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Green Chemicals from Awala (Phyllanthus emblica) and Hirda (Terminalia Chebula) seed oils of Vidarbha Region of Maharashtra.

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ABSTRACT: *The world has been confronted with an energy crisis due to depletion fossil resources and increased environmental problems. Such situation has led to the increase of research for an alternative energy such as biofuels from sustainably biomass resources. Among various possible options, fuels derived from triglycerides present promising "greener" substitutes for Biofuels. Among biofuels, biodiesel exhibits fuel properties which compatible to those of petroleum-based diesel, and which can be used commercially. The present paper investigates, seed oils such as Awala (Phyllanthus emblica) and Hirda (Terminalia Chebula) found in Vidarbha region of Maharashtra as a potential source for green chemicals such as biodiesel. Biodiesel is an attractive alternative fuel because it is environmentally friendly and can be synthesized from edible and non-edible oils..Biodiesel has been prepared using a three-step method comprises with saponification of oil, acidification of the soap and esterification of FFA. The final step is esterification that produces fatty acid methyl ester (FAME). The biodiesel prepared from Awala and Hirda Seed oils have the properties comparable to the commercial diesel.*

Keywords: *Biofuel, Triglyceride, Saponification, , Esterification, Fatty Acid Methyl Ester (FAME).*

I. INTRODUCTION

In recent times[1], the world has been confronted with an energy crisis due to depletion fossil resources and increased environmental problems. Such situation has led to the increase of research for an alternative energy such as biofuels from sustainably biomass resources. The scarce and rapidly depleting conventional petroleum resources have promoted research for alternative fuels for combustion engines. Among various possible options, fuels derived from triglycerides (vegetables/oils/animal fats) present promising "greener" substitutes for Biofuels Among biofuels, bio-diesel exhibits fuel properties which compatible to those of petroleum based diesel, and is commercialized for use in existing motor vehicles.

Vegetable oils[2] are becoming a promising alternative to diesel fuel because they are renewable in nature and can be produced locally and environmental friendly as well. India which is abundant in natural resources could utilize their natural oil resources to become raw material for biodiesel production. Biodiesel[3] is an attractive alternative fuel because it is environmentally friendly and can be synthesized from edible and non-edible oils. Biofuels have become one of the fastest growing markets in the world at 15% growth a year. Many environmental NGO strongly support biofuels as one of many renewable technologies needed to reduce our dependence on hydrocarbons and to avert the worst of climate change. Importance of BIODIESEL may be summarized as Environment friendly, clean burning renewable fuel, No engine modification, Increase in engine life, Biodegradable and non-toxic, Easy to handle and store.

The synthesis of biodiesel from edible oils like sunflower oil[4] and Cynara cardunculus oil[5] oil and from crude non-edible oils like Pongamia pinnata[6] and Jatropha curcas[7] have been studied. Physico-Chemical characteristics and fatty acid composition of Awala and Hirda[8] seed oils have also been studied.

II. MATERIAL AND METHODS

2.*1 Seed Material*

Awala and Hirda seeds were collected from the Nagpur and Amravati region of Vidarbha. The seeds in good condition were cleaned, de-shelled and dried at high temperature of 100-105^{0}C for 35 min. Seeds were grounded using grinder prior to extraction.

2.2 *Oil Extraction*

The seed kernels were ground, using a mechanical grinder, and defatted in a soxhlet apparatus, using hexane (boiling point of 40-60^{0}C). The extracted oil was obtained by filtering the solvent oil contained to get rid of the solid from solvent before the hexane was removed using rotary evaporator apparatus at 40^{0}C. Extracted seed oil was stored in freezer at -2^{0}C for subsequent Physico-Chemical properties.

III. ANALYSIS

The seed oils were analyzed for Oil content, Acid value, Iodine value, Saponification value and refractive index by standard methods[9].

3.*1 Determination of Fatty Acid Compositions of the Oils*[10]

All the seed oils were converted to the respective methyl esters and fatty acid composition of seed oil fatty acids esters was determined using agilent 6890 series gas chromatography (GC) equipped with flame ionization detector and capillary column (30m x 0.25mm x 0.25mm). About 0.1 ml oil was converted to methyl ester using 1ml NaOMe (1 M) in 1 ml hexane before being injected into the GC. The detector temperature was programmed at 240^{0}C with flow rate 0.8 ml/min. The injector temperature was set at 240^{0}C. Hydrogen was used as the carrier gas. The identification of the peaks was achieved by retention times by means of comparing them with authentic standards analyzed under the same conditions. Standard bio-diesel sample was procured from market.

IV PREPARATION OF BIODIESEL FROM SEED OILS [11]

4.1 *Apparatus*

The apparatus used for transesterification consisted of oil bath, reaction flask with condenser and digital rpm controller mechanical stirrer. The volume of glass reactor capacity was 1 L and consisted of three necks, one for stirrer, and the other for condenser and inlet of reactant. A digital temperature indicator was used to measure the reaction temperature. The batch reactor had an opening value at the bottom for collection of the final product.Preparation of Biodiesel from seed oils was carried out by the Transesterification process. The displacement of alcohol from an ester by another alcohol in a process similar to hydrolysis except than an alcohol is used instead of water. The process in which an alcohol molecule brakes the triglyceride molecule to fatty acid alkyl esters and glycerol is called as Transesterification. The excess methanol was removed by vacuum distillation. The product was allowed to stand for 24 hrs. Upper (biodiesel) layer was separated from lower layer (glycerin). Biodiesel was washed with water, then heated from 15 min to remove moisture. Catalyst used was 1% KOH (w/v), Temperature 60^{0}c, Reaction time 3 hrs. and Yield was nearly 92%.

V. RESULTS

Physico-Chemical characteristics and fatty acid composition of seed oils

Table 1: Analysis of seed oils

Physico-Chemical characteristics	**Awala Seed**	**Hirda Seed**
Oil content in seeds % by wt.	16.7	32.6
Specific Gravity	0.9221	0.9132
Refractive Index	1.4870	1.4700
Acid Value	2.3	4.9
Saponification Value	192.8	201.3
Iodine Value	139.5	107.3
Fatty acid composition (by wt.%)		
Linolenic	8.8	1.1
Linoleic	44.0	23.3
Oleic	28.4	54.8
Stearic	2.1	9.6
Palmitic	3.0	1.4
Myristic	--	1.9

Table 2 : Analysis of Biodiesel

Test	**Standard Biodiesel**	**Bio-diesel from Awala Oil**	**Bio-Diesel from Hirda Oil**
Viscosity (30^0C)	3.6	4.1	5.6
Specific Gravity (15^0C)	0.85	0.92	0.91

Carbaon Residue (%)	0.15	0.11	0.23
Calorific Value	40-44	44-47	38-40

VI CONCLUSION

The oil extracts exhibited good physicochemical properties and could be useful as biodiesel feedstock and industrial application. The way of reducing the biodiesel production costs is to use the less expensive feed stock containing fatty acids such as inedible oils, animal fats, waste food oil and by-products of the refining vegetable oils. With no competing food uses, this characteristics turns attention to awala and hirda which grows in tropical and subtropical climates across the developing world the bio-diesel from awala oil gave comparable results. The results agreed well on work carried out on vegetable oils.[12-14]

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