The Effects of Catalyst on Cetane Number for the Pyrolysis Oil

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***Abstract**:* The cetane number, a widely used diesel fuel quality parameter related to the ignition delay time and combustion quality of a fuel, has been applied to alternative diesel fuels such as biodiesel and its components. In this work, the cetane numbers of two samples of euphorbia antiquorum and cissus qudrangularsis were determined.

The cetane numbers of these samples which improve the properties of biodiesel can be employed without greatly influencing ignition properties compared to the more common euphorbia antiquorum and cissus qudrangularsis.cetane numbers were determined in an ignition quality tester(IQT)which is a newly developed, to determine a cetane number aniline point apparatus method using only small amounts of material. The IQT is as applicable to biodiesel and its components as previous cetane-testing methods.

Reported values of the cetane number for biodesel vary widely. For the euphorbia antiquorum and cissus qudrangularsis oil-derived biodiesel, the values range from 17 to as high as 24.some of this variation may be due to differences in the biodiesel composition of the euphorbia antiquorum and cissus qudrangularsis samples but other factors are also important.

This paper reviews development of the cetane number test procedure and its current status.it discusses the existing data for the cetane number of biodiesel and presents new data for the effect of the fuel quality composition of ignition delay time and for the fuel**.**

IndexTerms - Cetane number, pyrolysis oil, Euphorbia antiquorum, Cissus qudrangularsis, Aniline, paraffin oil, Heater

1. INTRODUCTION

The cetane number is one of the most commonly cited indicators of diesel fuel quality. It measures the readiness of the fuel to auto ignite when injected into the engine. It is generally dependent on the composition of the fuel and can impact the engine's startability, noise level, and exhaust emissions. The cetane number of biodiesel is generally observed.

Data presented below will show values varying between 17and 24. The objective of this paper is to discuss the possible reasons for the wide range in reported values of the cetane number of biodiesel. Suggestions for reporting the fuel properties of biodiesel that correlate to cetane number are also provided.

The cetane number test procedure has been subject to much criticism in recent years. Most of this criticism is based on the differences between the cetane test engine configuration and operating conditions and the configurations and operating conditions of modern engines.

The cetane number test procedure now designated as grew out of a number of research programs to determine the ignition quality of diesel fuel in a similar manner to the octane test for gasoline. As a result of work to determine the causes of knock in spark-ignition engines, researchers in the 1920s were aware of the relationship between fuel type and a property known as the spontaneous ignition temperature (S.I.T.).

2. METHODS TO DETERMINE CETANE NUMBER

2.1. Aniline Point Method

Aniline Point Lowest temperature at which equal volumes of fresh aniline and an oil are completely miscible. Field experience and laboratory tests have indicated that oils with a high aromatic content were more detrimental to rubber products than those with a low aromatic content.

The relative aromatic content of oil is indicated by its aniline point. Oils having a high aromatic content have a low aniline point, and oils with a low aromatic content have a high aniline point.

2 .2 Processes

Clean and dry the 'U' tube and arrange the apparatus desired. Now add 10ml of distilled aniline and 10ml of given sample in the 'U' tube, it will form two layers. Arrange the apparatus with stirrers in such way that liquid in 'U' tube and the paraffin of the beaker are stirred simultaneously. Switch on the heater to heat the paraffin at a controlled rate, so there is no much difference in temperature of paraffin bath and 'U' tube. The minimum temperature at which two layers give a single phase is noted as aniline point. Now stirring of 'U' tube mixture is stopped, and mixture is allowed to cool. Temperature at which two layers are formed is also considered as aniline point. Finally the one phase temperature of aniline point is noted.

2.3 Formula Used

Cetane number= 0.72 X dieselindex X 10

Diesel index=degree of API X aniline point
1000

Degree of API = 141.5 / Relative density -131.5

3. CALCULATION

3.1 Calculation of EA sample

Given
Volume of aniline taken = 10 ml
Volume of sample oil = 10 ml
One phase temp(aniline point) = 65 0C
Degree of API = 141.5 / Relative density - 131.5
= 141.5 / 0.84 - 131.5

Degree of API = 36.952
Diesel index = degree of API X Aniline point / 1000

= 36.952 X 70 / 1000

Diesel index = 2.5867
Cetane number = 0.72 X diesel index X 100
= 0.72 X 2.5867 X 10
= 18.62
The given pure sample oil of cetane number is 18.62.

3.2 Calculation of 10% Blend of EA sample

Given
Volume of aniline taken = 10 ml
Volume of sample oil = 10 ml
One phase temp(aniline point) = 65 0C
Degree of API = 141.5 / Relative density - 131.5
= 141.5 / 0.84 - 131.5

Degree of API = 36.952
Diesel index = degree of API X Aniline point / 1000

= 36.952 X 70 / 1000

Diesel index = 2.5867
Cetane number = 0.72 X diesel index X 100
= 0.72 X 2.5867 X 10
= 19.12

The given pure sample oil of cetane number is 19.12

3.3 Calculation of CQ sample

Given
Volume of aniline taken = 10 ml
Volume of sample oil = 10 ml
One phase temp(aniline point) = 65 0C

Degree of API = $\frac{141.5}{\text{Relative density}} - 131.5$

= $\frac{141.5}{0.84} - 131.5$

Degree of API = 36.952

Diesel index = $\frac{\text{degree of API X Aniline point}}{1000}$

= $\frac{36.952 \text{ X } 70}{1000}$

Diesel index = 2.5867
Cetane number = 0.72 X diesel index X 100
= 0.72 X 2.5867 X 10
= 17.67

The given pure sample oil of cetane number is 17.67.

3.4 Calculation of 10% Blend of CQ sample

Given
Volume of aniline taken = 10 ml
Volume of sample oil = 10 ml
One phase temp(aniline point) = 65 0C

Degree of API = $\frac{141.5}{\text{Relative density}} - 131.5$

= $\frac{141.5}{0.84} - 131.5$

Degree of API = 36.952

Diesel index = $\frac{\text{degree of API X Aniline point}}{1000}$

= $\frac{36.952 \text{ X } 70}{1000}$

Diesel index = 2.5867
Cetane number = 0.72 X diesel index X 100
= 0.72 X 2.5867 X 10
= 18.12.

The given pure sample oil of cetane number is 18.12

4. RESULTS AND GRAPHS

4.1 comparison of cetane number for EA and CQ samples

Table 1. Cetane number

S.No	% of blend	Cetane number of EA(series 1)	Cetane number of CQ(series 2)
1	Pure oil	18.62	17.67
2	10	19.12	18.12
3	20	19.97	19.36
4	30	20.73	20.06
5	50	21.63	20.96
6	70	22.38	22.27
7	80	23.23	23.10
8	Pure diesel	24.10	24.10

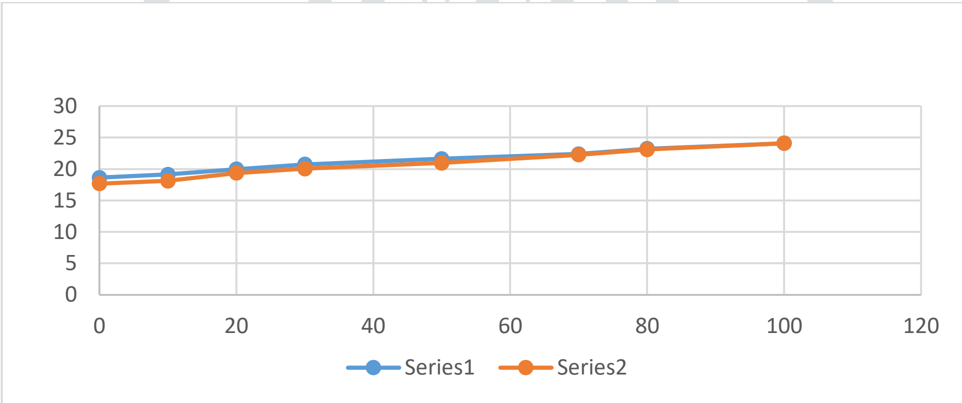
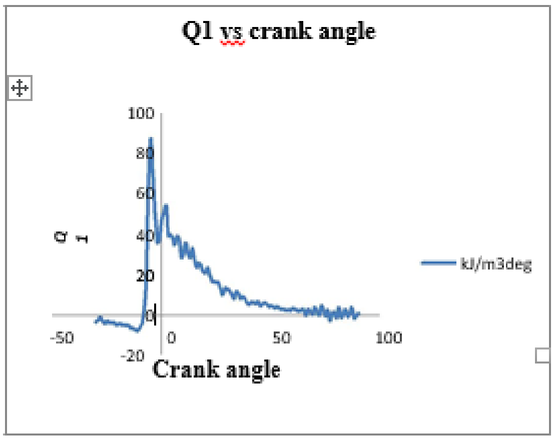


Fig 1. cetane number vs % of blend samples

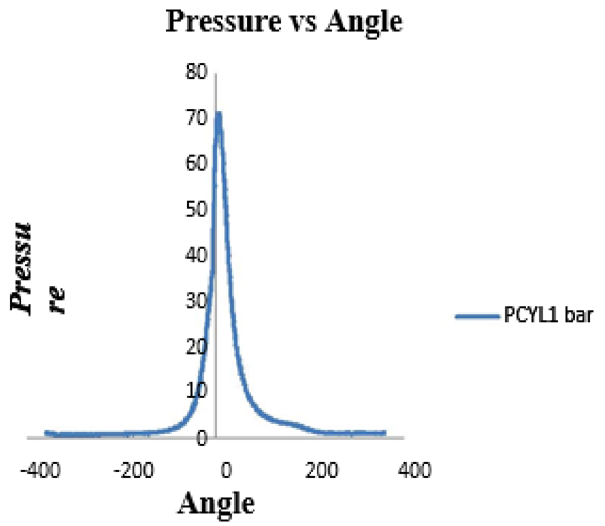
4.2 Heat released vs crank angle of EA samples



Crank angle deg	Q1 kJ/m3deg
-30	-3.133
-29	-2.332
-28	-1.048
-27	-2.838
-26	-3.92
-25	-2.714
-24	-3.388
-23	-3.9

Fig 2. 10% of blend with full speed.

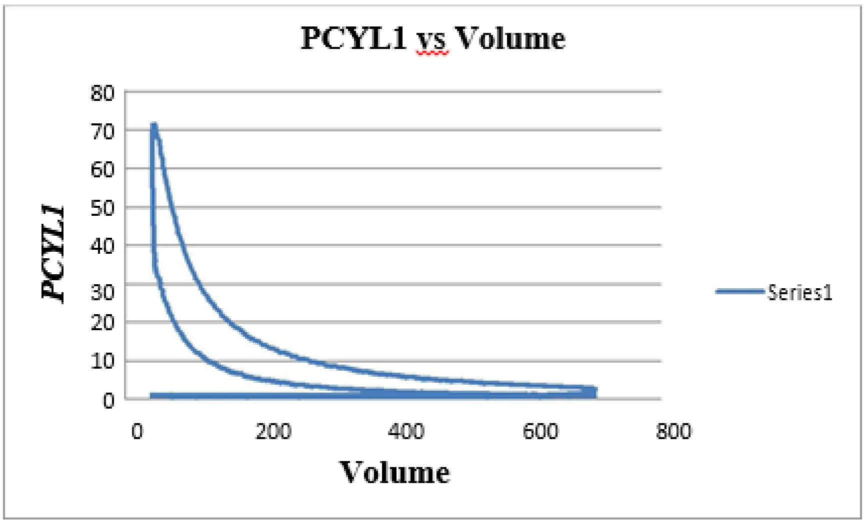
4.3 pressure vs crank angles of EA samples



Crank Angle	Pcyl1
deg	bar
-360	1.042
-359	1.042
-358	1.092
-357	0.962
-356	0.949
-355	1.036
-354	0.926
-353	0.926

Fig 3. 10% 0f blend with full speed

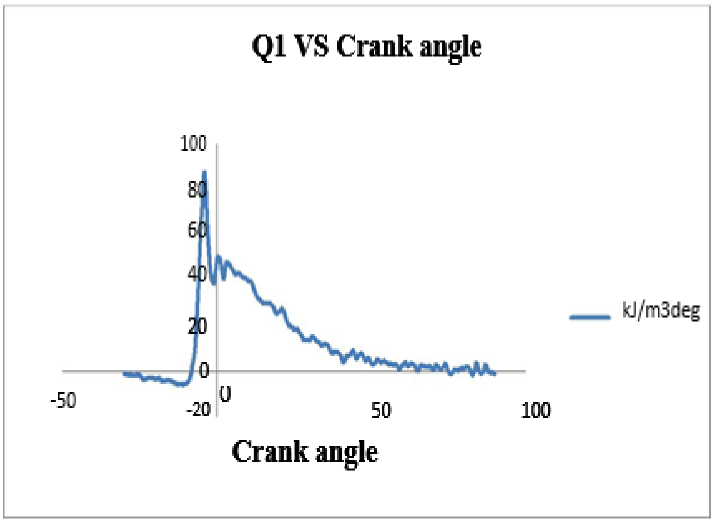
4.4 Cylinder Pressure Vs Volume of EA samples



Volume	Pcyl1
cm3	bar
40.9	1.042
40.15	1.042
40.34	1.092
40.65	0.962
41.9	0.949
41.66	1.036
42.35	0.926
43.17	0.926

Fig 4. 10% of blend with full speed

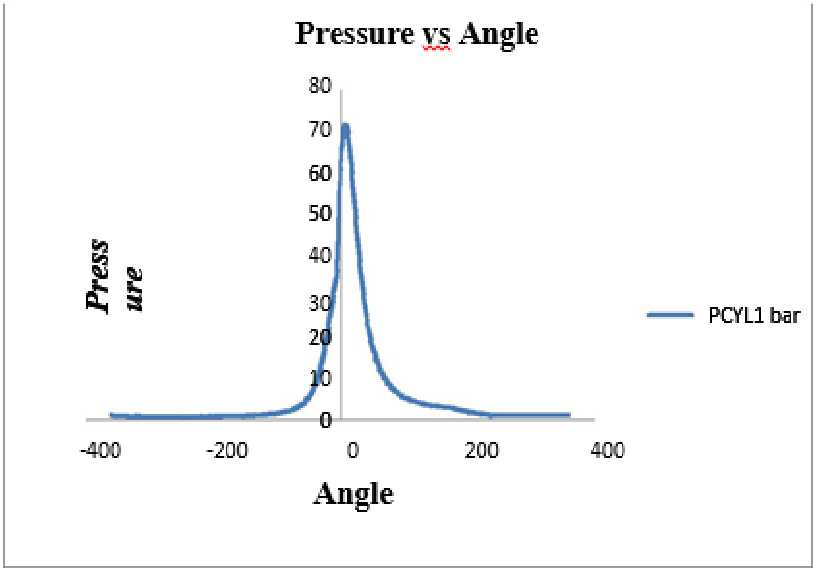
4.5 Heat Release Vs Crank Angle of CQ samples



Crank Angle	Q1
deg	kJ/m3deg
-30	-0.477
-29	-0.845
-28	-1.329
-27	-1.511
-26	-1.377
-25	-1.44
-24	-3.503
-23	-2.537

Fig 5. 10% of blend with full speed.

4.6 Pressure Vs Crank Angle Of CQ Samples



Crank Angle	PCYL1
deg	bar
-360	1.079
-359	1.053
-358	1.046
-357	0.999
-356	0.906
-355	0.913
-354	1.066
-353	0.986

Fig 6. 10% of blend with full speed

5. CONCLUSION

The addition of oil to diesel fuel changes the physicochemical properties of the blends.With the increase of oil cetane number high heat value and aromatics fractions of the blends decrease.Distillation temperatures also change Additive can enhance the stability of oil blended diesel fuel.We finally find the cetane number of euphorbia antiquorum and cissus qudrangularsis .Identify the ignition quality of fuel and study the effects of catalyst and performance of pyrolysis oil.

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