Hinthada University
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STUDY ON SOME CHEMICAL ANALYSIS OF *Terminalia catappa* L. (BANDA) SEED AND ITS EXTRACTED BANDA SEED OIL

PRESENTED

BY

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ABSTRACT

In the present work, *Terminalia catappa* L. (Banda) was selected for its popular uses in medicinal purposes and commercial food products. The study of traditional medicinal plants and their therapeutics play a very important role in health care system of Myanmar because the most of Myanmar people still rely on traditional medicine. The aim of the study is to investigate on the chemical analysis of *Terminalia catappa* (Banda) seed and its extracted Banda seed oil. The sample was collected from Hinthada Township, Ayeyarwady Region and it was identified at Department of Botany, Hinthada University. At first, preliminary phytochemical tests have revealed that the absence of cyanogenic glycosides in the sample according to test tube method. By Association of Official Analytical Chemists (AOAC) method, the collected fruit sample was found to contain 4.05 % of moistures, 1.61 % of ash, 21.62 % of crude protein, 4.94 % of crude fibre, 51.76 % of crude fat, 16.02 % of carbohydrate and 616.4 kcal/100 g of energy value based on dried sample. Ascorbic acid content in collected sample was done by iodometric titration and found to be 19.81 mg per 100 g fresh weight of sample. Banda seed oil of *Terminalia catappa* seed was extracted by hydro-distillation method with the use of Clevenger apparatus. It was found that Banda seed oil, pale yellow oil (15.09 g, 30.18 %) was obtained as hydrosol. Then, some chemical analysis of Banda seed oil was assessed by AOAC method and found to be iodine value 57.55 %, peroxide value1.99 mg/1000 g, acid value 8.30 mg KOH/g, free fatty acid 4.15 %, specific gravity 0.91, moisture 0.41 % and no rancidity. From the results of present study, it was found that *Terminalia catappa* (Banda) seed could be applied as the local health remedy to the local indigenous communities of our country. In addition, the current study showed that Banda seed possesses the valuable nutrients besides no toxicity in it. Therefore, it can contribute to public health and also could be suggested that Banda seed may be used as a potential food source.

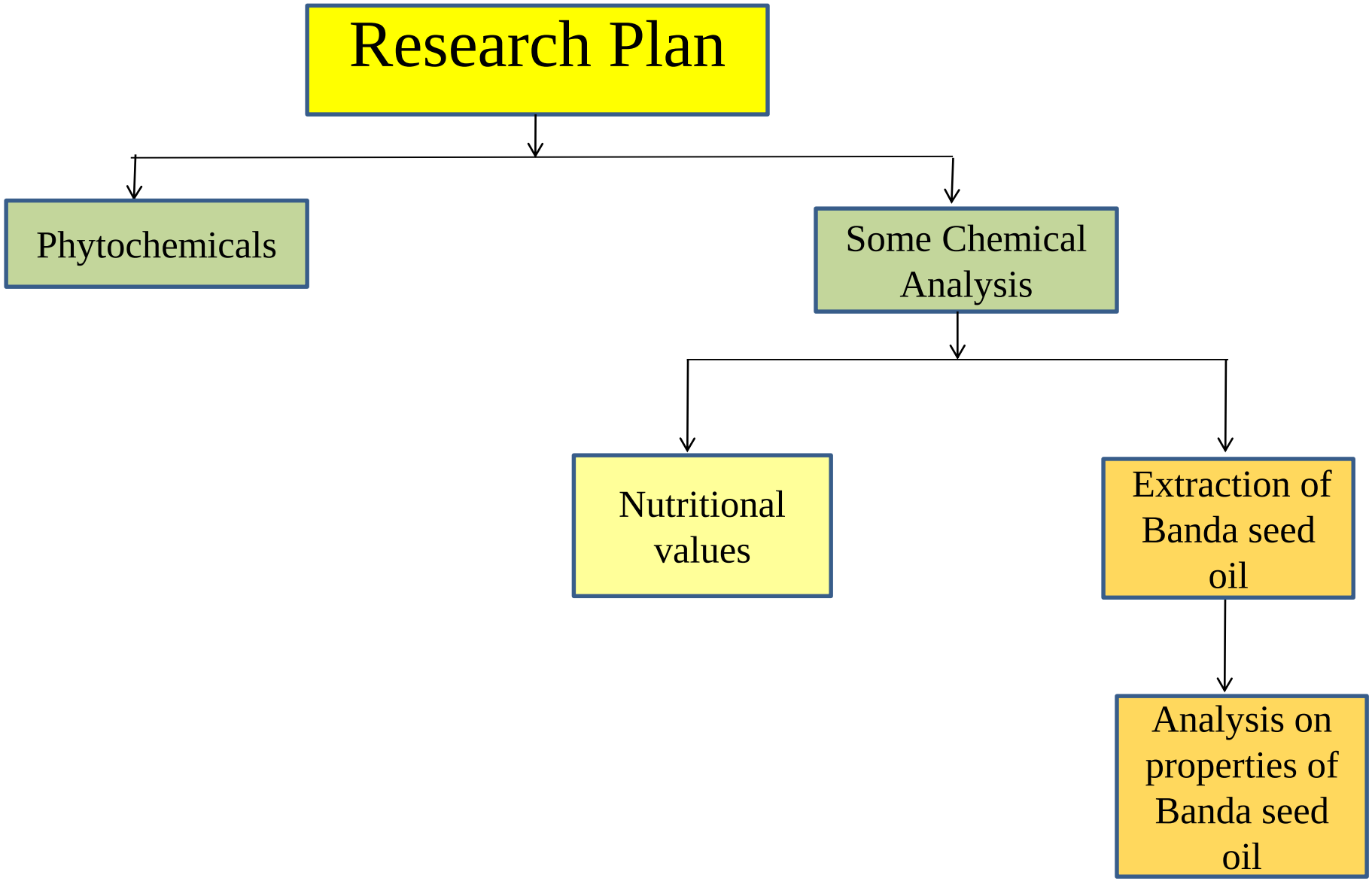
Keywords: *Terminalia catappa* seed, nutrients, Banda seed oil, chemical analysis, food source

AIM

To examine some chemical analysis of *Terminalia catappa* L. (Banda) seed and its extracted Banda seed oil

OBJECTIVES

- To collect and identify the selected seed sample of *Terminalia catappa* L. (Banda)
- To carry out the phytochemical tests on the collected sample
- To analyze some nutritional values such as moisture, ash, fat, fiber, protein, carbohydrate and energy value by appropriate analytical methods
- To determine vitamin C content by Iodometric titration method
- To extract Banda seed oil from *T. catappa* seed by hydro-distillation method
- To assess some chemical analysis such as iodine, peroxide value, acid value, free fatty acid, specific gravity, moisture and rancidity of Banda seed oil by appropriate analytical methods


Research Plan
Phytochemicals
Some Chemical Analysis
Nutritional values
Extraction of Banda seed oil
Analysis on properties of Banda seed oil

OUTLINE

* INTRODUCTION
* MATERIALS AND METHODS
* RESULTS AND DISCUSSION
* CONCLUSIONS
* REFERENCES

INTRODUCTION

❖ The Role of Medicinal Plants

- Important potential sources of therapeutics or curative aids
- key role in world health

Terminalia catappa L. (Banda)

- Ornamented for its beauty and shade in Myanmar
- Possess many medicinal properties especially in leaf and seed

(The seed within the fruit is edible when fully ripe.)

Scientific Classification

Family : Combretaceae

Genus : *Terminalia*

Species : *catappa*

Botanical Name : *Terminalia catappa* L.

English Name : Indian Almond

Myanmar Name : Banda

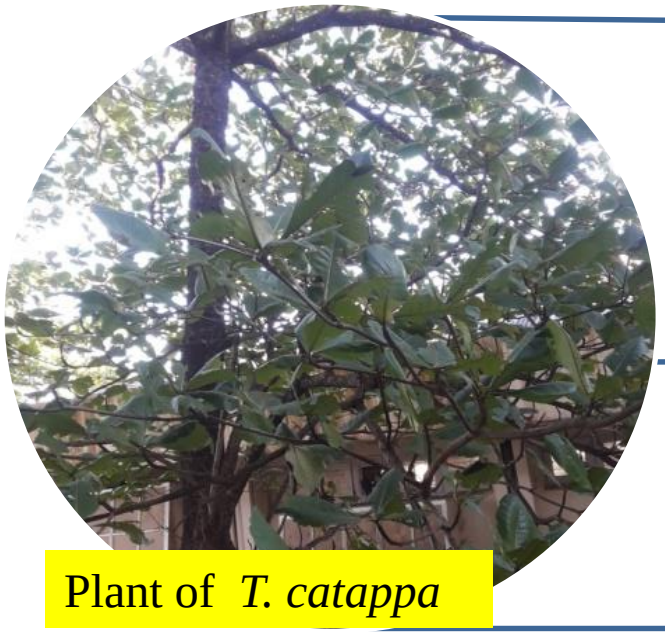
Part used : Seed

Distribution : Tropical regions of Asia, Africa, Australia and widely in Myanmar

Description : Fruit is drupe (5-7 cm) long and (3-5.5 cm) broad, sessile, laterally compressed, green at first, then yellow, and finally red when ripe, containing a single seed

Figure 1 The Plant of *T. catappa*

Some Medicinal Uses of *T. catappa* (Banda)



Plant of *T. catappa*

Leaf

- cough
- jaundice
- indigestion
- headaches
- colic
- dysentery

Seed

diabetes, tonic

Bark

- fever
- diarrhea
- thrush
-abscesses

Some Industrial Uses of *T. catappa* (Banda) Seed

- **Cosmetic Industry**

  - body lotion, hair care, moisturizer

- **Detergent Industry**

  - toothpaste, shampoo, soap

- **Food Industry**

  - chocolate, candy, biscuit

  - cake, ice-cream, bread, cereal

  - pasta, protein bars, milk shake

- **Energy Industry**

  - biodiesel

Hair oil containg Banda seed

Milk powder made by Banda seed

MATERIALS AND METHODS

Sampling of *Terminalia catappa* L. (Banda)

Figure 2 (a) Fruit of *T. catappa* (b) Seed of *T. catappa*

Name of plant ⟹ *Terminalia catappa* L. (Banda)

Collection site ⟹ Hinthada Township, Ayeyarwady Region

Part used ⟹ Seed

Identification ⟹ Department of Botany, Hinthada University

Preparation ⟹ air-dried, ground into powder, stored in air-tight bottles

Phytochemical Investigation of *T. catappa* Seed (Test Tube Method)

(1) Test for Alkaloids

(2) Test for α-Amino Acids

(3) Test for Carbohydrates

(4) Test for Cyanogenic glycosides

(5) Test for Flavonoids

(6) Test for Glycosides

(7) Test for Organic acids

(8) Test for Phenolic Compounds

(9) Test for Reducing Sugar

(10) Test for Saponins

(11) Test for Starch

(12) Test for Steroids

(13) Test for Tannins

(14) Test for Terpenoids

Some Chemical Analysis of *T. catappa*

Investigation of Nutritional Values

1. Moisture Content → Oven-drying Method
2. Ash Content → Ashing Method
3. Protein Content → Macro-Kjeldahl Method
4. Fiber Content → Acid and alkali digestion Method
5. Fat Content → Soxhlet Extraction Method
6. Carbohydrate → Calculation
7. Energy Value → Calorimetric Method

Determination of Ascorbic Acid Content in Vitamin C Tablet

(Using Iodometric Titration Method)

Vitamin C tablet (one tablet)

dissolved in

200 mL solution

→ vitamin C tablet solution

vitamin C tablet solution (20 mL)

(1) 1 % starch solution (1mL)

(2) titrated with 0.005 M standard Iodine solution

→ deep violet color (end point)

Determination of vitamin C (Ascorbic acid) Content in *T. catappa* (Banda) seed

(Using Iodometric Titration Method)

Freshly sample

(100 g)

(1) stirred with 100 mL D/W

(2) strained the pulp through cheese cloth

extracted solution (made up to 100 mL)

extracted solution (20 mL)

(1)1 % starch solution (1 mL)

(2) titrated with 0.005 M standard Iodine solution

deep blue colour (end point)

Extraction of Banda Seed Oil from *T. catappa* (Banda) Seed (Using hydro-distillation method)

Sample (powdered dried seed) 50 g

↓ (boiled with distilled water) (400 mL) (48 h)

↓ hydrosol

- Condensate (colloidal suspension)
- Suspension
  - Upper layer (Oily form)
    - ↓ Collected with syringe
    - Banda seed oil (15.09 g, 30.18 %) (Pale yellow)
    - (To assess some chemical analysis)
  - Lower layer (Residue and water)

Banda Seed Oil Obtained from *T. catappa*

Figure 3 Soxhlet apparatus used in the extraction of fat content from *T. catappa* (Banda) seed

Figure 4 Clevenger apparatus used in the extraction of Banda seed oil from *T. catappa*

Analysis on Some Chemical Properties of Banda Seed Oil

1.Iodine ⟶ Wijs Method

2.Peroxide value ⟶ Titration Method

3.Acid value ⟶ Titration Method

4.Free fatty acid ⟶ Titration Method

5.Specific gravity ⟶ Specific gravity bottle Method

6.Moisture ⟶ Oven-drying Method

7.Rancidity ⟶ Kreis Method

RESULTS AND DISCUSSION

Table 1 Results of Phytochemical Investigation of *T. catappa* (Banda) Seed

N0	Test	Extract	Reagent Used	Observation	Remark
1	Alkaloids	1 % HCL	Mayer's reagent Dragendroff's reagent Wagner's reagent Sodium Picrate Solution	White ppt Orange ppt Reddish brown ppt Yellow ppt	(+) (+) (+) (+)
2	α-amino acids	D/W	Ninhydrin reagent	Purple colour	(+)
3	Carbohydrates	D/W	10 % α-naphthol and Conc:H_2SO_4	Red ring	(+)
4	Cyanogenic Glycosides	D/W	Sodium picrate and Conc:H_2SO_4	No brick-red ppt	(-)
5	Flavonoids	96 % EtOH	NaOH and Dil. HCL	Yellow colour	(+)
6	Glycosides	D/W	10 % lead acetate	White ppt	(+)
7	Organic acids	D/W	Bromocresol green	Deep blue colour	(+)
8	Phenolic Compounds	D/W	5 % $FeCl_3$ and 1 % $K_3Fe(CN)_6$	Deep blue colour	(+)
9	Reducing Sugar	D/W	Benedict's solution	Green colour	(+)
10	Saponin Glycosides	D/W	Distilled water	Marked Frothing	(+)
11	Starch	D/W	Iodine solution	Red colour	(+)
12	Steroids	$CHCL_3$	Acetic anhydride and Conc: H_2SO_4	Reddish brown colour	(+)
13	Tannins	96 % EtOH	1 % gelatin	White ppt	(+)
14	Terpenoids	96 % EtOH	Acetic anhydride and Conc: H_2SO_4	Pink colour	(+)

(+) = presence (-) = absence

Table 2 Some Nutritional Values of *T. catappa* (Banda) Seed

No	Parameters	% Contents (w/w)
1.	Moisture	4.05
2.	Ash	1.61
3.	Crude Protein	21.62
4.	Crude Fiber	4.94
5.	Crude Fat	51.76
6.	Carbohydrate	16.02
7.	Energy Value (k cal/ 100g)	616.4

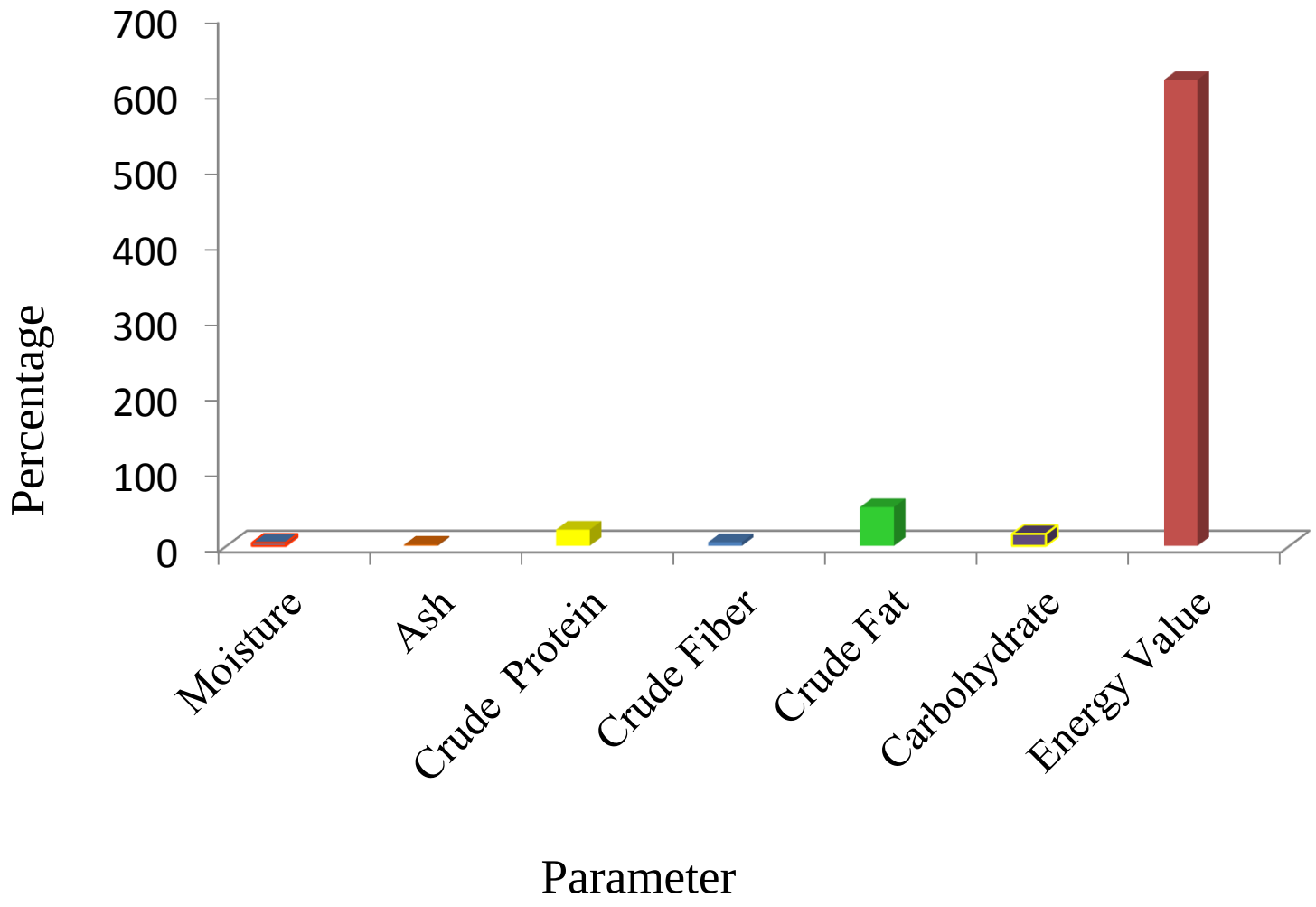


Figure 5 Some nutritional values obtained from *T. catappa* (Banda) seed

Table 3 Vitamin C (Ascorbic Acid) Content in *T. catappa* (Banda) Seed

Name of Samples	Observed value/(mg)	*Literature value/(mg)
Cevit from MPF	100	100
T. catappa (Banda) Seed	19.81	18.83

The observed values were based on vitamin C one tablet and 100 g fresh weight sample

* (Akwaowo, 2000)

Table 4 Some Chemical Analysis of Banda Seed Oil Extracted from *T. catappa* Seed

Sr	Experiment	Chemical Analysis Results	Remark
1	Iodine Value (%)	57.55	Unsaturated oil reactive, less stable, softer
2	Peroxide value (mg/1000 g)	1.99	No auto-oxidation reaction
3	Acid value (mg KOH/g)	8.30	A little acidity
4	Free Fatty acid (%)	4.15	Less FFA
5	Specific Gravity	0.91	Suitable for use as the edible oil
6	Moisture (%)	0.41	Less content
7	Rancidity	(-) ive	No oxidative degradation

CONCLUSION

- Preliminary phytochemical test (test tube method) in *T. catappa* seed → *presence of alkaloids, α-amino acids carbohydrates, flavonoids, glycosides, phenolic compounds, reducing sugar, saponins, starch, steroids, tannins and terpenoids

  * absence of cyanogenic glycosides

- Nutritional values of Banda seed (AOAC) →
  - 4.05 % of moisture, 1.61 % of ash
  - 21.62 % of crude protein, 4.94 % of crude fiber
  - 51.76 % of crude fat
  - 16.02 % of carbohydrate, 616.4 % of energy value

- Vitamin C (Iodometric titration) → - 19.81 mg per 100 g fresh weight

- Yield % → Pale yellow Banda seed oil (15.09 g, 30.18 %)

- Some chemical analysis of Banda seed oil → Iodine, peroxide value, acid value, free fatty acid, specific gravity, moisture and rancidity

Selected Medicinal Plant, (Banda Seed)

- possess many nutritional values
- analyses high yielded Banda seed oil was found to be good quality edible oil
- Not found plant toxin

CONTRIBUTION

- **may be applied in sustainable development for public health**
- **may be used in traditional medicine, food and cosmetic industries**

REFERENCES

Akwaowo, E. U., B. A. Udon and E. U. Etak. (2000). “Food Chemistry”. **70**, pp. 235-240

Chitmanat, C.K. Tongdonmuan, P. Khanom, P. Pachontis and W. Nunsohb. (2005). “Antiparasitic, Antibacterial, and Antifungal Activities Derived From a *Terminalia catappa* Solution Against Some Tilapia (Oreochromis Niloticus) Pathogens”. *Acta Horticulturae*, pp. 179-182

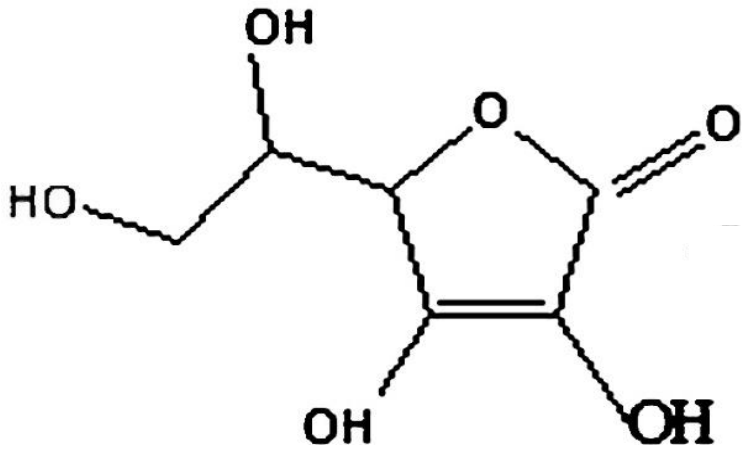
Maxim, V. and J.R. Lanting. (1982). “Germination of Talisai (*Terminalia catappa* Linn.) Seeds”. *Sylvatrop the Philippine forest research journal*, **7**(1), pp. 27-32

Omeje, E.O., G.B. Okide, C.O. Esimone and U. Ajali. (2008). “Kinetics of Autoxidation of an Oil Extract from *Terminalia catappa*”. *Indian Journal of Pharmaceutical Science*, **70**, pp. 260-262

Pinn, G. (2001). "Adverse effects associated with herbal medicine". *Aust Fam Physician*. **30** (11), pp. 1055-1075

Thank you

❑ Vitamin C (Ascorbic Acid)



Structure of Ascorbic Acid

- very popular antioxidant

- redox catalyst obtained from plants and animals sources in nature