A Review on Biodiesel Asa Alternative Fuel

C.P Saxena, R.Kumar,D. Bora

Abstract- Recycle of waste cooking oil is harmful for health, as it is not environmental friendly to disposed used cooking oil. The best way is to use it for making biodiesel. The biodiesel is blended with diesel oil to get B5 and B10 grade fuel. There are four basic ways for making biodiesel they are, direct use and blending, thermal cracking (pyrolysis), micro-emulsions and transesterification. The biodiesel is an alternative fuel for diesel engines, because diesel fuels have high rate of emissions,no_xcontent, high toxicity,non-renewability, co, so_x etc.

I. INTRODUCTION

It has been seen that 98% of carbon emission are resulted from fossil fuel combustion. The need of fossil fuel are increasing day by day due to which resources of fossil fuel are decreasing very fast. The major disadvantages of using petroleum fuels, they are more polluted as compared to bio fuels. The petroleum diesel combustion emits several greenhouse gases,no_x , so_x , co,and volatilesubstance. Several alternative fuels have been studied to either substitute to diesel.

It is well known that compression ignition engines were tested by their inventor, Rudolf Diesel, with peanut oil as fuel in 1911 [1], and in his patent he wrote that the "use of vegetable oil for engine fuel may seem more important than petroleum product ".

The use of bio fuels slow down the global warming by reducing sulfur, carbon oxides and hydrocarbon emissions. The biodiesel is often blended with diesel fuel in ratios of 2, 5 and 20%. The higher the ratio of biodiesel to diesel, the lower the co_2 emission. If we use pure biodiesel makes the net emission of co_2 zero. The waste vegetable oil from plant source is best material to produce biodiesel because the conversion of pure triglyceride to fatty acid methyl ester is

Higherand reaction time is shorter [2]. The diesel fuel have more costly then biodiesel fuel. The most used cooking oil which are cheaper also they are palm oil, jatrophaoil, soya bean oil and coconut oil. The used cooking oil (uco) have 10 time more kinematic viscosity and its density is 10% higher than that of mineral diesel therefor uco is preferred.

Biodiesel has a relatively higher flash point which make it less volatile in compression with diesel oil. It provide long engine life, engine wear and also have lubricant properties which are the basic advantage of biodiesel fuel.

II. RAW MATERIAL FOR BIODIESEL

Biodiesel oil can be made from vegetable oil or animals fats. The most edible oils used now a days are jatrophaoil,karanji or pongamiaoil,neem oil, jojoba oil, cotton seed oil, linseed oil, orange oil, sugarcane oil and rubber seed oil.

III. DIRECT USE AND BLENDING

The vegetable oil can be mixed directly or diluted with diesel fuel to improve the viscosity so as to solve the problem of direct use of vegetable oil in compression ignition engine.CaterpillarBrazil, in 1980, used a 10% mixture of vegetable oil to maintain total power. A blend with 20% vegetable oil and 80% diesel fuel is also successfully reported. Dilution with 25% sunflower with 75% diesel with a

viscosity of 4.88cst at 40°c has been studied by Ziejewski et al.

IV. MICRO-EMULSION PROCESS

The problem of higher viscosity of vegetable oils is by micro-emulsion process with solvent such as methanol , ethanol and i-butanol . microemulsion are clean , stable isotropic fluids with three components : an oil phase, an aqueous phase and a surfactant . the aqueous phase consist of salt or other ingredients and oil may consists of complex mixture of different hydrocarbon and olefins and in end phase can improve spray characteristics by explosive vaporization of the low boiling constituents .

V. PYROLYSIS

It is the process of conversion of one substance into another by means of heat or with the aid of catalyst in the absence of air or oxygen .the pyrolysis of vegetable oil to produce biofuels has been studied and found that it produce alkanes, alkenes, alkadienes, aromatics and carboxylic acids with different properties .

VI. TRANSESTERIFICATION

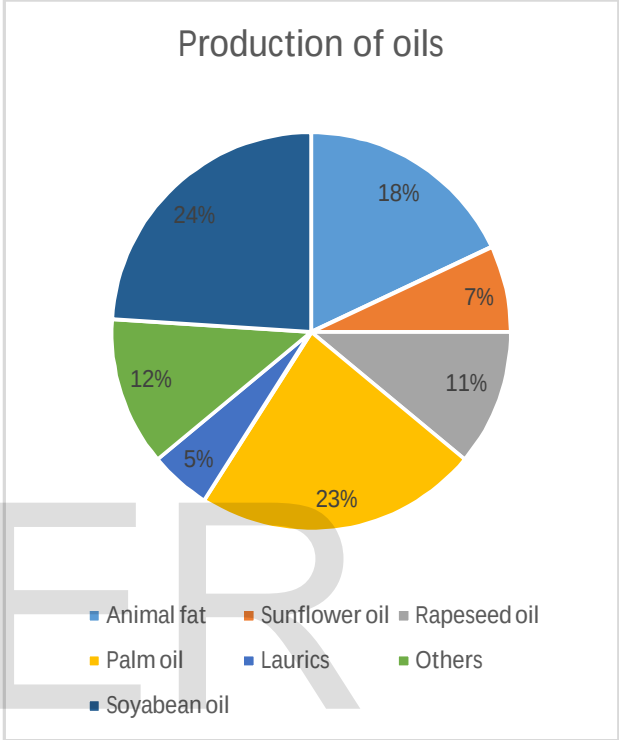
It is the chemical reaction that involves triglycerides and alcohol in the presence of a catalyst to form esters and glycerol. This process involving three consecutive reversible reaction , they are the conversion of triglycerides to digly- cerides , followed by the conversion of diglyceridesto monoglycerides. Glycerides are then converted into glycerol , gives one ester in each step. A catalysts is used for shorter the reaction rate.

Triglyceride + ROH→ Diglyceride + $RCOOR_1$

Diglyceride + ROH → Monoglyceride + $RCOOR_2$

Monoglyceride + ROH → Glycerol + $RCOOR_3$

Methanol and ethanol are used most frequently. However , methanol is the most preferable because of its low cost and its physical and chemical advantages as polar and shorter chain alcohol . methanol can also react with triglycerides quickly and easily dissolved the alkali catalyst. However there is quite risk with low boiling point of methanol therefore it shouldbe handled with care .



VII. CHEMICAL CHARACTERSTICS

Fatty acids- At high temperatures free fatty acids form salts with metals and thus can damage the engine or storage tanks . They are related to the iodine number, which indicates the degree of oil unsaturation, i.e. the presence of double bonds in the fatty acids. Double bonds are less stable than single bonds and can react with iodine . Oil can be defined as saturated (iodine number between 5 and 50), monounsaturated (iodine number between 50 and 100), bi-unsaturated (iodine number between 100 and 150) or tri-unsaturated (iodine number greater than 150) . The higher

the iodine number and the degree of unsaturation of the compound, the lower the viscosity of the oil. As the viscosity decreases the efficiency of the combustion process increases, due to short evaporation time, short ignition delay and low amount of sediments in the engine.

Wax content - Wax content does not affect combustion, but can influence the correct operation of secondary elements, such as pumps, filters, power supply devices. It varies according to the nature of the seeds and to the oil extraction temperature.

Peroxide value -It influences the oxidation level of the oil and its degree of stability in fact, unsaturated oils are characterized, as mentioned, by the presence of double bonds between carbon atoms that are not fully saturated by hydrogen atoms. Being less stable than single bonds, they can react with oxygen, hence be oxidized more easily. Chemical alteration of unsaturated fats and oils, by oxygen contained in air, begins with the formation of peroxides . Peroxide value of WVO is higher than in pure vegetable oils since the contact of hot oil with food reduces the oxidation stability .

VIII. PHYSICAL CHARACTERISTICS

Density - The weight per unit volume of vegetable oils is larger than that of petrol-diesel approximately by 10% . This is positive for the specific energy of the fuel . Higher density determines higher momentum and longer break-up times of liquid droplets, hence worst conditions of atomization, and higher amount for droplets reaching the combustion chamber walls.

Viscosity- The high viscosity of vegetable oils is due to their high molar mass (600–900 g/mol) . Fuel viscosity also affects injection timing, which is an important aspect to be taken into account when WVO is used in compression ignition engines without any modification of the fuel injection system or strategy . High temperatures reached during frying process cause several reactions, such as polymerization, with the formation of higher molecular weight compounds, that increase viscosity .

Cetane no - Cetane number is a measure of the fuel ignition delay. It indicates the behavior at ignition, hence it affects cold start, combustion development and engine noise. The higher its value, the shorter the ignition delay . In general, WVO is characterized by cetane number lower than diesel oil, although some exceptions exist. Anyway no standardized analyses exist to determine the cetane number of high viscosity fluids .

Flash point - It is the lowest temperature at which fuel vapors ignite in the presence of a flame . The value depends on the pressure and is normally measured at a standard pressure of 1013 bar. The higher the flash point, the higher the safety of storage, transport and handling of the fuel . Its value has no direct influence on the combustion efficiency or engine performance .

Bulk modulus - The bulk modulus of a substance measures its resistance to a uniform compression. It is defined as the ratio of the infinitesimal pressure increase to the resulting relative decrease of volume. Together with viscosity, the bulk modulus of a fuel plays a determinant role in the injection timing. The bulk modulus of vegetable oils is higher than that of petro-diesel, as confirmed by measurements performed on blends with various oil percentages at various temperatures. The higher the bulk modulus of compressibility the higher the speed of sound in the fuel.

Calorific value - Vegetable oils have a calorific value around 10–15% lower than petrol-diesel .the approx. value is around 37.27 MJ/Kg. variations in biodiesel energy density is more dependent on the feedstock used than the production process.

IX. CONCLUSION

Biodiesel has attracted wider attention toward alternative bio-fuel , which is renewable, biodegrable , non toxic and environmentally friendly . It is cheaper in comparison with diesel fuel .its physical and chemical characteristic is far better then diesel oil . high fatty acid content in waste cooking oil could be reduced by pretreating waste cooking oil with acid catalyst. Methanol is the most suitable alcohol because of its low cost and easy separation from biofuel .transesterification is a commonly employed method for the production of biofuel. The purpose of this method is to reduce the viscosity of oil or fat using acid or base catalyst in the preparation of ethanol or methanol. Preheating the fuel involves lower CO and soot emissions and higher NOx formation. High viscosity of fuel involves filter clogging and power loss issues; increasing WVO temperature, raising the tank or increasing the number of filters, can contribute to solve this problem. The exhaust gas temperature is higher when WVO is used in ICE, rather than petrol-diesel, especially if injection timing is advanced. The results about the pollutant emissions, CO, HC, NOx, SO 2, CO 2 and soot, are discordant, especially because different engine technologies, measurement techniques, operating conditions and fuel qualities have been tested in the various papers. On average, there is an increase in the CO and HC concentrations when using WVO with respect to petrol-diesel and a decrease in CO2 emissions.

X. REFERENCES

[1] Issariyakul T, Dalai AK. Biodiesel from vegetable oils. Renew Sustain Energy Rev 2014;31:446–71.

[2] Thirumarimurugan, M., Sivakumar, V.M., Merly Xavier, A., Prabhakaran, D., Kannadasan ,T.(2012) Prepration of Biodiesel From Sunflower Oil by Transesterification , International journal of Bioscience, Biochemistry and Bioinformatics, 441-444.

[3] Alemayehu ,G., Tewodros G., Abile T., " A Riview on Biodiesel Production As Alternative Fuel" journal of forest products and industries, 2015, 4(2) ,80-85

[4] A. Gnanaprakasam, V.M. Sivakumar ,A.Surendhar , M. Thirumarimurugan , T. Kannadasan Department of chemical Engineering, Coimbatore institute of technology vol 2013

[5] N. H Abdullah., S.H. Hasan , N. R.M. Yusoff Faculty of mechanical and manufacturing Engineering , International journal of materials science and Engineering Vol.1 2013

[6] D.Capuano , M. Costa , S.D. Fraia, N. Massarotti, L. Vanoli , Dipartimento di Ingegneria, Università degli Studi di Napoli "Parthenope", Centro Direzionale, Isola 2017