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Performance Analysis of Biodiesel Blends of Surahonne and Dairy Scum Waste on I.C Engine

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Abstract – Every human starts their life with consuming energy for his particular purpose to attain the respective task but in that, generally present situation is very tough to handle consuming of energized petroleum fuel for man usage because of rapid depleting of fossil fuel source, increasing population density and formation of petroleum fuel source will take more than thousands of year. So that man has focused on finding alternative fuel for petroleum fuel (pure diesel) from the other sources such as natural gas, waste vegetables oils, animal fat oil ect. Particularly alternative fuel extracted from natural resources commonly known as 'biodiesel' like pongamiya penatta, jatropha, neem, simaroubha, surahonne, waste cooking oil, dairy waste scum oil ect. In this study, the experimental were conducted to investigate and characterization of biodiesel blends of surahohonne (SHB) and diary scum biodiesel (DSB) and their effect on performance of single cylinder four stroke cycle diesel engines by preparing the blends to volume ratio such as SHB20, SHB40, DSB20, DSB40, equally volume of both surahonne and dairy scum biodiesel was blended to a proportion as SDB20 and SDB40. It is evident that B40 surahonne (SHB) has the higher mechanical efficiency, higher brake thermal efficiency and minimum brake specific fuel consumption as compared to B20 surahonne, B20 and B40 dairy scum biodiesel.

Index Terms – Biodiesel, B20, B40, fuel, blend ratios. Surahonne (SH), diary scum (DS).

1. INTRODUCTION

Biodiesel is methyl or ethyl ester of fatty acid made from virgin or used vegetable oils (both edible & non-edible) and animal fats. The main commodity sources for biodiesel in India can be non-edible oils obtained from plant species such as Jatropha Curcas (Ratanjyot), PongamiaPinnata (Karanj), and Calophyllum inophyllum (Nagchampa), Hevcabrasiliens is (Rubber) etc. Biodiesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend or can be used in its pure form. Just like petroleum diesel, biodiesel operates in compression ignition (diesel) engine which essentially require very little or no engine modifications because biodiesel has properties similar to petroleum diesel fuels. It can be stored just like the petroleum diesel fuel and hence does not require separate infrastructure. The use of biodiesel in conventional diesel engines results in substantial reduction of unburned hydrocarbons, carbon monoxide and particulate matters. Biodiesel is considered clean fuel since it has almost no sulphur, no aromatics and has about 10% built-in oxygen, which helps it to burn fully. Its higher cetane number improves the ignition quality even when blended with petroleum diesel.

1.1 Surahonne

Figure 1 Typical Surahonne Seeds.

Surahonne seed is an alternative resource for producing biodiesel which yields oil 35% to 48% and having fat ranges from 62 to 64%. Generally the development of Calophyllum inophyllum linn occurs in strands or low elevation area with the average annual temperature of 18 to 33°C and annual rain fall of 1000 to 500mm. It also developed in beach and coastal forests on east and west costal of India. It can be used for producing medicinal, Pharmacological purpose and now it is evident that the use of surahonne oil in diesel fuelled vehicle is beneficial for environmental and economic aspects.

1.2 Dairy Scum

Dairy waste scum is one of the promising alternative sources for the production of biodiesel and it can be able to obtain in all the season of the year. Annual production of milk in India is around 146.3 million tons in the year of 2014-2015. Thousands of large dairies are engaged in refining this milk across the country. Raw chilled milk of cows and buffalos are conveyed to market as refinery milk and by products of milk

such as Butter, Cream, Ghee, Peda, Panner, Cheese, Yoghurt, Ice cream and other products. Large dairies are having number of equipments for processing, handling, storage, packing and transportation of milk and milk products. Enormous quantities of water are used for housekeeping, sterilizing and washing equipment's, during this process residual butter and related fat which are washed and get collected in effluent treatment plant as a scum as shown in the above figure.

Figure 2 Dairy waste scum collection

Scum is a less dense floating solid mass usually formed by a mixture fat, lipids, proteins, packing materials and other impurities. A large dairy, processes 5 lakhs liters of milk per day, will produce approximately 200–360 kg of effluent scum per day, which makes it difficult to dispose. Most of the dairies dispose this scum in solid waste disposal site or by incinerating. By doing so, it is economically wasteful and generates pollutants. Further, scum causes direct as well as indirect operational difficulties for effluent treatment. By using this waste dairy scum for biodiesel production economically balance the profit for milk dairies indirectly.

2. OBJECTIVES OF WORK

In this study, engine performance parameters like mass of fuel consumption, brake specific fuel consumption, mechanical efficiency brake thermal efficiency and engine exhaust gas temperature were evaluated for both surahonne and dairy scum biodiesel blends together with an injection pressure of 200 bars.

3. EXPERIMENTAL SETUP AND OBSERVATION

3.1 Single cylinder four stroke cycle diesel Engine

The experiment were conducted on four stroke cycle diesel engine to evaluate the performance of an engine at an injection pressure of 200 bar and sample were made by using measuring 1000ml jar for surahonne and dairy scum biodiesel. During Conducting the experiment the engine was running at constant rated speed of 1500 rpm and then blended biodiesel was feed and take the reading in the respective meters to evaluate engine performance parameters. Figure 3.1.1 shows the testing ring experimental setup.

Figure 3 Single cylinder 4 stroke diesel Engine

Properties	Unit	Pure diesel	B20 SHB	B40 SHB	B20 DSB	B40 DSB	B20 equal proportion of SHB and DSB	B40 equal proportion of SHB and DSB
Specific gravity @ 28ºc	Kg/m3	0.82	0.84	0.85	0.85	0.854	0.848	0.856
Kinematic viscosity @ 40ºc	Cst	44	3.20	3.9	2.56	3.21	2.92	3.558
Flash point	ºC	54	76	98	58	68	66	85
Fire point	ºC	2.54	88	111	65	78	77.5	93.5
Calorific value	kJ/kg	43500	40440	38880	42500	38970	41475	38922

2.1 Properties of pure diesel, Blends of surahonne and dairy scum bio-diesel

4. RESULTS AND DISCUSSION

Figure 4.1 shows graph of Fuel Consumption v/s BP for different injection pressures of B20 equal proportions blending of surahonne and dairy scum biodiesel with pure diesel as a fuel in engine. From the Figure it is clear that, at all injection pressuresboth brake power and mass of fuel consumed goes on increasing as the load increases on the and may varied

marginally expect engine running at zero load. Here, in the above graph, both 250 and 250 bar injection pressure have higher fuel consumption rate with increasing brake power as the load applied on engine equal from 0 to 10 kg.

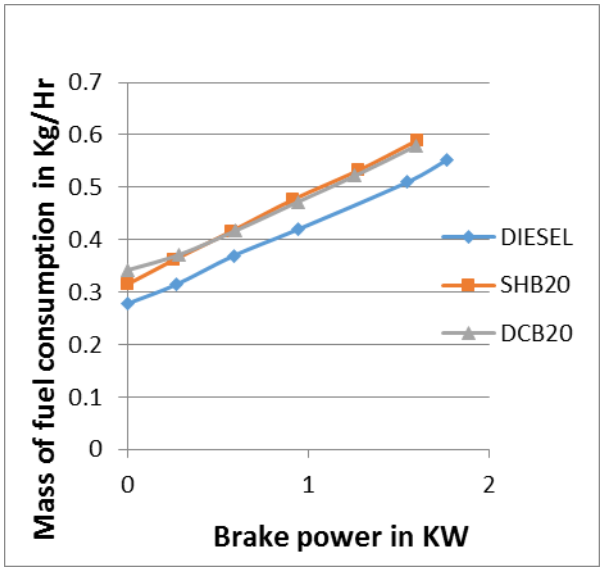

Figure 4.1: MFC v/s Brake power

Fig 4.2 shows the graph of Brake thermal Efficiency v/s BP for different injection pressure ofB20 equal proportion blendingofsurahonne and dairy scum biodiesel with pure diesel as a fuel. From the graph, it is clear that both brake thermal efficiency and brake power goes on increasing with increasing the load on the engine for eachinjection pressure and even though at all the injection pressure the increasing of brake thermal efficiency with brake power may varied marginally at all the corresponding loads.

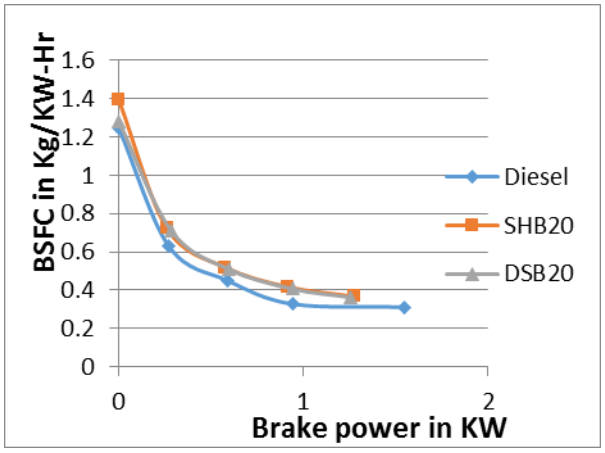

Figure 4.2: BSFC v/s Brake power

Figure 4.3 shows Mechanical Efficiency v/s BP of diesel engine for different injection pressure of B20 equal proportions of both surahonne and dairy scum biodiesel. From the Figure, it is clear that the at each injection pressure both the brake power and Mechanical efficiency increases continuously as the loadincreases on the enginemay varies from 0 to 10 kg. But as the injection pressure increases both mechanical efficiency and brake power goes on decreasing as the load increases gradually on the engine.

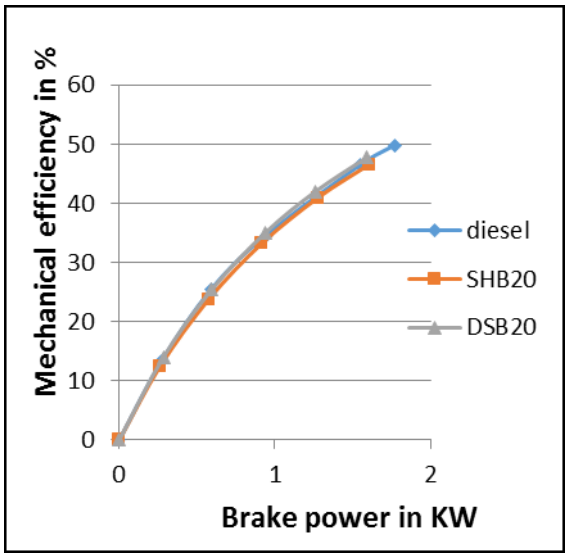

Figure 4.3: Mechanical efficiency v/s Brake power

Fig 4.4 shows graph of Brake thermal Efficiency v/s BP of the engine for different injection pressures of B40 equal proportion blending of surahonne and dairy scum biodiesel with pure diesel as a fuel. From the figure, it is clear that, at all the injection pressure both brake thermal efficiency and brake power of the engine goes on increasing as the load applied on the engine and even though from the above graph, 200 and 250 bar injection pressure marginally shows the higher value than that of 300 bar injection pressure at all the corresponding load.

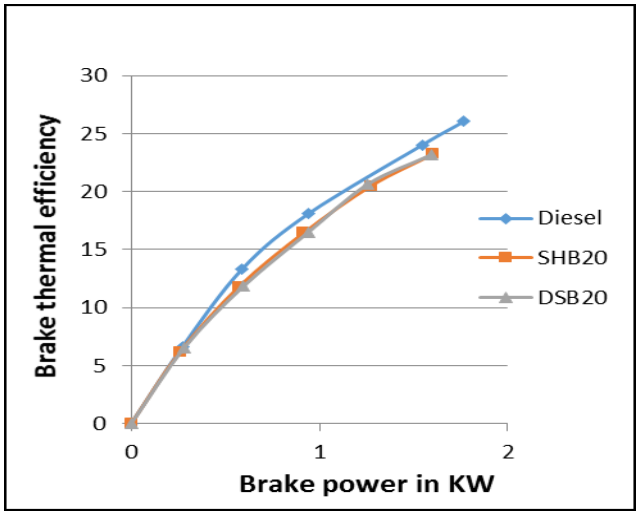

Figure 4.4: Brake thermal efficiency v/s Brake power

Figure 4.5 shows graph of Fuel Consumption v/s BP for different injection pressures of B20 equal proportions blending of surahonne and dairy scum biodiesel with pure diesel as a fuel in engine. From the Figure it is clear that, at all injection pressuresboth brake power and mass of fuel consumed goes on increasing as the load increases on the and may varied marginally expect engine running at zero load. Here, in the above graph, both 250 and 250 bar injection pressure have higher fuel consumption rate with increasing brake power as the load applied on engine equal from 0 to 10 kg.

Mass of fuel consumption (MFC):

From the above graphs 4.1, it is evident that SHB40 shows the minimum fuel consumption than SHB20, DSB20 and DSB40 blends of both surahonne (SHB) and dairy scum biodiesel(DSB) and it can be increases with small variaton than that of diesel fuel.

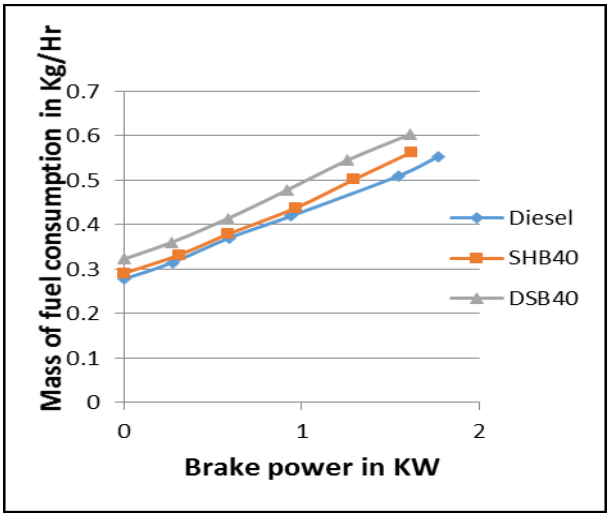

Fig 4.5: Fuel consumption v/s Brake power

Brake specific fuel consumption (BSFC):

From the above graphs 4.2, it was conclude that the brake specific fuel consumptioan of B40 surahonne biodiesel should have better performance than the other blends of both surahonne and dairy scum biodiesel and as compare to diesel fuel brake specific fuel consumption of B40 surahonne biodiesel is increased about 10.087% due to lower calorific value of biodiesel fuel.

Mechanical thermal efficiency (η_m):

From the above graphs 4.3, it was concluded that the mechanical efficiency of B40 surahonne biodiesel(SHB40) shows the higher mechanical than that of diesel and other biodiesel blends. It is increased only because of reducing the engine internal friction thereby working fluid acts like lubricating agent and smooth engine operation.

Brake thermal efficiency (η_{BTH}):

From the above graphs 4.4, it is clear that the B40 surahonne biodiesel having better performance than the other blends and which related to brake thermal efficiency. As concerned to the above graphs, B40 surahonne biodiesel having higher brake thermal efficiency than diesel fuel.

Exhaust gas temperature:

From the above graphs 4.6, it is clear that the exhaust gas temperature of all the blends of surahonne biodiesel having increased as the brake power increased during running the engine. Though surahonne biodiesel exhaust gas temperature was higher than that of dairy scum biodiesel and pure diesel fuel.

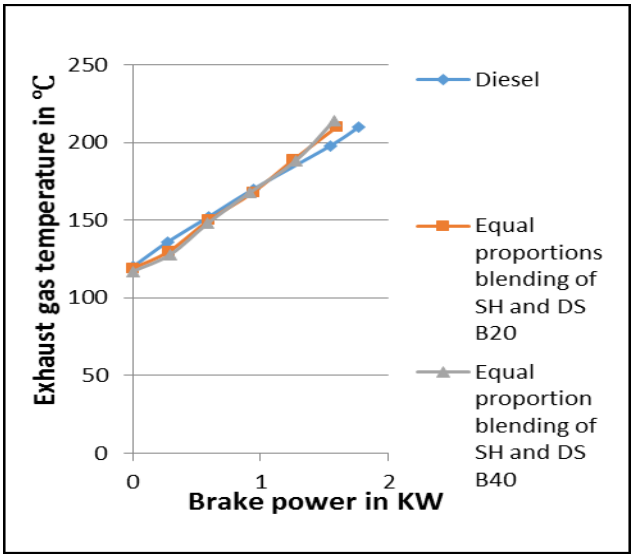

Figure 4.6:Exhaust gas temperature v/s Brake Power

5. CONCLUSION

In this work, oil was extracted from surahonni seeds and diry scam waste. By the process of transesterification with the catalyst of NaOH and methanol oils are converted into biodiesel. Fuel parameters like fire point, flash point, viscosity, density and calorific values are anlysed. Performance test on single cylinder , water cooled, 4four storke diesel engine was conducted with pure diesel , B20, B40 of surahonni and dairy scam waste biodiesel and also mixture of both and it is concluded that the B40 surahonne biodiesel shows the better performance than B20 surahonne, blends of dairy scum biodiesel and equal proportions blends of both the fuel.

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REFERENCES

[1] Ravi S. D, S.R Hotti, Dr. O.D Hebbal " Performance, *Combustion and Emission Characteristics on Single Cylinder Diesel Engine using Calophyllum Inophyllum (Surahonne) Oil "*International Journal of Engineering Research & Technology (IJERT), Vol. 3 Issue 9, September- 2014.

[2] Muralidharan N G, Ranjitha J "*Microwave assisted biodiesel production from dairy waste scum oil using alkali catalysts"* International Journal of Chem Tech Research CODEN (USA): IJCRGGISSN: 0974-4290 Vol.8, No.8, PP: 167-174, 2015.

[3] Mr. Santosh Bhuimbar, Dr. S. Kumarappa *"Engine Performance and Emission Characteristics of a Single Cylinder Four Stroke CI Engine in Dual Fuel Mode using Diesel, Karavera (ThevetiaPeruviana) Biodiesel and Surahonne (CalophyllumInophyllum) Biodiesel with CNG"* International Journal for Research in Applied Science & Engineering Technology (IJRASET).

[4] S. S. Saddu, Dr S. B. Kivade *"The Status of Biodiesel as an Alternative fuels Amoora, Surahonne and other oils used for Diesel Engine - An Overview"* International Journal of Science and Research (IJSR)ISSN (Online): 2319-7064Impact Factor (2012).

[5] Benson Varghese Babu, R Suresh & K V Yathish *"Effects of Diary Scum Oil Methyl Ester on a DI Diesel Engine Performance and Emission"* International Journal on Theoretical and Applied Research in Mechanical Engineering (IJTARME) ISSN (Print): 2319-3182, Volume-1, Issue-1, 2012.

[6] Ravichandra V Koti1, Dr. S B Prakash, Kiran K, Ravikumar T "*An investigation on the Performance and Emission characteristics of a Direct Injection Diesel engine using Safflower oil and Milk Scum oil as a Biodiesel*" International Refereed Journal of Engineering and Science (IRJES)-ISSN (Online) 2319-183X, (Print) 2319-182 Volume 3, Issue 4(April 2014).

[7] Sushma. S, Dr. R. Suresh , Yathish K V "*Production Of Biodiesel From Hybrid Oil (Dairy Waste Scum And Karanja) And Characterization And Study Of Its Performance On Diesel Engine"* International Journal Of Engineering Research & Technology (IJERT) ISSN: 2278-0181, Vol. 3 Issue 7, July – 2014.