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Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

A comprehensive literature review of bio-fuel performance in internal combustion engine and relevant costs involvement



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ARTICLE INFO

Article history:

Received 16 November 2012

Received in revised form

6 September 2013

Accepted 8 September 2013

Available online 10 October 2013

Keywords:

Diesel fuel

Bio-fuel

Ethanol

Additive

Food chain

Green house gases

ABSTRACT

Bio-fuel has come under consideration due to the effect of fossil oil crisis. Bio-fuels are acting as a renewable replacement of petroleum fuels due to some environmental and economic benefits. Bio-fuel can be produced from different kinds of raw materials. Researchers have seen that absolute utilization of bio-fuel is not appreciable as it will affect the food chain but the blend of bio-fuel with conventional fuel could precisely reduce its use and become beneficial to green house effect. It has been inferred that in the hot and cold environment bio-fuel is not fully convenient to replace fossil fuel. In the controlled environment with modified combustion equipment, biodiesel can be used as an alternate fuel. Research results reveal that bio-fuel has lower heating value in comparison to diesel fuel so it is consumed more in fuel-break mean effective power ratio and emits more NO_x in comparison to the diesel fuel. Thus there remains a compromise between GHG emission and saving of fossil fuel energy by introducing bio-fuel either totally or as a blending component of engine fuel. Finally, bio-fuel could be considered as a replenishable energy source which might pave the future pathway management and planning of energy.

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Contents

1. Introduction	30
2. History	31
3. Bio-fuel production and costs	32
3.1. Biodiesel production and costs	32
3.2. Bio-ethanol production and costs	32
4. Emissions characteristics	33
5. Engine performance	35
5.1. Engine power	35
5.2. Economic performance	35
6. Additives	36
6.1. Bio-fuel classification	36
6.2. Blend stability	36
6.3. Lubricity and viscosity of fuel	36
6.4. Materials compatibility	37

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7.	Incentives for bio-fuel production	37
7.1.	Food price evolution	38
7.2.	The freezing impact on bio-fuel production.....	39
7.3.	The elimination impacts on bio-fuel production	39
8.	Impact on environmental from bio-fuel.....	39
8.1.	Impact of engine emissions on environment and Human health	40
8.2.	Factors affecting engine emission.....	40
9.	Summary	40
	Acknowledgments.....	41
	References.....	41

1. Introduction

Oil crisis in 1970 had influenced many countries to consider alternative fuels for replacement of fossil fuel [1]. So, blend of bio-fuel with conventional fuel could precisely reduce its use and become beneficial to green house effect. In the hot and cold environment bio-fuel is not fully convenient to replace the fossil fuel. However, in the controlled environment with modified combustion equipment bio-fuel can be used as an alternate fuel. Bio-fuel having lower heating value is consumed more in comparison to diesel fuel. It also generates more NO_x emission, which has an adverse effect on the environment. Raw material source of bio-fuel limits the food growing ground, which is ultimately becoming a great concern.

Bio-based systems develop other doable ecological drawbacks. Biomass from agricultural resources is comparatively land intensive, and they are engaged with water resources pollution risk from pesticides and fertilizers, which are needed to add to the land to enhance plant growth. Many scientific studies have observed this conundrum and also have tried to investigate bio-ethanol programs in the shot to explain their sustainability in the environmental. They have also discovered bio-based fuels to provide sustainable objective for environmental transportation. Some numerous studies have shown experiments with summarized results. One study dedicated to ethanol alone which provides typically undesirable tips [2,3]; the alternative review examined the bio-fuels of many typical types have presented some favorable results for ethanol, however they are cautioned regarding many environmental impacts [4]. It has enlisted varieties of studies which searched particularly the corn-to-ethanol route in the United States. It was terribly important for its environmental sustainability [3,5–7].

However, the question of problem of sustainability is sophisticated, which encompasses environmental and human health along with societal desires. This is obvious that the attempts to obtain distinguish solutions need to widen scope to prevent changing issues from one spot to a different one [8]. Many researchers have mentioned that these systems of liquid bio-fuel production, both projected and current, may a figure out an eco-friendly system from the currently used processes [3].

Bio-fuel is actually known as a renewable energy, which is produced from alternative renewable energy materials. The most prevalent bio-fuels, like biodiesel from vegetable seeds and ethanol from wheat, corn sugar beet, are produced from food plants, which require the rich agricultural land for growth [9–11].

Currently critical issues are dealt with global food offer. Fuel vs. Food could be a problem with regards to the danger of diverting crops farmland for producing liquid bio-fuels which is detrimental to the worldwide food supply. There are differences concerning how important this could be and what the impact is, what it inflicting and what will be done concerning it. Recently, the increase in world oil costs generated a pointy improvement in

the global bio-fuels production. Some products like sugar-cane, vegetable oil and corn are going to be used either as feed, food, or even create bio-fuels. Seed oils can be sustainable along with all of unlimited chances to obtain energy having fuel energy content near to the diesel fuel. In addition, intensive usage of vegetable oils could potentially result in different important issues like food shortage in developing countries. Agricultural education and forestry are fashionable technology which leads the handling of global food supply issues [9,12,13].

Energy costs influence clients decision and behavior and might have influenced on economic development. The relevant taxes of energy cost need to be definitely recognized from prices, contract markets, spot markets and averaged prices from sample prices. Biomass fuel includes the main exploited global renewable energy. High capability, Low priced methods for the process of biomass into liquid bio-fuels conversion are crucial for minimizing reliance on petroleum sources, increasing the employment of neutralizing carbon techniques, and improving rural profits [14,15]. Grain-based vegetable-oil and ethanol are mostly dependant on biodiesel and used recently with an agony from the competition while using food grains [9].

The goal is always to supply cheap biomass to a stream which is accustomed to selection of chemicals, fuels and alternative materials which might be cost competitive to the regular products. The definition of liquid bio-fuel is noted as biomass-to-liquid fuel. BTLF can supply completely different renewable sources to petroleum; on the other hand it still incorporates a low quantity of petroleum in the blend. The main distinction between petroleum and bio-fuels feedstocks is content of oxygen [16,17].

Two global liquid transportations of bio-fuels can be replaced by diesel and gasoline fuel; these include biodiesel and bio-ethanol, correspondingly. The biodiesel can be used as a replacement for petroleum diesel whereas bio-ethanol is utilized as a replacement of gasoline [18–20].

Biodiesel means any kind of equivalence between diesel and bio-fuel typically derived from animal fats or seed oils. Specifically, it can be employed as fuel of some engines, or mixed with petroleum in diesel engines with no or a few modifications. Biodiesel has developed into a wide range of engagement for the environmental advantages [21,22]. The biodiesel expense is usually the main obstacle for commercial trade. Cooking oils are used as a staple, the possibility of a nonstop transesterification method and the best glycerol quality recovery as a production of primary choices of biodiesel are considered for the price reduction of biodiesel [9,11,23,24].

The thermochemical conversion techniques of biomass are endothermic in nature and the heat dissipated is similar to different renewable energy sources like solar energy. The fuel made ideally represents the whole of energy kept during the entire photosynthesis and also the direct thermal assortment [9,25]. However, if additional energy is provided from other renewable resources like wind and solar, then the additional biomass carbon could be changed to the

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