Renewable Energy Sources from *Moringa Oleifera* Seed Oil: A Rich Source of Oil for Bio Diesel

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ABSTRACT
The increasing demand of petrochemical fuels all over the world and their negative impact on the environment has led to increased research and development of renewable energy sources. Bio fuels as a transportation fuel will play a very vital role in near future. Bio fuels produced as vegetable oil from plants, burning leads to a complete recyclable carbon di oxide, which reduces green house effect. The use of vegetable oils like hemp, *Jatropha, sesame, mahua* and a mixed vegetable oil have been studied by a number of researchers in diesel engine for suitability as an alternative fuel. This study presents drum stick (*Moringa oleifera)* seed oil as a sustainable source of renewable energy for biodiesel production. The seeds yield 38-40% of oil. The fatty acid profile of seed oil was examined. The saponification value, Iodine value, acid value, viscosity index of seed oil was determined. These values were compared with the reported values of Ratanjot (*Jatropha curcus*) and Karanj (*Pongamia pinetta*) seed oil samples. It was found that most of the values have resemblance as use in biodiesel. It was concluded that the seed oil of *Moringa oleifera* might be a promising source of biodiesel.

Keywords
Bio diesel, *Moringa oleifera* seed oil, fatty acid composition

1. INTRODUCTION
In India the consumption of transportation fuel is continuously increasing. The annual rate of increasing is about 6.8% of these fuels. The import of crude oil can be minimized by developing new and non conventional energy sources. The role of seed oil as a boifuel is quite promising especially in our desert climate.[1, 2]

Bio fuel refers to a vegetable or animal fat based diesel fuel consisting of long chain alkyl esters. Biodiesel is typically made by chemically reacting lipids with vegetable oil or with animal fat with alcohol producing fatty acid esters. The methyl, ethyl or propyl esters are present in bio diesel.Bio diesel can be used alone or blended with petro diesel in any proportions. The bio diesel producing plant species are ratanjot, mahua, rapeseed, hemp etc.

This study presents Drum stick (*Moringa oleifera)* seed oil as a sustainable source of renewable energy for bio diesel production.

2. EXPERIMENTAL MATERIALS
Moringa oleifera belongs to Moringaceae family. *Moringa oleifera* is one of the common medium sized tree, found in wild as well as cultivated for fruits and young flowers in kitchen gardens[3,4,5].The flowering and fruiting time is November to March and seeds ripening time is March to May. It contains several phytochemicals some of which are of high interest because of their, value. This tree has been reported as a boon to arid lands due to versatile unique applications[4].Young fruits and flower buds are used as vegetable, leaves as camel fodder, seed oil in acute rheumatism, plastering bones are some of them[6- 8].First of all a detailed field survey was done on the basis of literature of distribution of species in arid and semi arid zone of Rajasthan[7]. Seeds were collected in the month of April-May from different parts of Western Zone of Rajasthan. The oils of jatropha and karanja [9]were treated by the same methods.

3. METHODS
The air dried seeds were grounded and extracted with petroleum ether (40-60 degree boiling point range) at 40-60 degree c. using Sox let apparatus. The solvent was recovered by Rota-evaporator under vacuum. The analytical values of seed oil were determined according to the procedure recommended by American Oil Chemical Society as shown in Table-1[10, 11]

The analytical TLC was carried out on 0.25 mm layers of Silica gel G using petroleum ether and diethyl ether (80:20).The spots were visualized by exposure to iodine vapor and then charring with sulphuric dichromate spray.

The Infra red spectra were recorded on Shimatzu 8201 PC (400-350cm-1) Spectrophotometer and Ultraviolet Spectra on Hitachi 320 Perkin Elmer Lambda 15 Spectrophotometer in methanol. The refractive index was recorded on Abbey Refractometer.GLC analyses were carried out with Varian Vista 6000 Gas Liquid Chromatograph using DEGS and SE-30 columns. The UV and IR Spectra showed the absence of any unusual functional group. Various TLC methods were used for further confirmation.

Table 1. Physico chemical characteristics of seed and oil

Moisture content	1.26%
Oil content	38.9%
Protein content	61.60%
Refractive index $_nD^{30}$	1.462
Unsaponifiable matter	2.18%
Iodine value	140.37
Saponification value	252.0
Ultra violet	Usual
Infra red	**No specific absorption**

4. RESULT AND DISCUSSION

The following results were found by the gas liquid chromatography of fatty acid methyl ester -

Total Saturated Fatty Acids: The total amount of saturated fatty acids were found as 7.21%.Myristic,Palmitic and Behinic acids were found absent in selected species.

Total Unsaturated Fatty Acids: The amount of oleic acid was found as 56.16% as major component. Other unsaturated acids viz. lonolic and linolenic acids were also found in good amount.

Poly Unsaturated Fatty Acids (PUFA): The combined content of linolic and linolenic acid was found as 36.62%.

Category of Oil: On the basis of PUFA content the seed oil of *Moringa oleifera* is categorized as non-drying oil.

Comparison with earlier reports: The comparison of present findings with earlier reports was done. The richness of oleic acid (56.16%) and absence of any oxygenated fatty acid component were similar.The percentage composition of fatty acids varied in present study due to environmental factors. For example Palmitic acid was not found in our sample while it has been reported up to 12.51%.Similarly Arachidic Acid also show presence in our sample, which was not reported in earlier findings.[12,13,14]

Comparison of Moringa oil with other oil-The table indicates the comparative chemical composition of seed oils of three species. It is clear that most of the properties resemble with jatropha and karanj oil .It is concluded that Moringa oil could be a substitute of pre existing seed oil. It can be cultivated as a food crop producing all the parts as human and animal consumption. Since the oil is found in good amount hence it can be proved a promising source of Indian economy especially in our desert zone. It is suggested that the cultivation of this plant should be granted under government projects.[10, 11]

Figure.1-Plant of *Jatropha Curcyus*

Figure.2 Fruits of Jatropha Curcus

Figure.3 Plant of Pongammia Pinetta

Figure.4 Dried Pods and Seeds

Figure.5 Tree of Moringa Oleifera

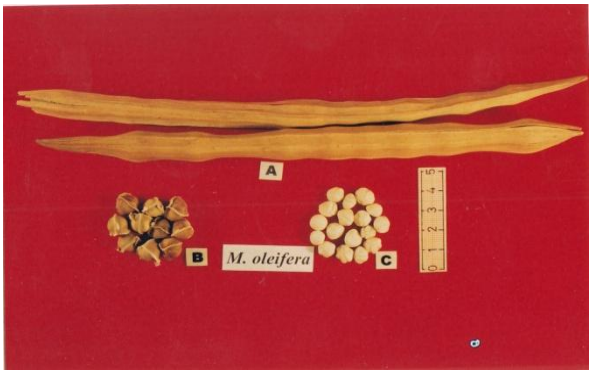

Figure.6 Dried Pods and Seeds

TABLE-2 Comparison of *Moringa* Seed Oil With *Jatropha* and *Karanj* Seed Oils

Sr.	Component	Jatropha	Karanj	Moringa
1	Oil Content	35	38	38
2	Specific Gravity	.918	.934	1.000
3	Saponification Value	195	192	252
4	Iodine Value	86	90	140
5	% Unsap Matter	1	1	1
6	Myristic Acid	.6	---	---
7	Palmitic Acid	14	5.5	---
8	Stearic Acid	7.5	5.6	4.6
9	Oleic Acid	49.9	56	56.2
10	Linolenic Acid	---	**2.6**	**17.1**
11	Linoleic Acid	28	14	19.5
12	Unusual Component	Absent	Absent	Absent
13	Pufa	28.0	16.8	36.6
14	Category Of Oil	Non Drying	Non Drying	Non Drying

5. ACKNOWLEDGEMENT

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