Potential of seed oil of *Hildegardia Barteri* (mast.) Kosterm for Biodiesel Production

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INTRODUCTION

❖Energy plays a fundamental role in shaping human condition

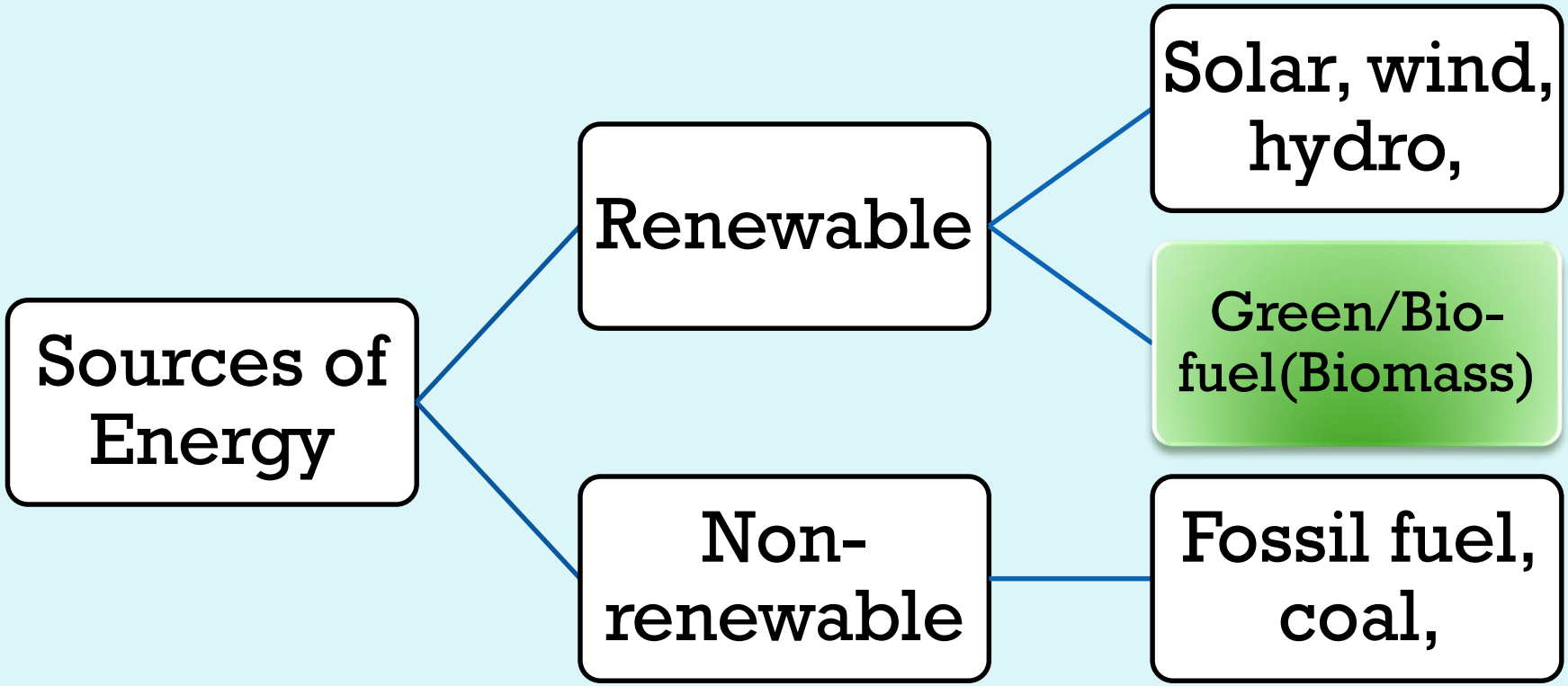
❖People's need for energy is essential for survival

❖ Energy production and consumption becomes one of the most important activities of human life.

❖Fossil fuels and environmental hazard

Search for green fuel

INTRODUCTION cont'd



This study focuses on Green fuel –a renewable source of energy that are under-utilized.

Introduction Cont'd

❖ Energy production from biomass was described by Mckendry, (2001) as the most common form of renewable energy widely used.

❖ Recently, much attention has been focused on identifying suitable biomass species which can provide high energy outputs to replace conventional fossil fuel sources.

❖ It has been argued that energy is the key "to the advance of civilization," and that the evolution of human societies is dependent on the conversion of energy for human use (Oswald, 1907)

❖ Based on this fact, the quest for energy for human use is continuous and inevitable.

Introduction Cont'd

❖ To achieve this, numerous crops such as oilseeds, have been proposed by researchers and are being tested for production of commercial energy.

❖ Another concern is the production of renewable energy that would bring about improved air quality, lower consumption of fossil fuel and reduced green house gas emission (Canadian Forest Service, 2012).

❖ Thus, for this research, the need to determine the energy value of the oil from the fruits of this selected lesser-used species -*Hildegardia barteri*,

RESEARCH PROBLEM

- Harvesting of wood for the purpose of fuelwood without adequate reforestation leads to loss of biodiversity and thereby distort ecological balance. Thus, the need for alternative source of renewable energy through the use of tree produce such as fruits, seeds rather than the wood itself.

- Emission of green house gases (GHG) via combustion of fuelwood and fossil fuel. The latter is characterized by some elements which has been a major concern. Hence, the need to determine a broad range of physical and chemical properties.

RESEARCH PROBLEM cont'd

- The gestation period of having wood formed to the point of end-use is a major challenge. Thus, the need to ascertain the energy value of this species considered in this study.

- Some tropical tree species lie fallow with some potentials that are yet to be exploited due to inadequate technical information on them as corroborated by Sukumar e*t al*, (2013).

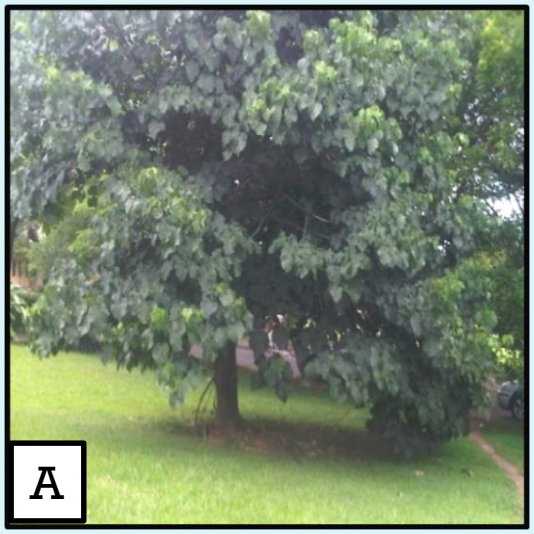
OBJECTIVES

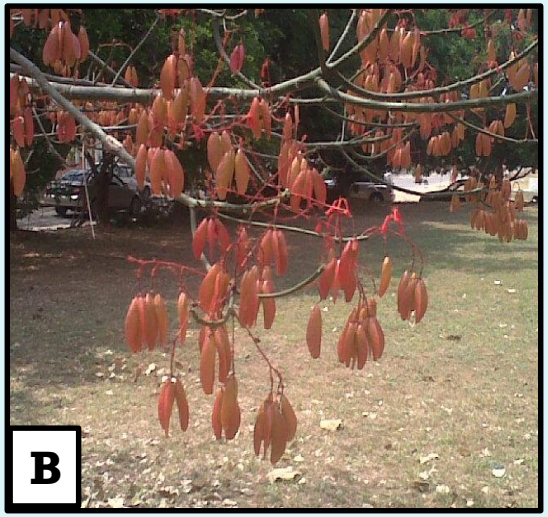
- Determination of oil yield of two different extraction and different drying methods.
- Evaluation of the proximate composition of the extracted oil.
- Comparison of the physicochemical and elemental constituents of the extracted oil.
- Determine the calorific/energy value of extracted oil.

MATERIALS AND METHOD

STUDY AREA

The fruits of *H. barteri* were obtained from Department of Agronomy, University of Ibadan, Ibadan, Oyo state (latitude 3^{o}.8937′E and longitude 7^{o}.4508′N).





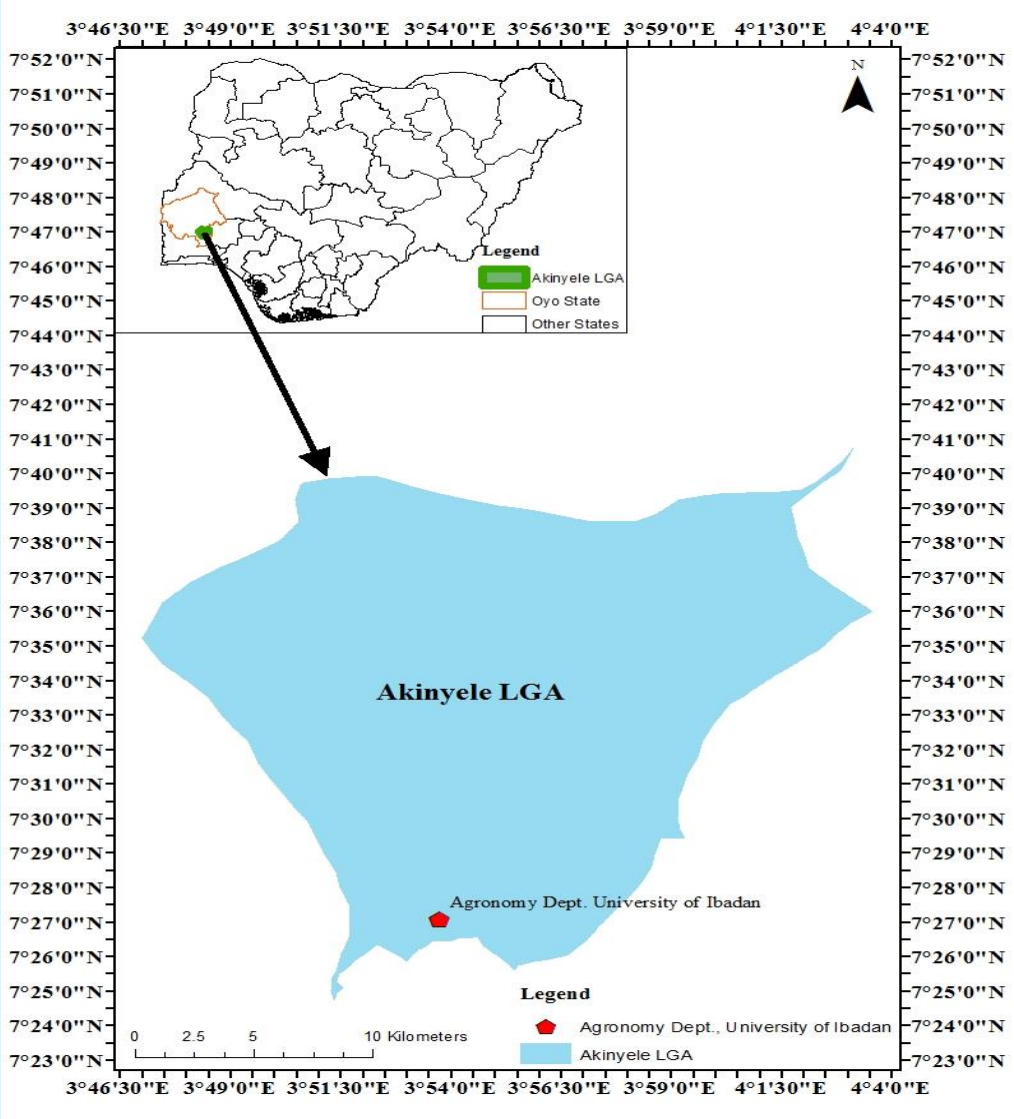


Fig.1: Map of Akinyele LGA showing the seed source

Sample collection and preparation

- After collection of the *H. barteri* fruits, the following procedures will be carried out before the extraction process.

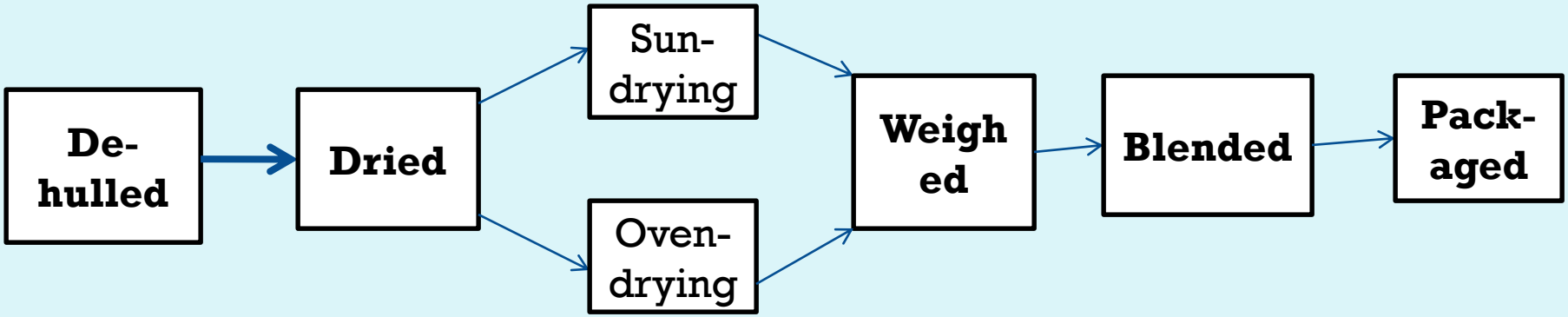


Plate 1: one-seeded pods **Plate 2: seeds**

Plate 3: Kernels **Plate 4: Dried kernels**

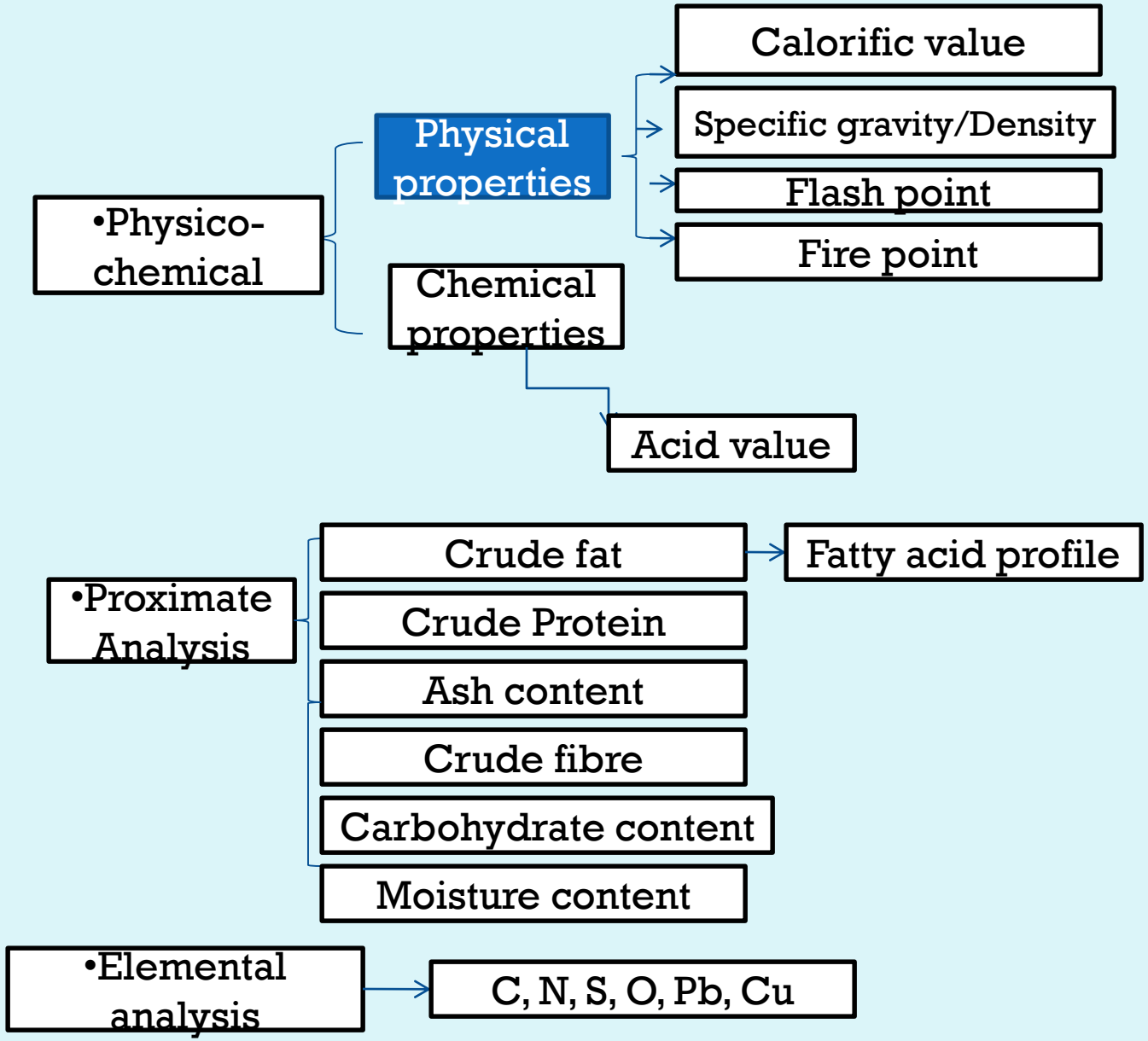
❖EXTRACTION OF OIL CONTENT

- Method 1: Soxhlet Extraction with N –Hexane Solvent

Method 2: Mechanical Extraction

• For each method, oil content of the kernels will be extracted in three replicates.

❖ Laboratory Analyses



Statistical analysis

- A 2 x 2 factorial experiments in a completely randomized design was used

RESULTS

Table 1: Percentage Oil Yield of *H. barteri*

Source of Variation	DF	MEAN	P-Value
OD+SE	2	23.15 ± 1.51^{a}	0.0238
SD+SE	2	30.53 ± 3.02^{b}	
OD+ME	2	21.96 ± 1.35^{a}	
SD+ME	2	19.52 ± 2.10^{a}	

Means ±SE of triplicate values with same alphabets are not significantly different;at p-value < 0.05

EXTRACTED OIL FROM THE SEED

- OD + SE

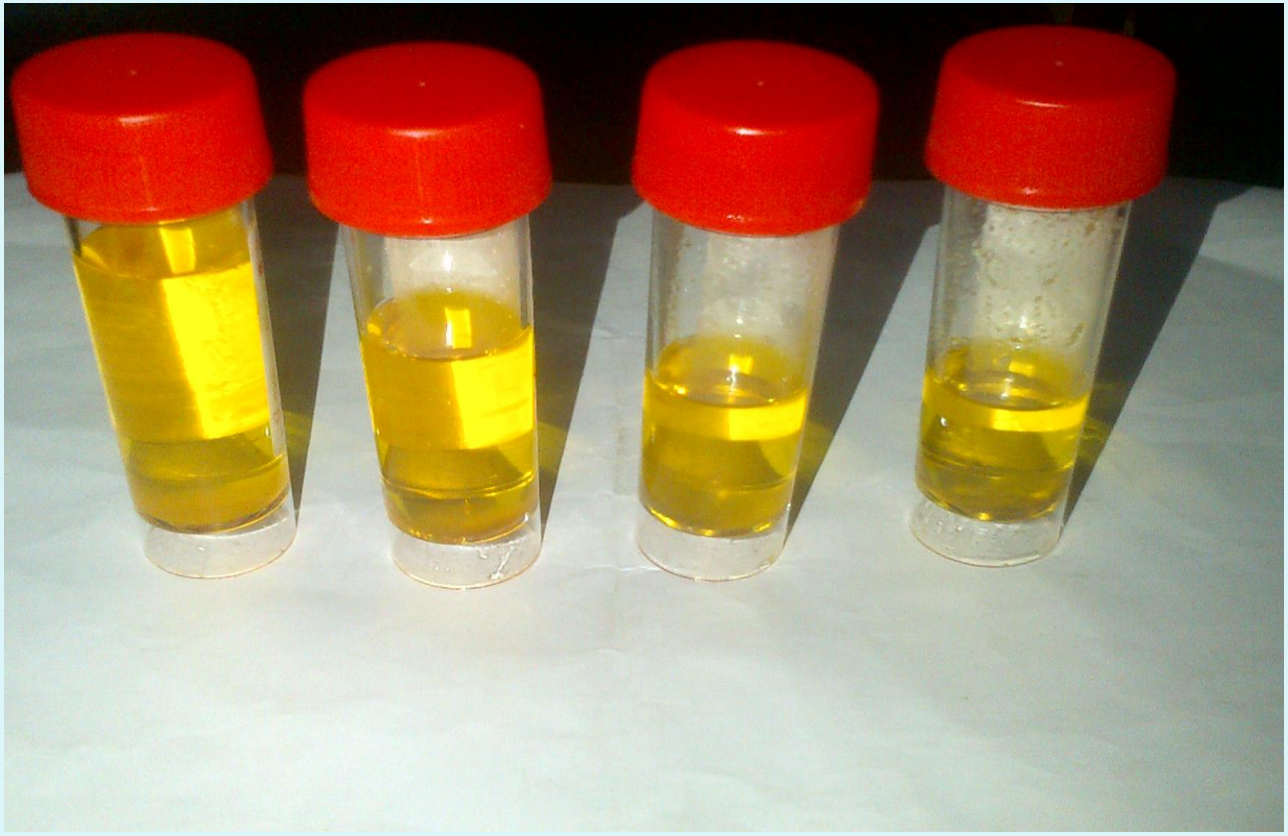


Table 2: Elemental analysis of seed oil

SAMPLES	%NITROGEN	%HYDROGEN	% OXYGEN	%SULPHUR	% CARBON
OD+ME	0.16 ± 0.03^{a}	8.49 ± 0.01^{b}	17.99 ± 0.51^{ab}	0.02 ± 0.01^{a}	71.29 ± 0.01^{a}
OD+SE	0.26 ± 0.02^{b}	9.57 ± 0.01^{d}	18.57 ± 0.01^{b}	0.035 ± 0.01^{a}	72.05 ± 0.01^{b}
SD+ME	0.19 ± 0.01^{a}	8.3 ± 0.01^{a}	17.7 ± 0.01^{a}	0.035 ± 0.02^{a}	71.33 ± 0.02^{a}
SD+SE	0.27 ± 0.01^{b}	9.38 ± 0.01^{c}	18.42 ± 0.01^{b}	0.065 ± 0.02^{a}	72.12 ± 0.01^{b}

Table 3: Heavymetal in the seed oil of *H. barteri*

SAMPLES	%Pb	% Cd	% Ni	% Co
OD+ME	0.017±0.002^{b,c}	0.0035±0.001^{b}	0.025±0.001^{a,b}	0.012±0.001^{a,b}
OD+SE	0.01±0.002 $^{a, d}$	0.007±0.001^{c}	0.029±0.001^{a}	0.014±0.001^{b,c}
SD+ME	0.023±0.002^{e}	0.003±0.001^{b}	0.022±0.001^{b}	0.01±0.001^{a}
SD+SE	0.007±0.001^{a}	0.0045±0.001^{b}	0.034±0.002^{c}	0.017±0.002^{c}

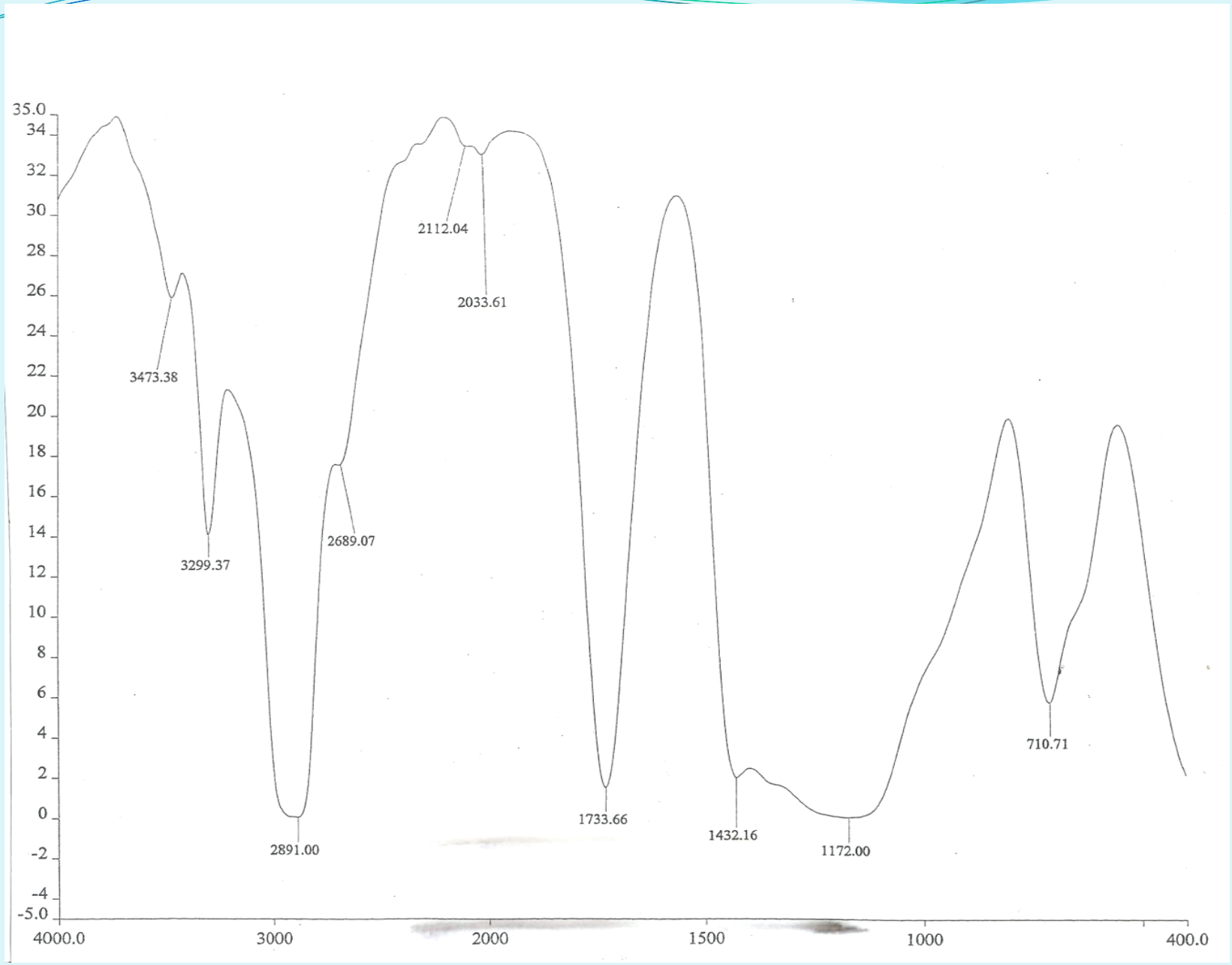
Table 4:Physico-Chemical Analysis of the seed oil of *H. barteri*

Properties		
Specific gravity	0.73±0.09 – 0.91±0.06	
Fire point	77.3±1.1 – 85.55±0.05 ^{o}C	
Viscosity	4.05±0.55 – 4.45±0.15mm^{2}/sec	
Cloud point	7.25 – 8.35 ^{o}C	
Conradson carbon	0.15 - 0.28%	
Acid value	<0.05mgKOH/g	
Iodine value	57.95 – 61.85	
Calorific value	33.41 – 36.14 MJ/Kg	

Table 5 : Functional groups in OD+SE Sample

SAMPLE	WAVENUMBER (cm^{-1})	FUNCTIONAL GROUP	COMPOUND
OD+SE	3473.88	O-H	Alcohols
	3299.37	O-H	Alcohols
	2689.07	C-H	Alkanes
	2033.61	C≡H	Alkynes
	2112.04	C≡H	Alkynes
	1432.16	C-H (bend)	Alkanes
	1733.66	C=O	Aldehyde
	1172	C-O	Alcohols
		C-O	Esters
		C-O	Ether
		C-O	Carboxylic acids
		C-H-(CH_2X)	Alkyl halides
		C-N (stretch)	Aliphatic Amines
	710.77	C-Cl	Alkyl Halides

FT-IR ANALYSIS OF THE OIL



References

- Ajiwe, VIE; Okeke, CA; Nnabuike, B; Ogunleye, GA; Elebo, E 1997. Application of oils extracted from African star apple (Chysoplyllum africanum), horse eye bean (Mucuna sloanei) and African pear (Dacroydes edulis). Biores. Technol (59):259 – 261
- AOAC. 1984. *Official methods of Analysis;* 14th Ed. Association of Official Analytical Chemists; V. A. Arlington
- AOCS 1978 – Official and Tenta Methods of the American Oil Chemists' society 3rd Edition, Champaign, Illions; AOCS (Association of official Analytical Chemists' society)
- ASTM Standards D2015-96 (1998). Standard test method for gross calorific value of coal and coke by the adiabatic bomb calorimeter. In: Annual Book of ASTM Standards, Section 5, Vol. 05.05. West Conshohocken, PA: *American Society for Testing and Materials*, 239–247
- ASTM D6751-14, Standard Specification for Biodiesel Fuel Blend stock (B100) for Middle Distillate Fuels, ASTM International, West Conshohocken, PA, 2014, www. Astm.org
- Burkill, H.M. 1985. 'The useful plants of west tropical Africa' JSTOR, Vol 5.
- CSG. 2008. Specific gravity and viscosity of liquids. *Computer Support Group, Inc. and* 75 CSGNetwork.com. Online, www.csgnetwork.com/sgvisc.html.
- Gravalos Ioannis, Dimitrios Kateris, Panagiotis Xyradakis, Theodoros Gialamas, Spiros Loutridis, Augoustinos Augousti, Anastasios Georgiades, Zisis Tsiropoulos (2010) -A study on calorific energy values of biomass residue Pellets for heating purposes
- Hildergadia Notes, 2009**.** Http://www.malvaceae.info/Genera/Hildegardia/Hildegardia.ph
- http://b100research.com/resources/fat-oil-grease-industry/iodine-value2.-accessed 4/09/2014
- Inglett G. E., Cavins J. F., and Spencer G. F., 1973. Seed Composition of *Hildegardia barteri"; Made* ill *the United States of America*, Reprinted from Economic botany. Vol. 27, No.1, January-March 1973,pp. 128-130

NEXT LEVEL

- Production of biodiesel from the oil produced
- Need facility support for characterization
- You can be of help please!


Thanks for Listening