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Vegetable Oil, A Source of Renewable Fuels in Diesel Engine: A Study

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Abstract: ***Modernization and increase in the number of automobiles worldwide, the consumption of diesel and gasoline has enormously increased. All over the world there are steps taken to replace petrol or diesel fuel due to crisis of fossil fuels. A lack of petroleum world wide would lead to war. A need for replacing petroleum with non fossil fuel is required that should be a renewable resource and can be used for longer span of time. This paper tells us about the use of vegetable oils in engine. There is a lack of power supply and oil prices and global warming is increasing at an alarming rate, there is a need to develop substitute energy resources to maintain economic development.***

KEYWORD: **Transesterification, Hydro cracking, Conocophilips Process, Eniecofining Process.**

I. INTRODUCTION

There is a depletion of non renewable resources. The population growth of the country is increasing at an alarming rate. Rudolf diesel was the father of the engine he citied in 1912 "the fact that oils from vegetable sources can be used may seem insignificant today, but in course of time it importance would be great as natural mineral oils and tar products are now"[1]. There is a great urge to develop a non depletable fuel. Petroleum comes from a "greek" word *πέτρα* (rock) + latin: oleum (oil) is a naturally occurring flammable liquid consisting of a complex mixture of hydrocarbons of various molecular weight . It is recovered through oil drilling. In 2010 world wide biofuel production reached 105 billion liters. There is a need to switch over vegetable oils which are renewable and eco friendly vegetable oils of molecular weight . The use of petroleum as a fossil fuel can have a negative impact on the biosphere releasing pollutants and greenhouse gases and in turn destroying the ecosystem Sunflower, Peanut, Soyabean, Rapeseed, Olive, Cottonseed, Jatropha Rubber seed, Jojoba etc as alternate fuel for diesel. Soyabean oil is a primary source for biodiesel in the united states. In Malaysia and Indonesia, palm oil is the source of biodiesel. In Europe, rapeseed is the source of biodiesel. In India and Southeast Asia, jatropha tree is the source of biodiesel. Major exporters of vegetable oil are Malaysia, Argentina, Indonesia, Philippines, and Brazil. Major importers of vegetable oils are China, Pakistan, Italy, and the United Kingdom. A few countries such as the Netherlands, Germany, the United States, and Singapore are both major exporters as well as importers of vegetable oils .

II. VEGETABLES OLIS AND BIOMASS - DERIVED FUELS

Vegetable oils and biomass-derived fuels have received much attention in the last few decades. Biomass is a renewable energy source and holds the promise of reducing carbon dioxide emission a significant contributor to global warming . Orange oil has been used as a fuel for spark ignition engines, since most of its properties are closer to gasoline. The high-octane value of these fuels can enhance the octane value of the blend when it is blended with low-octane gasoline[2].

III. VEGETABLE OIL AS A FUEL FOR DIESEL ENGINE

Vegetable oil should be blend with diesel or kerosene upto a ratio of about 20% depending on extra additives and temperature. Biodiesel can be blended with diesel at 5% in some petrol stations[3] .Biodiesel is a derivative of vegetable oil and has lower viscosity than straight vegetable oil. In 2004 a survey took place in Australia by engineers, who demonstrated that the best solution for reducing the greenhouse gas emissions was the use of alternative fuels that is vegetable oil. The methyl esters of vegetable oil, known as biodiesel are becoming popular because of their low ecological effect[4].

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IV. VEGETABLE OIL BLENDING

The relatively high kinematic viscosity of vegetable oils must be reduced to use in engines and fuel system. . As petroleum is non renewable source of energy and the petroleum reserves are scarce nowadays, there is a need to search for alternative fuels for automobiles[5] . Co solvent blending is a low cost and easy to adapt technology that reduces viscosity by diluting the vegetable oil with a low molecular weight solvent . Blending of vegetable oil with some percentage of diesel fuel has a suitable method of reducing choking and for extended engine life.

V. VEGETABLE OIL REFINING

Vegetable oil refining is a process to transform vegetable oil into fuel by hydro cracking or hydrogenation. Hydro cracking breaks big molecules into smaller ones using hydrogen while hydrogenation adds hydrogen to molecules. The majority of plants and animal oils are vegetable oils which are triglycerides- suitable for refining. Some commercial examples of vegetable oil refining are NExBTL, H-Bio, the ConocoPhilips process and the UOP/Eni Ecofining process [6].

VI. BIODIESEL PRODUCTION

->Biodiesel is a alternative fuel for diesel engines that is produced by chemically reacting a vegetable oil or animal fat with an alcohol such as methanol or ethanol. It can be represented by reaction

OIL+ ALCOHOL → BIODIESEL + GLYCERIN

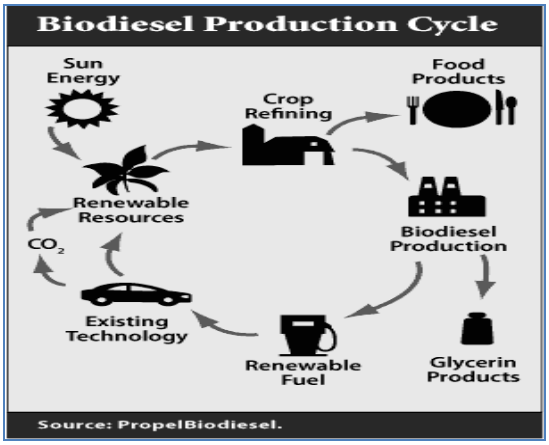

Fig 1: Biodiesel Production Cycle

Fig2: a bottle of biodiesel and glycerin

->Fig 2. Shows a bottle of biodiesel and glycerin. The biodiesel is the lighter-colored layer at the top. The darker –colored crude glycerin has settled at the bottom. The unmodified vegetable oil also called straight vegetable oil is not biodiesel.

->The chemical reaction that converts a vegetable oil or animal fat to biodiesel is called “transesterification” [7]. This is a simple process of combining a chemically compound called an “ester” and an alcohol to make another ester and another alcohol.

->Methanol is the most common alcohol used for making biodiesel. it is very toxic and swallowing .

->The chemical reaction used to make biodiesel requires a catalyst. A catalyst is usually added to a reaction to speed up the reaction. In biodiesel production, the actual compound that catalyzes the reaction is called methoxide. One common way to make methoxide is to dissolve sodium hydroxide or potassium hydroxide in methanol.

VII. EXHAUST EMISSION PARAMETERS

The exhaust emissions of the diesel engine using vegetable oil deal with CO,HC,NOx, Soot, Particulate emissions, Aldehydes, Ketones, and aromatic hydrocarbons and particulate bound polycyclic aromatic hydrocarbons. High intensity of exhaust gas smell is also noted. This toxic emission causes health and environmental problems.

BIODIESEL REDUCES EMMISION		
EMISSION	**B100**	**B20**
Carbon monoxide	-43.2%	-12.5%

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Hydrocarbons	-56.3%	-11.0%
Particulates	-55.4%	-18.0%
Nitrogen Oxides	+5.8%	+1.2%
Air Toxics	-60%-90%	-12%-20%

Table 1: Exhaust Emission of Gases.

There would be some demerits of vegetable oil also due to this emission it will cause choking to the injector, it may invalidate vehicles warrantee and thickening and gelling of the lubricant oil . The vehicle would be difficult to start in the morning, and their may be exhaust smell of chips.

VIII. BENEFITS OF VEGETABLE OIL

- Environmentally friendly.
- Waste oil is cheaper.
- Smooth engine running: no knock.
- Better lubrication.
- Less reliance on petro-chemicals.
- Liquidity.
- Environmentally friendly.
- Readily available.
- Lower sulphur and aromatic content.
- Bio-degradability.
- Enhanced street credibility

IX. FUTURE OF VEGETABLE OIL

- According to international energy agency, biofuels have the potential to meet more than a quarter of world demand for transportation fuels by 2050.
- Vegetable oil can be used to save on more than gas. Vegawatt, a company based for Massachusetts has developed a way to convert their vegetable oil into electricity and hot water [8].
- Vegetable oils are used in various industrial applications such as emulsifiers, lubricants, plasticizers, surfactants.
- Recent research focused on the development of new industrial products, including the use of vegetable oils in paint and coatings, printing inks.

X. CONCLUSION

The solution to avoid twin problems of environmental pollution and energy shortage should be carefully planned gradual shift of our energy economy from fossil fuels to renewable sources of energy. Renewable fuels have gained popularity due to their sustainability, low contributions to the carbon cycle. The geo- political ramifications of these fuels are also of interest , particularly to industrialized economics .The benefits of using vegetable oil to displace fossil fuels can reduce air pollution, greenhouse gas emissions.

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