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Review Article

Green Diesel-Biodiesel an Alternative Fuel and its Effect on Health in India-A Review

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Abstract

From day to day performance fuels became an integral part of life but due to insufficient storage n hazardous emissions due to this fuel green diesel have the most important and future of human being life. biodisel is the combination of methanol with vegetable oil having catalyst as sodium hydroxide. Biodiesel is a renewable, environmentally friendly substitute for petroleum-based diesel fuel. It is produced from vegetable oils, animal fats, or wastes cooking oils and fats, and can be used in existing diesel engines without any expensive modifications. Biodiesel can also be added to petroleum diesel to create a biodiesel blend with favourable performance attributes and environmental benefits roughly proportional to the biodiesel fraction. Biodiesel is safe, nontoxic, biodegradable, and reduces the emissions of many harmful compounds associated with the combustion of petroleum-based diesel. Because biodiesel is produced from domestically produced plant oils or waste fats, switching from petroleum-based diesel to biodiesel decreases dependence on foreign petroleum, reduces net greenhouse gas emissions, and provides tangible benefits for the domestic economy. This paper describe the biodiesel analyze the social, political, and economic factors that have prompted people to consider replacing petroleum-based diesel with biodiesel, and explore the potential for biodiesel adoption in India. Public and private fleet vehicles represent a particularly attractive market for biodiesel, especially in the India, although future demand is dependent on public policy decisions. Since one of the key values provided by biodiesel is the regional nature of its production.

Keywords: *Biodiesel performance, exhaust emissions, Environmental aspects, India*

1. Introduction

Vegetable oils have long been promoted as possible substitutes for diesel fuel. In fact, Rudolph Diesel, the inventor of the diesel engine, reportedly used peanut oil in his original engine designs around the turn of the century. Interest in vegetable oils as transportation fuels continued in various parts of the world for several decades, until the relative abundance of inexpensive fossil fuels after the conclusion of World War II made research into diesel substitutes unnecessary. The OPEC embargo of the 1970s revived interest in alternative fuels, including vegetable oils as fuel for diesel engines, although interest in alternative energy subsequently waned in the United States and, to a lesser extent, other industrialized nations.

Recently, environmental and political concerns have prompted a resurgence in the use of biodiesel and other alternative fuels. In 1991, the European Union placed severe restrictions on the sulfur content of transportation fuels and proposed a 90% tax deduction for the use of biodiesel. Subsequently, many biodiesel manufacturing plants were built to convert rapeseed oil, the most common oilseed plant grown in Europe, into low-sulfur biodiesel fuel. European motorists currently consume over a quarter billion gallons of biodiesel fuel annually. Interest in biodiesel is also growing in the United States thanks to recent public policy decisions that mandate increased alternative fuel usage and require on-road diesel fuel to meet ultra-low sulfur requirements by 2008.

A. Biodiesel performance

Biodiesel has a higher cetane numberand offers similar power, torque, and fuel economy characteristics to low-sulfur petroleum-based diesel fuel without major engine modifications. Biodiesel also provides significant lubricity improvement over petroleum diesel fuel, even for very low blends (e.g. B01 or B02), which is an important consideration since low-sulfur petroleum-based diesel has very low lubricity and generally requires a lubricity additive.

The two main performance problems reported with using biodiesel in diesel engines are cold weather performance and rubber degradation. Cold weather can cloud or even gel any type of diesel fuel, and these problems seem to be particularly acute when using

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Table 1 The differences between biodiesel and petroleum-based diesel

S.N.	Property	Biodiesel	Petroleum Diesel
1	Cetane No	51 - 62	44 - 49
2	Lubricity	Greator than diesel	Lower
3	Biodegradability	Good	Poor
4	Toxicity	Non -Toxic	Highly Toxic
5	Oxygen	11% free Oxygen	Very Low
6	Aromatics	No aeromatic	18 – 22 %
7	Sulpher	None	0.05 %
8	Cloud Point	Slightly more	---
9	Flash Point	300 – 4000F	125
10	Spoil Point	NONE	High
11	Heating Value	2– 3 % higher than diesel	---
12	Renewable Supply	Renewable	Non –Renewable
13	Alternative Fuel	Yes	No
14	Production Process	Chemical Reaction	Reaction

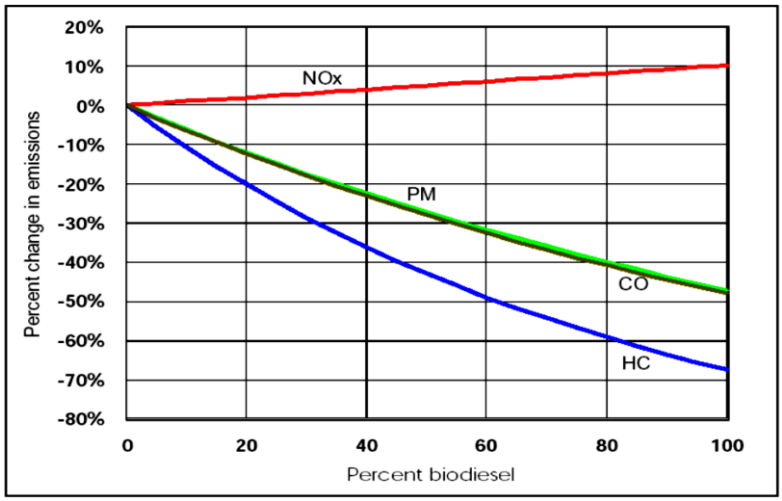

Fig 1: Biodiesel emission changes relative to petroleum-based diesel

either low-sulfur diesel or biodiesel. The most practical solutions to these problems are to blend the fuel with conventional (#1) diesel or a cold flow additive, use dedicated fuel heaters to keep the fuel above the cloud point, and/or store vehicles and fuel in or near a building when the weather is cold. Additional research is needed in this area before biodiesel can be adopted on a widespread basis in cold-weather climates. [McCormick *et al*,2002].

Methyl esters can also soften and degrade certain kinds of elastomers and natural rubber compounds over time, so using biodiesel could impact fuel system components (most notably fuel hoses and fuel pump seals) over time. Most vehicles made after the 1990 Clean Air Act amendments (which mandated the use of low-sulfur diesel—see the following section) use components that are compatible with biodiesel, but owners of older vehicles should have their engine components regularly inspected or replaced after switching from petroleum-based diesel to biodiesel. Methyl esters can also dissolve fuel tank deposits in older vehicles, which can clog the fuel filter, although this is an inexpensive part that is easy to replace during regularly scheduled vehicle maintenance.

B. Environmental benefits of biodiesel

There is a large body of literature describing the environmental benefits obtained when petroleum-based diesel is replaced with biodiesel for use as a transportation fuel. The exact reduction in emissions obtained by switching from petroleum-based diesel to biodiesel is dependent on a number of factors, including the engine type and age, the operating conditions, the feedstock used to produce the biodiesel, the percentage of biodiesel in the blend, and the characteristics of the crude oil use to produce the conventional diesel that is being replaced; in most cases the differences between different fuels, engines, etc. are not very large, and the statistics below reflect the average environmental benefits reported. It should also be noted that the emission benefits associated with a biodiesel blend are generally roughly proportional to the percentage biodiesel in the blend (i.e. using B20 yields approximately one-fifth of the benefit obtained using pure B100 biodiesel).

Biodiesel contains zero sulfur, so sulfate and sulfur dioxide (the two largest contributors to acid rain) are completely eliminated from the tailpipe emissions of

vehicles using pure (B100) biodiesel. The tailpipe emissions of pure biodiesel also have 67% fewer unburned hydrocarbons (including 80% fewer polycyclic aromatic hydrocarbons, which are potentially carcinogenic, and 50% fewer speciated hydrocarbons, which contribute to smog formation), 48% less carbon monoxide (which is toxic), and 47% less particulate matter (which causes respiratory problems) than those of low-sulfur petroleum-based diesel. These benefits are even larger when biodiesel is compared to regular diesel fuel, which is not affected by the 1990 Clean Air Act amendments and is commonly used in boats, farm equipment, and off-road vehicles. Biodiesel does produce a slight increase (10%) in nitrous oxide (NOx) tailpipe emissions relative to conventional diesel fuel, but the total smog forming potential is much lower for biodiesel and the absence of sulfur dioxide from biodiesel exhaust is expected to allow NOx control technologies (similar to the catalytic converter) to be adapted to diesel engines.[EPA *et al*,2002].

2. Biodiesel opportunities in India

India is a rapidly expanding country in terms of both its population and its economy. According to the 2001 Census of India, country's population stood at 1,027,015,247 persons. Although India occupies only 2.4% of the world's land area, it supports over 15% of the world's population. Demographics indicate the population will grow because almost 40% of Indians are younger than 15 years of age and are likely to produce offspring. By 2050, United Nations' demographer's project that India will have added another 530 million people for a total of more than 1.5 billion. If India continues on its projected demographic path, it will overtake China by 2045, becoming the world's most populous country.

Economic growth in India, as in many developing and developed countries, is currently correlated with increased energy consumption. The environmental issues often discussed in public policy debates in India arise because of two factors, the sectors responsible for energy use and where economic development is happening.

Although a large proportion of Indians (approximately 70%) live in 550,000 rural villages, urbanization levels have increased consistently since 1971. Many Indians have begun congregating in large cities as evidenced by the fact that cities with at least a million people increased from 12 in 1981 to 23 in 1991. The total population in these metropolitan areas accounts for nearly one-third of total urban population. Over 50% of the population of these metros lives in the five giant conglomerates- Mumbai (12.57 million), Calcutta (10.92 million), Delhi (8.38 million), Chennai (5.36 million) and Bangalore (4.09 million). In Delhi this has increased the number of registered vehicles to increase from 841,000 in 1985 to over 3.5 million in 2001.

Despite the fact that 350 million Indians live on less than a dollar a day, the country as a whole has been experiencing material economic growth over the last few decades. A consequence of India's rapid economic growth has been severe air and water pollution, deforestation, water shortages, and carbon emissions. The country's carbon emissions are rising rapidly due to industrialization, transportation sector growth, and the wide-spread use of coal as a fuel. Between 1986 and 1995, India's carbon emissions rose 40 percent. Sulfur dioxide and the airborne particulate levels in many Indian cities greatly exceed international standards.

3. Health Problems and Policy Mandates

Rapid population growth, economic growth, and the increasing vehicle population within the large cities has had a material impact on air quality. As a result, the Indian Government has taken measures to reduce pollution in these metropolitan areas, including:

- In 1995 unleaded gasoline was introduced in the cities of Delhi, Bombay, Calcutta, and Madras, followed by expansion to the entire country;
- In 1999 the level of permitted sulfur content was reduced from 0.5% to 0.25% (2,500 ppm). Some large cities, including Delhi, face tougher 2000 standards of 0.05%;
- Permitted benzene content has been reduced from 5% to 1%;
- In 1990 the Euro II emissions standards were implemented in Delhi, Bombay, Calcutta, and Madras, with a time schedule to tighten standards for two and three-wheelers to Euro II and Euro III standards in 2005 and 2010 respectively; and
- A Supreme Court mandated the use of compressed natural gas (CNG) by the Delhi bus fleet. Superior economics of CNG use compared to petroleum has resulted in a substantial number of private owners to convert their cars, taxis, and auto-rickshaws.[Han deqi *et al*,2003 ; Jude barry *et al*,2002].

4. Why biodiesel is attractive in India

On top of the evolving policy mandates that require the use of cleaner fuels, biodiesel production in India is attractive for several other reasons. Petroleum diesel fuel has been sold at government-subsidized rates in India to keep the transport costs low and increase GDP. Currently, a liter of gasoline normally costs 2.5 times more than a liter of diesel fuel. Taking advantage of this cost differential, Indian car manufacturers have been investing heavily in the production of diesel vehicles. As such, there are a substantial number of vehicles on the road that demand diesel and would not require the relatively expensive retrofits needed to use CNG. According to the Program for Computational Reactive Mechanics report "Modeling Anthropogenic Emissions

from energy activities in India: Generation and Source Characterization," the ration of diesel usage to gasoline usage in India is 7:1. India's economic surge has relied heavily on the use of imported, non-renewable energy sources. As reported by Clean Cities International:

- The share of India's energy derived from oil will increase from roughly 30% now to 70% in 2010
- India imports 60% of its oil, paying foreigners $12 billion US per year
- Projected energy needs will completely consume India's known oil reserves by 2012 [7]

The final factor making biodiesel production in India attractive is the potential to cultivate cheap feedstocks. India has a climate that is conducive to growing two species of trees, JatrophaCurcas and PangomiaPinnata, that produce large quantities of non-edible oil. According to experts interviewed by the NGO Renewing India, one hectare of cultivated Jatropha can yield 5 MT of seeds from which 1.5 MT of oil and 3.5 MT of cake could be derived. The nitrogen, phosphorus, and potassium rich cake could be used as an organic fertilizer on plantation. This prolific oil-producing tree:

- has a wide environmental tolerance,
- grows in any type of soil,
- is easy to propagate through seeds or cuttings,
- requires minimal care;
- demonstrates a lower gestation period;
- is not susceptible to grazing by animals; and
- adapts well to various kinds of wastelands the government currently is trying to reclaim.

Pilot Jatropha plantation projects are underway. The adoption of large-scale biodiesel production and consumption potentially lowers India's dependence on foreign oil, helps improve air quality in major cities like Delhi, reclaims unusable wastelands, employs unemployed Indians, and keeps the country's economy on track for its planned 8% annual GDP growth over the next five years.

5. Best opportunity for market entry in India

It appears that there are several drivers in place that make biodiesel development in India attractive. As investors in a foreign country, it may be challenge to find the proper entry into this market. Preliminary research does not indicate whether or not yellow grease would be an option in India. Much of the literature and "buzz" around biodiesel centers on agricultural feedstocks. If that is the case, India's agricultural industry will likely quickly take up the challenge of growing the feedstocks.

The country already has a well established distribution system, with some major national and global players firmly entrenched. It appears that the most accessible link on the value chain may be biodiesel refining. A well-executed commitment of capital towards a refinery near Delhi, coupled with alliances with the major petroleum diesel distributors could prove help improve air quality in one of the most dirty urban areas on the planet and provide a reasonable return on the investment.[Sheehan *et al* ,1998; paxner *et al*,2002].

Conclusion

Biodiesel is a promising alternative for using in diesel engines. It is easier for delivering and storage than diesel oil, because of its higher flash point. Biodiesel represents one of the best alternatives as a renewable fuel for diesel engines from economic, energy, and environmental protection perspectives. Due to its structural nature, biodiesel is a fuel that does not contribute to the greenhouse effect. Biodiesel recycles carbon rather than pumping it from petroleum wells. As suggested by the results of this study, biodiesel may also be very cost competitive compared with the methanol and CNG alternative fuels.

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