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PREDICTION OF POWER AND TORQUE OF CI ENGINE USINGISOBUTANOL IN COTTON SEED OIL METHYL ESTER

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ABSTRACT

The agricultural industry is provided an opportunity to utilize the agricultural by-products by using cottonseed oil biodiesel as a fuel supplement, as well as acting as an agent in the push toward becoming less dependent on non-renewable energy sources. Biodiesel is a renewable fuel which can be blended with diesel. The impact on engine performance, exhaust emissions and combustion characteristics are significant to recognize the biodiesel from various feedstocks. The ultimate aim of this paper is to carry out the effect analysis of different input process parameters like Blend percentage (COS %), Engine speed and Compression ratioof Isobutanol in Cotton Seed Oil Methyl Ester for predicting the output parameters power and torque. For predicting the output process parameters, artificial intelligence tool like Adaptive Neuro Fuzzy Inference System is used.

Keywords: Cottonseed Oil, Adaptive Neuro Fuzzy Inference System, Engine Speed, Blends.

I INTRODUCTION

Due to the reduction of fuel reserves and polluted air emerged from emissions; there is a need to use alternative fuel instead of using diesel in IC engines. Large number of vegetable oils like castor oil, soybean oil, jatropha curcas oil, rapeseed oil, cottonseed oil wasused in IC engine as an alternative fuel.The critical preferences of vegetable oils as fuel are that they are inexhaustible, can be created locally, shabby and less toxin for condition

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contrasted with diesel fuel. As indicated by writing, utilization of vegetable oils as fuel in diesel motors causes a few issues, in particular poor fuel atomization and low instability began from their high thickness, high sub-atomic weight and thickness. After the utilization of vegetable oils for an extensive stretch of time, these issues may cause imperative motor disappointments. To improve fuel properties and diminishing thickness and thickness of oils, different strategies, for example, warming the vegetable oils, blending with diesel fuel, emulsion with liquor and transesterification has been utilized. Numerous trials have unmistakably uncovered that the generally connected and advantageous strategy for decrease of thickness and thickness of vegetable oils is transesterification. The fills created by means of transesterification of the oils are called biodiesel. A critical property of biodiesel is its oxygen substance of about 10%, which is normally not contained in diesel fuel. Regardless of transesterification treatment, consistency and thickness of biodiesel is as yet higher than that of diesel fuel. It is notable that consistency of fills influences a few procedures, for example, atomization, vaporization and fuel air blending in the motor. The motor execution and discharges of diesel motors fuelled with biodiesels have been inspected by numerous specialists. The biodiesels utilized in the examinations performed by these specialists were delivered from various vegetable oils, for example, cottonseed, sunflower, rapeseed, soybean, karanja, elastic seed, and so forth. In this investigation, the execution parameters and warm efficiencies of a solitary barrel, four-stroke diesel motor utilizing diesel fuel and biodiesel, which is cottonseed oil methyl ester, have been determined. The estimations are done from hypothetical information for oil diesel, jatropha biodiesel and cottonseed oil methyl ester.

II LITERATURE SURVEY

Cottonseed oil and its methyl esters are relied upon to end up one of these biofuels in nations where cottonseed oil is copious, for example, India it might turn into a critical elective fuel. Numerous specialists have tentatively researched the execution and discharges qualities of both the cottonseed oil and cottonseed oil methyl ester. Raj et al. [1] done a test take a shot at the single barrel four strokes diesel motor

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equipped for delivering the power yield of 5.2kW and test is conveyed at the speed of 1500rpm and under shifting the heap condition for the mixes of cottonseed oil and isobutanol with diesel arranged by the volume premise i.e., B10, B10+5%, B10+10%, B20, B20+5% and B20+10%. The outcome demonstrates that the expansion of cottonseed oil expands the brake warm effectiveness with the decrease in the particular fuel utilization and fumes gas temperature. Expanding the measure of the cottonseed oil in the mix additionally lessens the emanation parameter, for example, CO, CO2, NOX and O2 with increment in HC discharge. The expansion of the isobutanol in the cottonseed oil mix diesel fuel has comparable impact to that of expansion of unadulterated cottonseed oil in differing extent that builds the brake warm productivity with the decrease in the particular fuel utilization and fumes gas temperature.Harinathareddy et al. [2] gives the brief out line about the overall generation cottonseed and its oil, cotton seed oil properties, its examination with diesel and Jatropha biodiesel. It examines the execution of a diesel motor utilizing diesel fuel and cottonseed oil biodiesel regarding brake warm proficiency and showed warm effectiveness for traditional diesel, cottonseed oil, just as for Jatropha oil. This investigation uncovers that the utilization of cottonseed oil biodiesel improves the execution parameters of CI motor contrasted with ordinary diesel fuel.Al-Samaraaeet al. [3] consider examines the physicochemical properties of safflower biodiesel and its mixes with Euro diesel and butanol. A polynomial bend fitting strategy was utilized to foresee kinematic consistency and thickness of the ternary mixes. This work underpins that biodiesel can be mixed with diesel and butanol as ternary mixes (up to 20%) for use as a fuel in pressure start (CI) motors. Accordingly, burning attributes of mixes will be additionally explored.Ranganathan et al. [4] portray the relative execution of single chamber diesel motor with direct utilization of cotton seed oil methyl ester and preheated condition at variable temperature, for example, 50, 70 and 90oC.The properties, for example, thickness, streak point, pour point were tentatively estimated of COME, in this manner got are equivalent with ASM biodiesel models. There is no noteworthy change found in brake control where as

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fumes gas temperature of all preheated biodiesel COME is high and break explicit vitality utilization required to preheat COME is high when contrasted with diesel. Be that as it may, the ideal conditions for biodiesel creation are proposed in this paper. A limit of 76% biodiesel was created with 20% methanol in nearness of 0.5%pottasium hydroxide.Kumar et al. [5] were done a test examinations on C.I.engine with Bio Diesel mixes of cotton seed Methyl Esters and Neem Oil Methyl Esters .The motor utilized for the trials was single chamber Four Stroke water cooled, consistent speed diesel motor . Cotton seed Methyl ester (CSOME) and Neem oil methyl ester (NOME) are determined through transesterification procedure and parameters of transesterification were improved. The mixes of different extents of the CSOME and NOME with diesel were arranged, dissected and contrasted and diesel fuel, and examination was improved to propose the choice among the bio diesel.

From the literature survey it is clearly shown that there are no studies or investigations going on with the performance improvement of bio diesel through modelling tools. So in this research an artificial intelligence tool like adaptive neuro fuzzy inference system is used for predicting the output responses like power and torque with carried out the effect analysis of impact of input process parameters blend percentage, engine speed and compression ratio.

III EXPERIMENTAL WORK

The different blends of the biodiesel are made by mixing ester with diesel. The Isobutanol is added with each blend at 10% in volume of each blend. The blends without adding Isobutanol and adding Isobutanol are kept separately for doing engine performance testing. The engine parameters of the engine from which the performance test carried out is given in table 1. Power and Torque of CI engine using isobutanol in cotton seed oil methyl ester at varying the input parameters blend percentage, engine speed and compression ratio were tabulated in the below table 2 by doing experimental work in IC engine.

Table 1 Engine Parameters

Make	Kirloskar
Type	1 Cylinder 4 Stroke
Power	5.2 KW
RPM	1500
Bore	80 mm

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Stroke length	110 mm
Method of Starting	Hand Starting
Cooling System	Water cooled
Compression ratio	17.5
Rotation	Clockwise/anticlockwise
Fuel Filter	Present

Table: 2Experimental Trails

Run	Blend percentage (COS %)	Engine speed	Compression ratio	Power (kW)	Torque (Nm)
1	60	1500	14:1	4.37	15.2
2	40	1500	16:1	4.41	15.35
3	0	1300	15:1	4.501	10.45
4	40	1500	17:1	4.36	15.35
5	20	1400	17:1	4.589	12.45
6	0	1400	16:1	4.614	11.68
7	60	1300	16:1	4.163	11.7
8	40	1200	17:1	4.073	10.1
9	20	1400	16:1	4.589	14.014
10	20	1400	16:1	4.512	12.6
11	20	1500	16:1	4.873	15.67
12	60	1500	15:1	4.785	15.2
13	40	1200	16:1	4.073	10.8
14	20	1300	17:1	4.471	12.67
15	60	1300	16:1	4.16	11.88
16	40	1400	16:1	4.36	13.9
17	40	1200	15:1	4.247	9.8
18	20	1500	16:1	4.873	15.67
19	0	1200	15:1	4.284	9.7
20	0	1500	16:1	4.901	15.67

IV MODELING AND ANALYSIS

An ANFIS is a sort of counterfeit neural system that depends on Takagi–Sugeno fluffy derivation framework. Since it incorporates both neural systems and fluffy rationale standards, it can possibly catch the advantages of both in a solitary structure. Its deduction framework compares to a lot of fluffy IF– THEN decides that have learning ability to estimated nonlinear capacities. Henceforth, ANFIS is viewed as a widespread estimator. For utilizing the ANFIS in an increasingly proficient and ideal way, one can utilize the best parameters acquired by hereditary calculation.

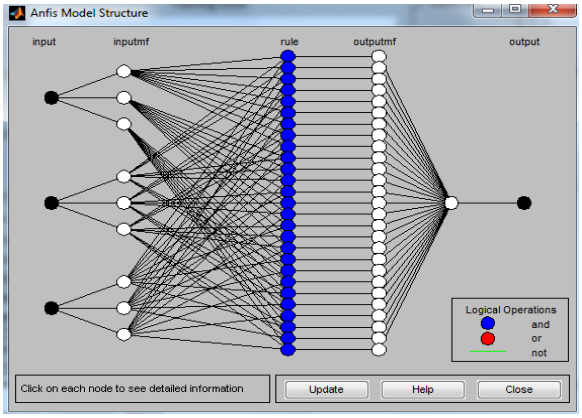

Figure 1 Proposed ANFIS Structure

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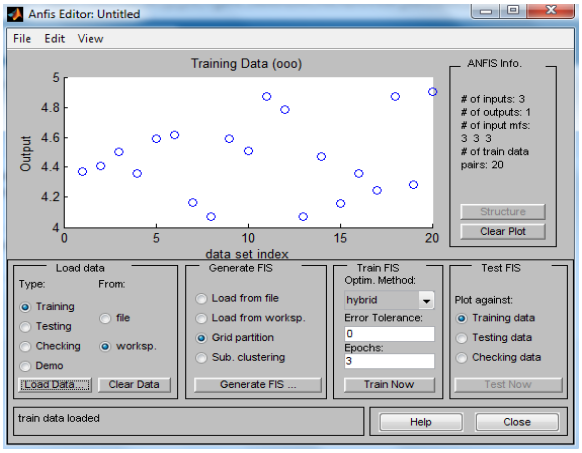

Figure 2 Loading of input parameters and output power

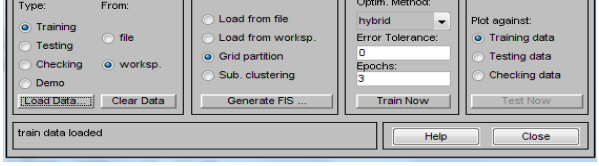

Figure 3 Loading of input parameters and output torque

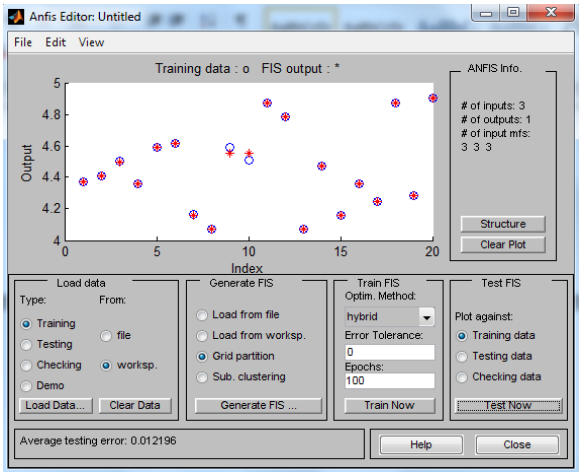

Figure 4 Plotting of actual output power and predicted power

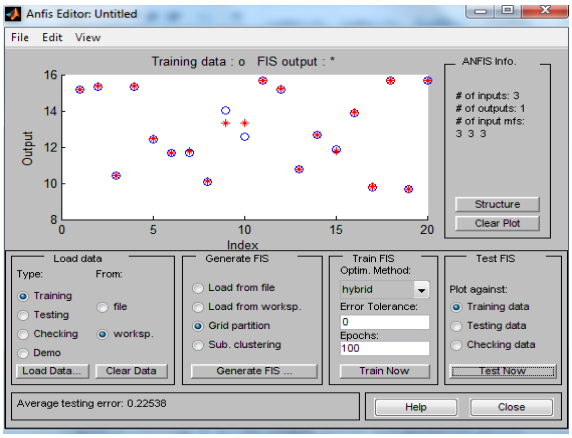

Figure 5 Plotting of actual torque and predicted torque

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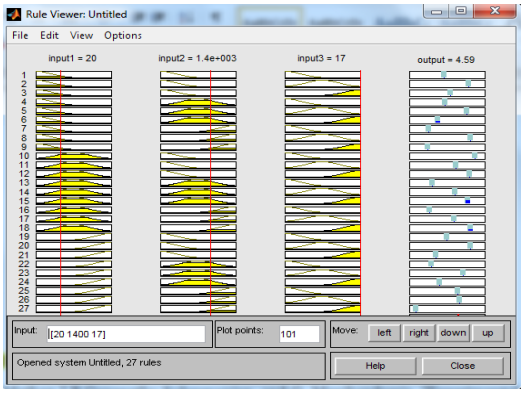

Figure 6 Rule Viewer for Power

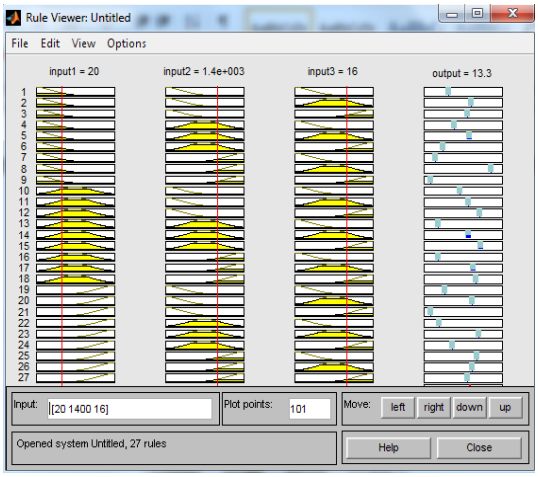

Figure 7 Rule Viewer for Torque

In this work ANFIS tool is mainly used for predicting the process output parameters and identifying the influence of each input parameter in it. In this work Gaussian membership function is used and the prediction is done by hybrid ANFIS method. The predicted otput responses like power and torque which is tabulated in the table 3 is almost very closed to the actual output.

Table: 3 Experimental Trails and the Predicted outputs

Run	Blend percentage (COS %)	Engine speed	Compression ratio	Power (kW)	Torque (Nm)	Predicted Power (kW)	Predicted Torque (Nm)
1	60	1500	14:1	4.37	15.2	4.37	15.2
2	40	1500	16:1	4.41	15.35	4.41	15.4
3	0	1300	15:1	4.501	10.45	4.50	10.5
4	40	1500	17:1	4.36	15.35	4.36	15.4
5	20	1400	17:1	4.589	12.45	4.59	12.5
6	0	1400	16:1	4.614	11.68	4.61	11.7
7	60	1300	16:1	4.163	11.7	4.16	11.7
8	40	1200	17:1	4.073	10.1	4.07	10.1
9	20	1400	16:1	4.589	14.014	4.55	13.3
10	20	1400	16:1	4.512	12.6	4.55	13.3
11	20	1500	16:1	4.873	15.67	4.87	15.7
12	60	1500	15:1	4.785	15.2	4.79	15.2
13	40	1200	16:1	4.073	10.8	4.07	10.8
14	20	1300	17:1	4.471	12.67	4.47	12.7
15	60	1300	16:1	4.16	11.88	4.16	11.9
16	40	1400	16:1	4.36	13.9	4.36	13.9
17	40	1200	15:1	4.247	9.8	4.25	9.8
18	20	1500	16:1	4.873	15.67	4.87	15.7
19	0	1200	15:1	4.284	9.7	4.28	9.7
20	0	1500	16:1	4.901	15.67	4.90	15.7

VI CONCLUSION

An adaptive neuro fuzzy inference system model with Gaussian membership function (gaussmf) using the hybrid method for membership function is used for predicting the power and the torque of Isobutanol in Cotton Seed Oil Methyl Ester in diesel engine. From the results clearly shows that

the predicted values using adaptiveneuro fuzzy inference system model with Gaussian membership function (gaussmf) using the hybrid method for membership function produced closer as well as accurate result. And hence ANFIS with hybrid method can be used as an effective prediction tool in future work.

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