1M NH_4OH and standardized with 0.1M HCl solution. The result revealed that the Cassia sieberiana DC extract colour is yellow in acid and orange in base. This property coincides with that of standard indicators used (Phenolphthalein and Methyl Orange) which shows different colours in acidic and basic media. From the titration results of strong acid against strong base and strong acid against weak base show that the end point obtained for the Extract is closely related to that of synthetic indicators (phenolphthalein and methyl orange). The dye from the aqeuos extract has a λ_{max} at 500nm while that of the ethanolic extract has a λ_{max} at 520nm This results reveals that even the Cassia sieberiana DC extracts is suitable for strong acid- strong base and strong acid-weak base titrations in place of synthetic indicator.**

Keywords: **Acid, Base, Cassia sieberiana DC, Flower Extract, Indicator, Titration.**

I. INTRODUCTION

An Indicator is an organic substance which shows a wide range of colour changes depending on the relative proportion of hydrogen or hydroxide ions present in solution of that substance. They are mostly used extensively in examining the end or equivalent point when neutralizing bases with an acid and vice versa in Acid-base titrations or reactions. In long search for less hazardous and eco-friendly chemical substances from natural products several scientists had extensively work on the use of flower extract as indicators and has proof to be effective (Ayodele, Olabode, & Bolarinwa, 2020) (Kapilraj, Keerthanan, & Sithambaresan, 2019). Vinayak et al., 2013) The plant *Cassia sieberiana* DC belongs to the kingdom Plantae, subkingdom Tracheobionta, phylum Angiospermophyta, superdivision Spermatophyta, division Magnoliophyta, class Magnoliopsida, subclass Rosidae, order Fabales, family Fabaceae, genus *Cassia* and species *sieberiana*. The flowers are very bright yellow during the dry season, which is from February through to March. The flowers are also arranged either uprightly or in pendulous racemes ranging from 30–50 cm. Phyto-constituents such as anthraquinones, flavonoid, saponins, steroid/terpenoids, tannins and cardiac glycoside have also been identified in various parts of *C. sieberiana* such as leaves, root bark and seed extract. (Archer, et al., 2019)

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II. MATERIALS AND METHODS

Sample Collection and Preparation

The flower of *Cassia sieberiana DC* was collected along Biri-Wawa road of Gombe State, Nigeria and authenticated in the department of science laboratory technology, Gombe state Polytechnic, Bajoga. The fresh flower petals were separated from the whole flower and washed to remove dirt.

Extraction Preparation

About 40g of the *Cassia sieberiana DC* petals were grounded in a mortar with a pestle, and then transferred into two beakers containing 400cm^3 of ethanol and another 40g was dissolved in 400cm^3 of distilled water separately and macerated carefully for about 48 hours. The colour from the petals was in the solutions as the extract. This was cooled and filtered into a clean, labeled bottles with a stopper.

Standardization of Acid and Base with Flower Extract

The extract of *Cassia sieberiana DC* flower was tested with acid and base solutions to determine extract colour in different media. Three drops of the extract were added into two conical flasks containing 25cm^3 of 0.1M NaOH and the other containing NH_4OH and were titrated against 0.1M HCl solution. The procedure was repeated with standard Phenolphthalein and Methyl orange indicator. The titration was repeated three more times to obtained consisted values.

III. RESULTS AND DISCUSSION

The result obtained from the conducted experimental analysis are presented on Table 1, 2 and 3 below. The result in Table 1 (indicator's colours in Acidic and basic media) shows that the colour of both Aqueous and Ethanolic *Cassia sieberiana DC* extract were yellow in acid and orange-red in base. This property coincide with the result obtained by (Ayodele, Olabode, & Bolarinwa, 2020) in which the colour of *Hibiscus sabdariffa* aqueous and Ethanolic extracts in acid is brown and pale green in base. Also, (Mahadi & Abubakar, 2012)find out that the colour of Flamboyant flower extract from a mixture of Acetone and Ethanol in the ratio1:1 is colourless in acid and orange-red in base. The results in Table 2 (Titration of strong acid against strong base) and Table 3 (Titration of strong acid against weak base) shows that the end points obtained for both the aqueous and ethanolic extract of *Cassia sieberiana DC* are very close to those obtained using synthetic indicator (i.e phenolphthalein and methyl orange). This reveals that the plant extracts considered are suitable for strong acid-strong base and strong acid-weak base titrations. This result agrees with the result of Bhise et al. (2014) on Acalipha wilkesiana as acid-base indicator especially for strong-acid strong-base and strong-acid weak-base, so also Bhuvaneshwari et al. (2015) and Powar et al. (2013) reported a similar result for *Beta vulgari* as a suitable acid-base indicator.

Table 1: Result of Indicator's colours in Acidic and Basic Media

S/N	INDICATOR	COLOUR IN ACID	COLOUR IN BASE	pH	λ_{max} (nm)
1	Aqueous extract of *Cassia sieberiana DC*	Yellow	Orange red		500
2	*Ethanolic extract of Cassia sieberiana DC*	Yellow	Orange red		520
3	Methyl orange	Red	Yellow	6.1	460
4	Phenolphthalein	Colourless	Pink	6.3	-

Table 2: Result of Strong Acid-Strong Base titration of Aqueous and Ethanolic extract of Cassia sieberiana DC

	INDICATOR	1st TITRE(cm^3)	2nd TITRE(cm^3)	3rd TITRE(cm^3)	MEAN VALUE(cm^3)	ENDPOINT COLOUR
1	Methyl orange	24.80	24.50	24.70	24.67	Orange
2	Phenolphthalein	24.90	24.80	24.80	24.83	Colourless
3	Aqueous extract of *Cassia sieberiana DC*	24.60	24.90	24.70	24.73	Yellow
4	*Ethanolic extract of Cassia sieberiana DC*	24.70	24.80	24.60	24.70	Yellow

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Table 3: Result of Strong Acid-Weak Base titration of Aqueous and *Ethanolic extract of Cassia sieberiana DC*

	INDICATOR	1st TITRE(cm^3)	2nd TITRE(cm^3)	3rd TITRE(cm^3)	MEAN VALUE(cm^3)	ENDPOINT COLOUR
1	Methyl orange	24.70	24.80	24.70	24.73	Orange
2	Phenolphthalein	24.80	24.80	24.90	24.83	Colourless
3	Aqueous extract of *Cassia sieberiana DC*	24.90	25.00	24.70	24.86	Yellow
4	*Ethanolic extract of Cassia sieberiana DC*	24.80	24.80	24.70	24.76	Yellow

IV. CONCLUSION

The use *Cassia sieberiana DC* flower extract as an indicator was investigated in this research. From the result obtained it can be concluded that *Cassia sieberiana DC* flower extract is suitable to use as indicator for both strong-acid strong-base and strong-acid weak-base in place of synthetic indicators/

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