EXPERIMENTAL INVESTIGATION OF CI ENGINE FUELED WITH DIESEL AND KEROSENE BLEND WITH COTTON SEED OIL- A REVIEW

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ABSTRACT

The fuel prizes are increasing gradually all over the world for this purpose we have started use of biodiesel which increases the availability of alternate fuel. Production of Biodiesel from various vegetable oils by the process of transesterification is found to be effective method of reducing viscosity and eliminating operational and durability problems, but the cost for production of these biodiesel is nearly equal to the price of Diesel. To overcome these we can use neat cottonseed oil blend with Diesel and kerosene. The experiment is to be conduct when the Engine is fuelled with Diesel and Kerosene and neat cotton seed oil in various proportions like 5%, 10%, 20% and 30% by its volume and allow it to blend to occur various emission characteristics of Diesel Engine at different load conditions.

Keyword: - *Blending, Cotton seed oil, Diesel engine, Optimization, Performance.*

1. INTRODUCTION

The limited Petroleum resources and increasing fuel cost have caused interests in the development of alternative fuels for I.C. Engines Vegetable oil is considered as an alternative because it has several advantages like; it is renewable, environment friendly and produced easily in rural areas. Therefore, during recent years a systematic approach has been made by several researchers to use vegetable oils as a fuel in IC engines. Primarily the Cotton seed is used to make Cottonseed oil, it contains high levels of saturated fat, and tends to have high levels of pesticide residue as well, and hence it is not healthy for human consumption. The benefits of cottonseed oil are mainly viewable from a manufacturing standpoint. It has an incredibly long shelf life and also a very high smoke point (450 degrees). Cottonseeds have little use outside of producing cottonseed oil. The cost of cottonseed oil is increases due to transesterification which will not helpful for cost controlling. To overcome these we can use Blends of Diesel and Kerosene with neat Cotton seed oil are mixed by volumetric percentages of 5, 10, 30, 50 and 60% which will reduce the cost of alternate fuel. Cotton seed oil fuel is preheated at different preheating temperatures of 50, 70, 80 and 90°C and burned in a diesel engine to study engine performance and emission. These tests were performed on a four stroke, single cylinder, water cooled diesel engine at different loads and rated speeds of 1500 rpm. This research reveals that there is an increase in specific fuel consumption, exhaust temperature and air-fuel ratio in Diesel, Kerosene and preheated Cotton seed oil blends (B5, B20, B40, B70 and B100) than diesel fuel.

2. MATERIALS AND METHODS

Cotton seed oil is available at local vendor in all over India. All materials and reagents used were analytical grade (AnalaR) chemicals except otherwise stated. Glassware, containers and other tools are initially washed with liquid detergent, rinsed with 20% (v/v) nitric acid and finally rinsed with distilled water.

3. LITERATURE REVIEW

Author has proposed blending of diesel and cotton seed oil with other vegetable oils which increases availability of alternate fuel for CI engine.

3.1 Md. Nurun Nabi, Md. Mustafizur Rahman, Md. Shamim Akhter(2009): The study is about the production of biodiesel from nonedible Cottonseed by transesterification process. A maximum of 77% BD production was found at 20% methanol and 0.5% NaOH at 550 C reaction temperatures. where various parameters for the optimization of biodiesel production were investigated and performance study of diesel engine with diesel fuel and biodiesel mixtures were carried out in which thermal efficiency with biodiesel mixtures was slightly lower than that of neat diesel fuel due to lower heating value of the mixtures [1].

3.2 Hasan Bayindir(2007): The blends of cotton oil with kerosene at various rates are studied. Four stroke single cylinder and air cooled diesel engine is used for performance using different blended cotton oil-kerosene (COK) for engine power, torque, brake specific fuel consumption and brake specific energy consumption. By using COK fuel for so long in unmodified diesel engine can partly cause injection system faults and carbon soot problems. It is also found that there is no problem faced at the time of starting of engine and, it can be used in diesel engine in cold climate also due to lower freezing point of the COK25 (-28oC) [2].

3.3 Tizane Daho, Gilles Vaitilingom, Salifou K. Ouiminga, Bruno Piriou, Augustin S. Zongo Samuel Ouoba, Jean Koulidiati (2013): Study about Combustion of cottonseed oil and its blends with diesel fuel in a direct injection diesel engine is done. Performance is observed by analyzing fuel droplet size distribution and determining engine specific fuel consumption and thermal efficiency, combustion parameters and emissions. By increasing percentage of cottonseed oil in blends it is observed that specific fuel consumption and CO emissions increase and NOx emissions decrease. It is also found that the cylinder pressures are very close and rates of heat release are slightly different for cottonseed oil and diesel fuel [3].

3.4 C.V. Subba Reddy, C. Eswara Reddy & K. Hemachandra Reddy(2012): It is found that the combustion efficiency in the combustion chamber depends on the formation of homogeneous mixture of fuel with air. The formation of homogenous mixture depends on the amount of turbulence created in the combustion chamber. It is concluded that out of five different diesel engine configurations, the base line engine with TGP-2 configuration proved to be better in all respects. At 200 bar with 20% COME (20BD), better efficiency and low emissions are obtained. The clearance volume in the combustion chamber increases and the compression ratio decreases further slightly by making grooves on the piston crown [4].

3.5 R. SenthilKumar, R.Ramadurai(2013): The properties like calorific value, physical and chemical properties etc. are found lower in biodiesel made from cottonseed, pongamia, mustard, sea lemon Straight vegetable oils so, they started process of transesterification and mainly preheating is found to be effective method of reducing viscosity and eliminating operational and durability problems. The test is conducted on single cylinder DI engine at constant speed of 1500 rpm which gives increasing efficiency than other biodiesel and decrease in emission [5].

3.6 Mr. Y. Alhassan, N. Kumar, I.M. Bugaje, H.S. Pali, P. Kathkar(2014): The new technology to improve transesterification process started called Solvent Technology. Co-solvent Diethyl Ether (DEE), Dichlorobenzene (CBN) or Acetone (ACT) mixed with cotton seed oil transesterification process and catalyst Potassium hydroxide (KOH) used. The reaction conditions optimized include; the molar ratio of co-solvent in methanol, reaction temperature and time. The catalyst concentration was also optimized. The optimization was based on the percentage yields of Fatty Acids Methyl Esters (FAMEs) produced. The addition of co-solvents CBN and ACT in methanol was improves the properties like viscosity, calorific value [6].

3.7 Dr V. Naga Prasad Naidu, Prof. V. Pandu Rangadu(2014): The study on Evaluation of performance and emission characteristics of a single cylinder four stroke diesel engine with different blends (B05, B10, B15, B20 and B25 in comparison to diesel) of cotton seed biodiesel and Diesel. The performance is compared with diesel fuel, on

the basis of brake specific fuel consumption, brake thermal efficiency, exhaust gas temperature and emissions of hydrocarbons and oxides of nitrogen. Blend B20 gives closer performance to diesel and hydrocarbon emissions are less than diesel according to experimental investigation [7].

3.8 Tejrao Ghormade, Kiran Thekedar(2014): The study is about main alternative fuel of significance in the present and near future may be bio fuels or bio diesel. Bio-diesel is an efficient, clean 100% natural energy alternative to petroleum fuels. It is a renewable substitute or blending stock, currently being commercialized in United States and Europe. Bio-diesel operates in C.I. engines similar to diesel fuels. It can be burnt in any standard unmodified diesel engine blended with 25% to 100% bio-diesel with diesel. Cottonseed oil can be converted into bio-diesel fuel as ethyl fuel as ethyl ester by transesterification. Cottonseed oil methyl ester was prepared which showed density, calorific value, flash point, and pour point close to that of diesel oil. The blends of varying proportions of this bio-diesels and diesel were used to run a single cylinder compression ignition engine and significant improvement in brake thermal efficiency [8].

3.9 Palash M. Mendhe, Mirza Munawwar Baig and Chetan D. Madane(2015): The viscosity of cottonseed oil for the C.I. engine was decreased by blending with diesel. Significant improvement in engine performance was observed compared to neat cottonseed oil as a fuel. The brake thermal efficiency, specific fuel consumption, volumetric efficiency, peak cylinder pressure, smoke, CO, HC, NO and the exhaust gas temperatures were analyzed. The test showed increase in thermal efficiency, volumetric efficiency as the amount of diesel in the blend increased and the exhaust gas temperature with the blends decreased. The smoke, CO and HC emissions of the engine ware also less with the blends. 20–40% of cottonseed oil gives better result without any modification [9].

3.10 S. Naga Sarada, M.Shailaja, A.V. Sita Rama Raju1, K. Kalyani Radha(2010): The study is about effect of higher viscosity of vegetable oil on CI engine. And by using problem of higher viscosity of vegetable oils can be overcome to a greater extent by various techniques, such as heating of fuel lines, trans-esterification, modification of injection system, etc. In the present investigation, short term tests were conducted with the use of untreated cotton seed oil in a single cylinder, four stroke, and direct injection diesel engine. Tests were conducted with cotton seed oil and diesel. To improve the combustion characteristics of cotton seed oil in an unmodified engine, effect of increase in injection pressure was studied [10].

3.11 D. Srikanth, M. V. S. Murali Krishna, P. Ushasri & P. V. Krishna Murthy(2013): Low heat rejection (LHR) diesel engine with ceramic coated cylinder head of cotton seed oil in crude form (CSO) and biodiesel form (BD) with varied injector opening pressure. Performance parameters of brake thermal efficiency, exhaust gas temperature, coolant load, sound levels and volumetric efficiency were determined at various values of brake mean effective pressure (BMEP) of the engine. Conventional engine (CE) showed compatible performance, while LHR engine showed improved performance with biodiesel operation at recommended injection timing and pressure [11].

3.12 M. Harinathareddy, Dr. P. Nageswara Reddy, Dr. K. Vijayakumar Reddy(2013): A Single Cylinder, 4-stroke vertical, water-cooled, self-governed diesel engine developing 5 HP at 1500 rpm is used for the performance analysis in terms of brake thermal efficiency and indicated thermal efficiency for conventional diesel, cottonseed oil, as well as for Jatropha oil. The comparison between blends diesel fuel and Jatropha oil diesel and cottonseed oil showed that the brake thermal efficiency and indicated thermal efficiency of CSO biodiesel was slightly higher than that of diesel fuel and Jatropha oil. Use of cottonseed oil improves the efficiencies of Diesel engine [12].

3.13 K. Srithar and K. Arun Balasubramanian(2014): The physical–chemical properties like calorific value, kinematic viscosity, specific gravity, volatility characteristics, cetane number, surface tension and corrosiveness of the blends were measured using the International Standard methods of pongamia pinnata biodiesel, jatropha biodiesel and the combination of diesel-pongamia pinnata – jatropha belnd with diesel fuel are determined depending upon the requirement of blend and performance and emission analysis of the mixed fuels of pongamia pinnata biodiesel, jatropha biodiesel and diesel fuel (DPJ) have been done. It is seen that dual biodiesel blends decreases calorific value and increases viscosity which emits less HC and CO [13].

3.14 Md. Abdul Wakil, Z.U. Ahmed, Md. Hasibur Rahman, Md. Arifuzzaman(2012): Properties of Cottonseed oil, Mosna oil and Sesame oil oils are studied and compared with conventional diesel fuel. The process of trans-esterification is used for the production of biodiesel. The base catalyst like methanol is used mildly. Proper amount of biodiesel is produced from Cottonseed oil at 3:1M ratio of methanol and oil. Biodiesel from cottonseed oil has

various fuel properties which are similar to diesel. The significant change of fuel properties of these oils is observed. The cost of the biodiesel production is also studied [14].

3.15 Mr. S. V. Channapattana, Dr. R. R. Kulkarni(2009): Now day's vegetable oils have become beneficial because of their environmental benefits and it is made from renewable resources. Bio-diesel commands crucial advantages such as technical feasibility of blending in any ratio with petroleum diesel fuel, use of existing storage facility and infrastructure, superiority from the environment and emission reduction angle, its capacity to provide energy security to remote and rural areas and employment generation. There are more than 350 oil bearing crops identified, among which only sun flower, sunflower, soybean, cottonseed, rapeseed, Jatropha curcas and peanut oils are considered as potential alternative fuels for Diesel engines [15].

3.16 Dhruva D., Dr. M. C. Math (2014): The blends of crude rice bran oil methyl ester((RBOME) with conventional diesel oil in the proportions of 20:80(B20), 40:60(B40), 60:40(B60), 80:20(B80) and 100:0(B100) resp. Fuel properties rice bran oil methyl ester like viscosity, gross calorific value, flash and fire points compared with Diesel fuel for compression ignition fuel. The characteristics fuel properties of RBOME blends found to be varies much as compared with other biodiesel but blend of B20 found much close with diesel fuel. In addition kerosene is added with blend to meet the properties with higher amount of addition of blend [16].

3.17 Gaurav Dwivedi, Siddharth Jain, M.P. Sharma (2013): Performances and emissions of diesel engine using biodiesel are studied in recent 15 years. The process of transesterification is used for the production of biodiesel from vegetable oils or animal fats, is composed of saturated and unsaturated long-chain fatty acid alkyl esters which is used recently as an alternative fuel. Comparison between these biodiesel and conventional diesel using different feedstock is doen and reduction is observed in PM, HC and CO emissions with minimum power loss. But there is increase in fuel consumption and the increase in NOx emission by using biodiesel. The advance in injection and combustion of biodiesel also favour the lower THC emissions [17].

3.18 Leenus Jesu Martin, Edwin Geo , Prithviraj. D(2011): A single cylinder C.I. engine is used for performance using blends of varying proportions of cottonseed oil and diesel. Significant improvement in engine performance was observed compared to neat cottonseed oil as a fuel. The brake thermal efficiency, specific fuel consumption, volumetric efficiency, peak cylinder pressure, smoke, CO, HC, NO and the exhaust gas temperatures studied. The study shows that increase in the brake thermal efficiencies of the engine as the amount of diesel in the blend increased. There is increase in volumetric efficiency of the engine and decrease the exhaust gas temperature with the blends compared with that of neat cottonseed oil. It is found that smoke, CO and HC emissions of the engine ware also less with the blends. 20–40% of cottonseed oil blend with diesel gives maximum result without any modification [18].

3.19 A. Tandon, A. Kumar, P. Mondal, P. Vijay, U. D. Bhangale and Dinesh Tyagi(2011): There is a need for suitable alternative fuels for use in engines is to be fulfilled by using different biodiesel which creating tribology related new challenges world over and causes green house gas emissions and global warming worldwide. The study about lubricity of blends, carbon deposit, viscosity, corrosion of engine components, etc done for tribology related issue. Global harmonized standards are also discussed. Various solutions for alcohol fuel related engine problems due to the use of SVO in engine are discussed and engine performance decrease, injector choking, oil ring sticking, etc studied [19].

3.20 Prem Kumar, M.P. Sharma, Gaurav Dwivedi(2014): The demand of diesel for transportation, captive power generation and agricultural sector is increasing therefore the use of substitute like biodiesel is used. The use of 10% blending gives the maximum power output from performance of diesel engine under full load condition. The discussion is about combustion, performance, and emission characteristics of biodiesel and its different blends with diesel. Mainly performance of diesel engine for brake power, torque, brake specific fuel consumption (BSFC), thermal efficiency (BTE) and exhaust emissions is studied [20].

3.21 Narendranathan. S. K, K. Sudhagar(2014): For the fulfillment of fuel for diesel engines, Biodiesel is used which is derived from the transesterification of vegetable oils or animal fats. Biodiesel is used in the convention diesel engine for the better performance and emission. Study is done for reduction in Particulate Matter, Hydrocarbon and Carbon monoxide emissions. And also imperceptible power loss, the increase in fuel consumption

and the increase in NOx emission on conventional diesel engine with no or fewer modification is studied. Different properties of biodiesel like density, viscosity and bulk modulus are also studied [21].

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4. CONCLUSIONS

Thus we have studied various blending of Diesel with cottonseed oil and other vegetable oil Therefore the proposed project is to reduce the cost of alternative fuel by using blends of diesel and kerosene with cotton seed oil.

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