

BIODIESEL AS AN ALTERNATE FUEL FOR POLLUTION CONTROL IN DIESEL ENGINE

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Abstract:

Diesel vehicles are the major source for air pollution; there is great potential for global warming due to discharge of greenhouse gases like CO₂ from vehicles. Many lung problems are connected with particulate matter emitted by diesel vehicle including dust, soot and smoke. People are exposed to pollution even as they talk or when stir up the dust when they walk. Biodiesel is a non-toxic, biodegradable and renewable fuel. Compared to diesel fuel, biodiesel produces no sulfur, no net carbon dioxide, less carbon monoxide and more oxygen. More free oxygen leads to the complete combustion and reduced emission. Overall biodiesel emissions are very less compared to diesel fuel emissions which is promising pollution free environment.

Abundant source of vegetable oil in India and its ease of conversion to biodiesel help to save large expenditure done on import of petroleum products and economic growth of country. Biodiesel also generates huge rural employment and degraded lands can be restored due to plantation of oil plants which help in reducing pollution. Extensive research is going on in different countries on different types of vegetable oils like sunflower oil, karanj oil, linseed oil, soya been oil, palm oil, and many more, which can be used in those countries as per availability, our research is in progress on CNSL and its blend with diesel, research is going on in right direction and likely to get surprising results.

Key word: biodiesel, vegetable oil, methyl ester, diesel engine performance, emissions.

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Introduction:

With increasing power consumption and an increase in number of transport vehicle the coal pits are going to empty within a short period. The world at present is heavily depends upon the petroleum fuels for transportation and for operating agricultural machinery. Diesel engines dominates the field of transportation and agriculture machinery on account of its superior fuel efficiency, the consumption of fuel in india is several times higher than that of petroleum consumption. Roughly estimate of petrol and diesel consumption is 30% and 70% respectively.[3]

Diesel particulate matter (PM) is made up of very small particles that are inhaled deep into the human lung. Since there is no effective natural removal process from this area of the lung, the particles are increasingly urgent health concern. therefore, it has become very essential to develop the technology of IC engines, which will reduce the consumption of petroleum fuels and exhaust gas emissions.[3]

Irrecoverable rapid depletion of petroleum reserves, high price fluctuations, uncertainty in supply to consuming nations, high expenditures on fuel import, harmful effects of various exhaust emission on the human being and environment forces to search for alternative fuels that they themselves can produce. these alternative fuels should be preferably available from renewable sources. Therefore, attention is mainly focused towards biomass-based fuels. Alternative considered are ethanol, methanol, biogas and vegetable oil-based fuel that runs in diesel engine. One can bland it with regular diesel or run 100% biodiesel. The different benefits are (1) national security. Since it's made domestically, it reduces our dependence on foreign oil.(2) national economy. Using biodiesel keeps our fuel buying dollars at home instead of sending it to foreign countries. This reduce our trade deficit and creates jobs. (3) it's sustainable and non-toxic. Biodiesel is 100% renewable there will be no paucity of fuel never run out of it. Besides this, if it gets into water supply, it causes no problem(4) emissions. Biodiesel is nearly cabon-neutral, meaning it contributes almost zero emissions to global warming as well as also dramatically reduces other emissions.(5) engine life. Studies have shown it reduces engine wear by as much as one half, primarily because it provides excellent lubrication. Even a 2% biodiesel 98% diesel blend may be great use.(6) drivability.

An immediate smoothing of the engine with biodiesel is also claimed. It just runs quieter, and produces less smoke.[3]

Suitability of vegetable oil as diesel engine fuel:

Biomass derived oils are quite promising alternative fuels for diesel engines. A diesel engine was run on peanut oil at Paris Exposition of 1900 [6]. The vegetable oils include soybean oil, cottonseed oil, sunflower oil, rapeseed oil, palm oil, linseed oil, jatropha oil, neem oil, mahua oil. There are more than 350 oil bearing crops identified whose cetane number and calorific value are comparable with those of diesel fuels and are compatible with material vehicle fuel system. Vegetable oil is of special interest because it has shown to significantly reduce particulate emission relative to petroleum diesel [2]. Recent studies indicate that cetane number, aromatic content and type, sulphur content, density are important factors for emission control. Use of vegetable oils in diesel engine leads to slightly inferior performance and higher smoke emissions due to their high viscosity and carbon residues. Filter plugging and cold starting along with higher specific consumption observed. It is due to higher viscosity and lower calorific value of vegetable oils [6]. The performance of vegetable oil can be improved by modifying vegetable oil can be improved by modifying vegetable oil by transesterification process.[1]

Suitability of biodiesel and its effect on environment and health:

Biodiesel is methyl or ethyl ester of fatty acid made from vegetable oils. India having great demand of edible oil for cooking purpose and it is expensive too. The main source for biodiesel in India can be non-edible oil.[5]

A number of researchers have shown biodiesel has fuel properties and provide similar engine performance as that of diesel fuel. It is non-toxic, biodegradable, renewable fuel. Further advantages over petroleum based diesel fuel include a high cetane number, low sulphur, low aromatics, low volatility and presence of oxygen atom in molecule. The use of biodiesel in conventional diesel engines results in substantial reduction of unburned

hydrocarbon, carbon monoxide and particulate matter. Biodiesel reduces carbon dioxide emission. The primary cause of the green house effect up to 100% since biodiesel comes from plants and plants breathe carbon dioxide so there is no net gain in carbon dioxide by using biodiesel.[7]

Biodiesel is considered clean fuel, since it has almost no sulphur, no aromatics and has 10% built in oxygen, which helps it to burn fully. Its higher cetane number improves the ignition quality even when blended in petroleum diesel.

Biodiesel preparation:

The vegetable oil can be converted into biodiesel by a process called transesterification or alcoholysis. This process reduces the viscosity of triglycerides.[4]

Oilseed production:

India being an agriculture-based country, it will not be a big problem of cultivating crops for vegetable oils. It is estimated that 7 million acres plantation is required to produce 10% replacement petro diesel need of India.[4]

According to economic survey of government of India, out of cultivated land area, about 175 million hectares are classified as waste and degraded land which can be easily used for plantation of oil seed plants. And, thus help in accelerating the economic growth of India as well as reducing the pollution.[4]

Biodiesel is defined as mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats which conform to ASTM D6751 specifications for use in diesel engines. Biodiesel refers to the pure fuel blending with diesel fuel. Biodiesel blends are denoted as, "BXX" with "XX" representing the percentage of biodiesel contained in the blend (i.e., B20 is 20% biodiesel, 80% petroleum diesel).

The chemical and toxicological characteristics of emissions from an urban bus engine fueled with diesel and biodiesel blend showed that exhaust gases produced by a turbocharged

EURO 2 heavy duty diesel engine, operating in steady state conditions on the European test 13 mode cycle(ECE R49) were having regulated and unregulated pollutants,such as carcinogenic polycyclic aromatic hydrocarbons(PAHs) and nitrated derivatives (nitro-PAHs), carbonyl compounds and light aromatic hydrocarbons. The effect of the fuels under study on the size distribution of particulate matter(PM) was also evaluated.the use of biodiesel blends seems to result in small reductions of emissions of most of the aromatic and polyaromatic compounds, through these differences, however have no statistical significance at 95% confidence level.[8]

Biodiesel was prepared in various supercritical alcohol treatments with methanol, ethanol, 1-propanol, 1-butanol, or 1-octanol to study transesterification of rapessed oil and alkyl esterification of fatty acid at temperature of 300 and 350° C. the result showed that in transesterification, the reactivity was greatly correlated to the alcohol. the longer the alkyl chain of alcohol, the longer the reaction treatment. In alkyl esterification of fatty acids,the conversion did not depend on the alcohol type because they had a similar reactivity. Therefore the selection of alcohol in biodiesel production may be taken on the basis of consideration of its performance of properties and economics.[9]

Benefits of biodiesel:

- Biodiesel reduces CO₂ emission by 100%.
- Biodiesel reduces smoke due to soot free and complete combustion.
- Biodiesel reduces hydrocarbon emission.
- Biodiesel reduces carbon monoxide emission.
- Biodiesel is safe for transport due to high flash point.
- Biodiesel is safe for handle as it is biodegradable and non-toxic
- Bio-diesel is renewable energy source.
- Biodiesel promotes rural development.
- Biodiesel plantation reduces soil erosion.

However, some shortcomings should not be ignored as no oil is perfect. With an old diesel vehicles, there's a chance that your first tank or two of BD could free up all the accumulated crude and clog the fuel filter. It has a higher gel point. B100(100% biodiesel) gets slushy a little under 32 °F. but B20 (20% biodiesel, 80% regular diesel is more commonly available than B100) has a gel point of - 15° F. however, like regular diesel, the gel point can be lowered further with additives, such as kerosene. Old vehicles might require upgrades of fuel lines, as BD can eat, through certain type of rubber. Almost all new vehicles should have no problem with BD. Finally, the one emission that goes up with biodiesel is NOx. NOx is greatly offset by the reduction in all other emissions and the major reduction in greenhouse gasses.

Conclusion:

- (1) Biodiesel is renewable energy source; can be used without change in existing engine.
- (2) Biodiesel reduces the exhaust emission, thus helps in reducing pollution.
- (3) Biodiesel increase rural income; provide employment and leads towards economic growth of india.

References:

- Chincholkar S.P.(2004) : vegetable oil as a diesel engine fuel.
- lele S.V (2002) : biodiesel in india. Website : [http://www.svlele.com/biodiesel in india.html](http://www.svlele.com/biodiesel%20in%20india.html).
- Mooney J.J(2000): diesel engine emission control requires low sulphur diesel fuel; SAE paper 2000-01-1434.
- Patel s. mishra (2004): biodiesel a promising alternative of petrodiesel; science tech entrepreneur.
- Stavarache C. (2005): fatty acids methyl esters from vegetable oil by means of ultrasonic energy. Ultrason sonochem 12(5) 367-372.

- Stewart G.A (1981) : oilseed as a renewable source of diesel fuel; CSIRO, search 12(5), 107-115.
- Suryawanshi J.G (2004): experimental investigation on jetropha oil methyl ester fuelled diesel engine; ASME (ICEF) paper 866.
- Turrio-Baldassarri (2004): emission comparision of urban bus engine fueled with diesel oil and 'biodiese' blend. Sci total environ 327(1-3), 147-162.
- Warabi Y.Kusdiana (2004): biodiesel fuel from vegetable oil by various supercritical alcohols; appl biochem biotechnol. 113-116,793-801.

