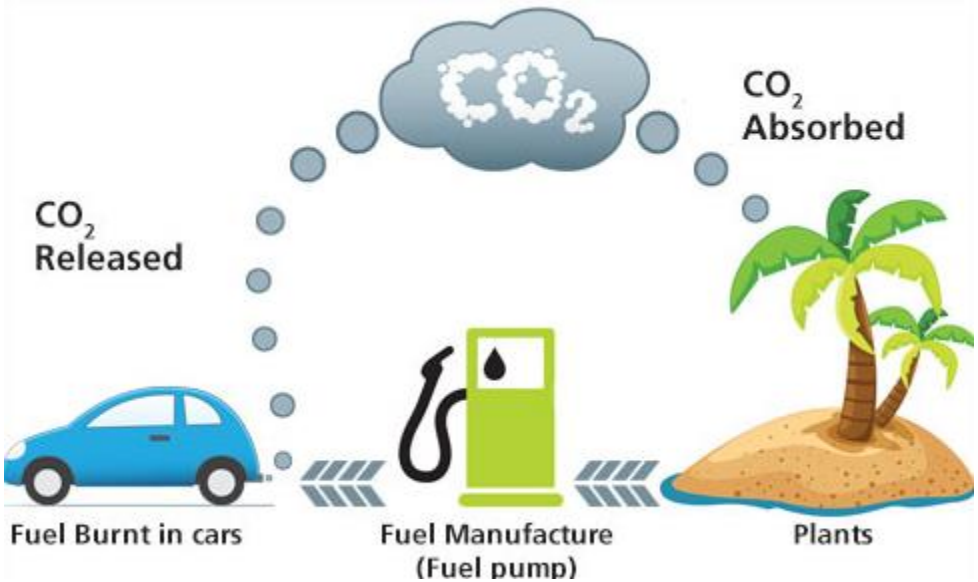
BIODIESEL FROM *GLIRICIDIA SEPIUM* AND *BAPHIA NITIDA*: A RENEWABLE SOURCE OF ENERGY FOR SUSTAINABLE DEVELOPMENT IN RURAL AFRICA

Adewale Adewuyi

Department of Chemical Sciences, College of Natural Sciences, Redeemer's University, Ede, Osun state, Nigeria.

INTRODUCTION



Vegetable oil- or animal fat-based diesel fuel consisting of long-chain alkyl esters

- ✓ ***End to fossil***
- ✓ ***Environmental issues***
- ✓ ***Economic control***

•Why seed oil?

✓Seed oils have superb environmental credentials, such as being inherently biodegradable, having low ecotoxicity and low toxicity towards human, being derived from renewable resources and contributing no volatile organic chemicals.

S/N	NAME	FAMILY	CODE	COMMON NAMES
1	*Baphia nitida*	*Leguminosae (Papilionaceae)*	BN	Camwood
2	*Gliricidia sepium*	*Leguminosae (Papilionaceae)*	GS	Mother of cocoa

EXPERIMENTAL

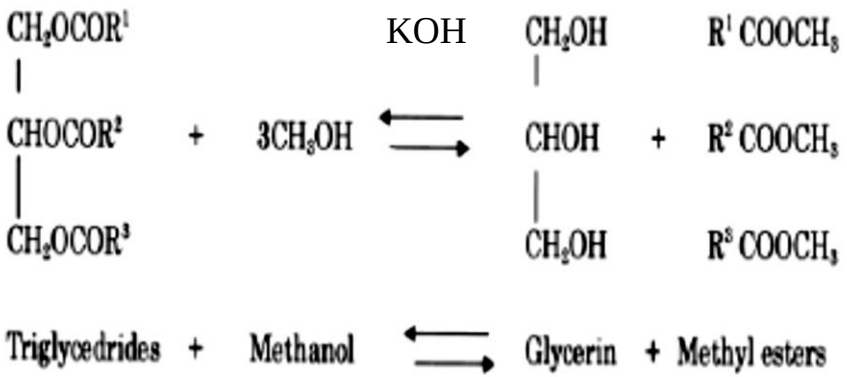
- **Characterization, lipid classes and fatty acid distribution**
- **Molecular species of the triglycerides, glycolipids and phospholipids of the oils**

Fuel properties of biodiesel

- ✓Copper strip corrosion test
- ✓Flash point
- ✓Oxidative stability
- ✓Density
- ✓Free glycerol content
- ✓Tri, di and mono glyceride
- ✓IV
- ✓Pour point
- ✓Ester content
- ✓Acid value
- ✓Phosphorus content

$$R\text{-}COOH + MeOH \xrightarrow{H^+} R\text{-}COOMe + H_2O$$

Esterification of free fatty acid using 2% sulphuric acid in methanol



Transesterification of triglyceride using 1% KOH in methanol

RESULTS AND DISCUSSION

Table 1: Proximate characterization of the seeds (%)

Plant	Crude fat	Crude protein	Crude fibre	Ash	Moisture	Carbohydrate
BN	27.14 ± 0.20	20.30 ± 0.70	2.01 ± 0.70	2.17 ± 0.10	6.80 ± 0.30	41.58 ± 0.70
GS	24.70 ± 1.00	18.70 ± 1.30	3.01 ± 0.10	4.06 ± 0.80	4.10 ± 0.20	45.41 ± 0.80

Table 2: Chemical Characterization of the oils

Sample	Iodine value (g iodine/100g)	Free fatty acid (%)	Saponification value (mgKOH/g)	Unsaponifiable matter (%)
BN	138.38 ± 0.50	1.23 ± 0.01	184.80 ± 0.60	2.48 ± 0.06
GS	128.60 ± 0.40	0.70 ± 0.40	197.90 ± 0.70	1.00 ± 0.20

- C18:1 & C18:2 were dominantly present in the Legumes
- Neutral lipids were the dominant lipid class
- Fatty acids were distributed along the classes with the saturated fatty acids highly accumulated in the phospholipids

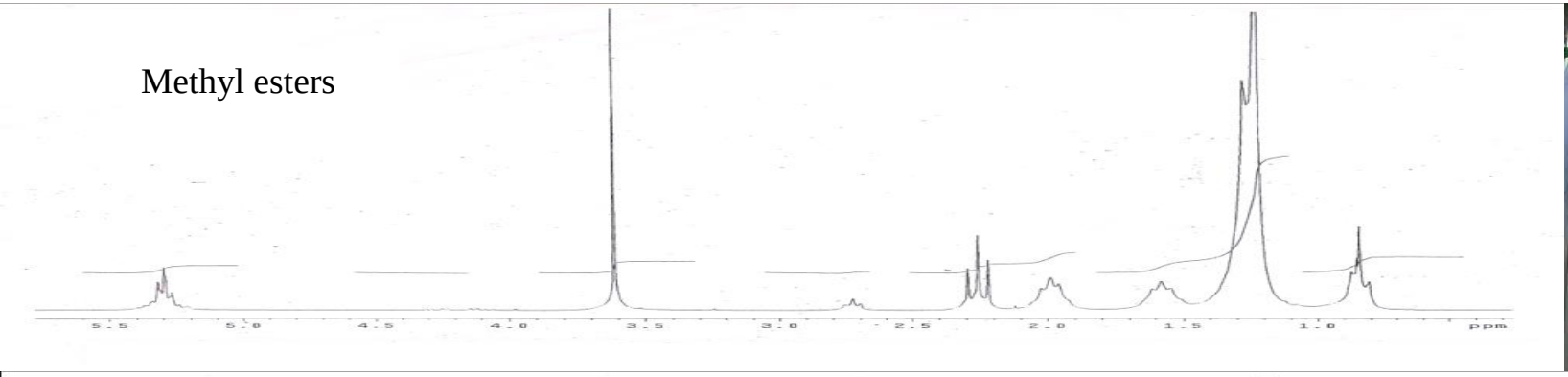
RESULTS AND DISCUSSION CONT

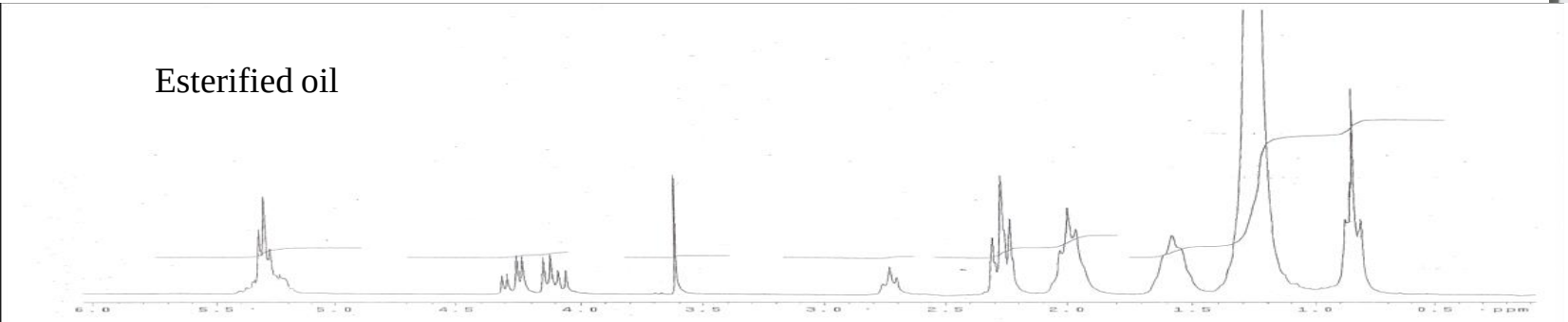
- Molecular speciation: Species with ECN C_{48} are predominantly present in the oils

- For glycolipids MGDG , DGDG , DGMG & MGMG were detected. DGDG was found most abundant.

- Phosphatidylethanol amine was the most abundant phospholipid in the oils

Biodiesel





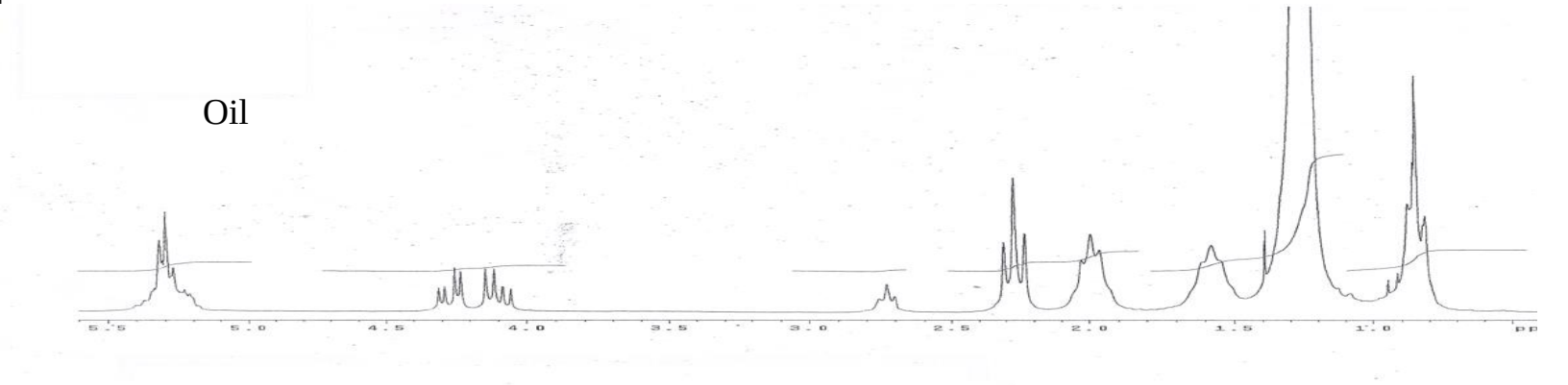


Fig. 1: ^{1}HNMR spectra of the oil, esterified oil and Methyl esters

Biodiesel

Table 3: Characterization of biodiesel from *B. nitida* and *G. sepium*

Parameters	*B. nitida*	*G. sepium*	EN Recommendation
Ester (wt %)	98.70 ± 0.20	97.00 ± 0.30	96.5
Triglyceride (wt %)	0.03 ± 0.00	0.10 ± 0.00	0.2
Diglyceride (wt %)	0.20 ± 0.05	0.20 ± 0.10	0.2
Monoglyceride (wt %)	0.20 ± 0.10	0.30 ± 0.10	0.8
Acidvalue (mgKOH/g)	0.02 ± 0.00	0.02 ± 0.01	0.6
Phosphorus (ppm)	< 1	< 1	10
Oxidative stability (hr)	16.40 ± 0.50	14.50 ± 0.70	6
Iodine value (g iodine/100 g)	137.20 ± 0.50	127.10 ± 0.20	120
Copper corrosion test(A)	1	1	1
Viscosity (40^{o})	4.60 ± 0.20	4.40 ± 0.50	3.50-5.00
Density (g cm^{-3})	0.88 ± 0.20	0.88 ± 0.10	0.86-0.90
Free glycerol	0.01 ± 0.00	0.01 ± 0.00	0.02
Pour point (^{o}C)	5. 00 ± 0.20	10.00 ± 0.50	-

Values are mean ± standard deviation of triplicate determinations.

CONCLUSIONS

- The physico-chemical characterization as well as the fatty acid profile of these evaluated oils suggest them as potential industrial resources.
- Seed oils such as *Baphia nitida* and *Gliricidia sepium* from this study have the potential of serving as replacement for other well known seed oils of similar composition.
- The pretreatment step showed that the free fatty acid can be reduced in a one-step pretreatment of esterification using H_2SO_4 as catalyst.
- Cost evaluation of the seeds?

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Thank You for Listening