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Experimental Investigation of Caster OilMethyl Ester on Diesel Engine

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Abstract**—** In this research work we mainly focus on the performance & emission characteristics of biodiesel obtained by blending of Caster oil with conventional diesel. The caster oil is extracted from caster seed by esterification and trans-esterification process. The extracted caster oils are blended with diesel by various percentages as B5, B10, B15, B20, B25 and B30. These biodiesels are tested on Single cylinder four stroke diesel engine with load conditions as 0, 9 kg, 18kg and 27 kg. The results indicates that the in various load conditions, the brake thermal efficiency and volumetric efficiency found to be higher than that of diesel and brake specific fuel consummation, CO and NOx emission found to be less than that of the diesel.

Keywords— biodiesel, caster oil, diesel engine, methyl ester, trans-esterification.

INTRODUCTION

Biodiesel refers to a vegetable oil- or animal fat-based diesel fuel consisting of long-chain alkyl (methyl, ethyl, or propyl) esters. Biodiesel is typically made by chemically reacting lipids (e.g., vegetable oil, soybean oil, animal fat (tallow) with an alcohol producing fatty acid esters. Biodiesel is meant to be used in standard diesel engines and is thus distinct from the vegetable and waste oils used to fuel converted diesel engines. Biodiesel can be used alone, or blended with petrol diesel in any proportions. Biodiesel blends can also be used as heating oil.

Biodiesel is oil from vegetables and animal fats, in its pure form, it can be burned by specifically designed engines. It can be combined with petroleum to be used in currently exiting engines. The government would need to supply the funds needed for manufacturing of the new designed engines. The infrastructure needed is labs for the combustion of biodiesel with petroleum, as well as factories for the manufacturing of design engines needed to convert pure biodiesel into energy. The caster oil is extracted from caster seed by esterification and trans-esterification process.

PROBLEM STATEMENT

We had gone through literature survey, and we found that there is less alternative fuels for CI Engine than that of petroleum products like petrol, diesel, kerosene etc. There is huge and tremendous use of biodiesel product such as caster, Jatropha, Karanja, Coffee, Ground nuts, Fish oil, Algae, Sunflower etc. So, after studying all the things we found our problem definition from biofuel domain. So, we have a problem statement as "Experimental investigation of caster oil methyl ester on diesel engine." In this project we will majorly focus on manufacturing and production of Biofuels from various sources available and testing of these biofuels in CI Engine.

OVERALL PROCESS OF BIODIESEL PRODUCTION AND BLENDING

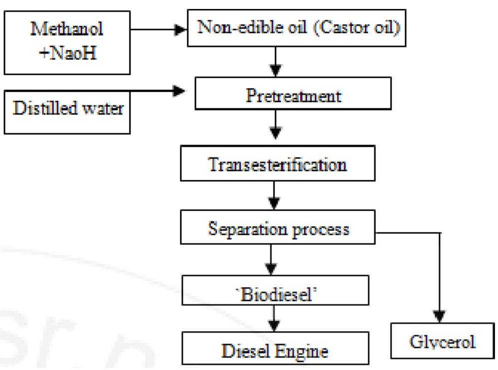

Fig .1 Flow Chart of Biodiesel preparation

RESULT AND DISCUSSION

I.RESULTS

Table 1 Load Vs. Break Thermal Efficiency

Sr. No	Load	B00	B05	B10	B15	B20	B25	B30
1	0	-	-	-	-	-	-	-
2	9	28.31	28.88	28.00	31.91	27.41	31.52	29.34
3	18	33.14	34.40	34.54	35.97	34.42	34.96	33.60
4	27	33.08	36.51	36.56	38.76	36.8	44.68	34.51

Table 2 Load Vs. Break Specific Fuel Consumption (G/Kw.Hr)

Sr. No	Load	B00	B05	B10	B15	B20	B25	B30
1	0	-	-	-	-	-	-	-
2	9	299.0	299.0	309.5	268.0	313.0	273.3	292.6
3	18	248.36	246.8	246.8	237.0	249.0	246.4	255.0
4	27	232.75	232.0	233.2	220.6	233.0	192.8	251.0

Table 3 Load Vs. Volumetric Efficiency (%)

Sr. No	Load	B00	B05	B10	B15	B20	B25	B30
1	0	77.66	77.67	77.66	77.67	77.48	77.67	77.67
2	9	77.48	77.27	77.77	77.48	77.36	77.27	77.15
3	18	77.8	77.91	81.54	78.40	77.87	78.79	78.67
4	27	77.90	78.86	79.07	79.06	78.39	78.68	78.62

II. DISCUSSION

Engine Performance:

It is widely accepted that the use of biodiesel blends does not significantly affect the engine thermal efficiency with relation to mineral diesel. There results indicate that castor biodiesel B15 fuel blends also followed this tendency, in spite of their inferior spray related properties .In fact, the only consistent trend within the ηt data is a slight efficiency gain or both castor and biodiesel blends at high load condition, whereas in low and medium loads the ηt deviations between the tested fuels are within the uncertainty margins.

CO Emission:

The results obtained here are at an intermediary position with relation to the scarce literature currently available for castor oil biodiesel. Considering biodiesel blends up to B20,found higher HC and CO emissions by castor and mineral diesel. On the other hand, blending castor biodiesel into diesel fuel continuously decreased the CO emissions, what was justified by increased fuel oxygen content.

NO_x Emission:

Higher NOx levels were observed to the biodiesel blends with relation to fossil diesel at each and every load except 0 Kg load and it can be seen the result shows reason for this is content of Iodine Value (IV) present in biodiesel value. Castor biodiesel emit less NO_x value as compared to other biodiesel.

CONCLUSIONS

1. With compare to diesel, B25 biodiesel shows increase of thermal efficiency by 11% respectively.
2. With compare to diesel, B15 biodiesel shows increase at thermal efficiency by 15% respectively.
3. With compare to diesel, B20 and B30 shows less CO emission 16% & 50% respectively.
4. With compare to diesel, at zero load condition B10, B25, B30 biodiesel shows less NOx emission a58%, 55% and 11% respectively.
5. With compare to biodiesel, B5, B15, B25 biodiesel shows less brake specific fuel consumption upto 2%, 16% and 10% respectively.
6. With compare to diesel, at 18 kg B10, B15, B25, B30 shows volumetric efficiency more as 4.5%, 1.0%, 1.5% and 1.3% respectively.

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