

# ADVANTAGE WASTE THE CEIBA PENTANDRA SEEDSTO ALTERNATIVE FUEL DIESEL ENGGINES

*by Dr Muhaji*

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# PROCEEDING

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# **EDUCATIONAL TECHNOLOGY AND VOCATIONAL IN ASEAN ECONOMIC COMMUNITY, INTERNATIONAL CONFERENCE PROCEEDINGS**

**3-6 August 2016**

**Auditorium State University of Medan, Medan, North Sumatera, Indonesia**

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## Preface

We feel thankful to Allah for the blessing s<sub>1</sub> that the book of proceeding of National Seminar completely compiled in relating to the 8th National Convention of Indonesian Association of Technological and Vocational Education (APTEKINDO) and 19th Indonesian Congress of FT/FPTK-JPTK 3 - 6 August 2016 in State University of Medan.

The main objectives of the seminar is to improve the capability in vocational technology in theme: **The role of educational technology and vocational in Asean Economic Community (AEC)** which is adopted from the researches in order to upgrade the graduates to be International standard so that the output of LPTK-PTK be able to compete in AEC. Therefore, the National seminar, convention and workshop of Indonesian LPTK-PTK may emerge the thoughts how to strength the role of LPTK to improve the quality of the vocational teachers in Indonesia.

Hopefully this proceeding book will be useful to develop technology, art, and culture. This book also can be as a reference to intensify the National development.

The committee would express our gratitude to all participants and stakeholders in supporting the National seminar, convention and workshop of Indonesian LPTK-PTK

Medan, 6 August 2016  
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EI-05-017

## ADVANTAGE WASTE THE CEIBA PENTANDRA SEEDSTO ALTERNATIVE FUEL DIESEL ENGGINES

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**ABSTRACT** : The purpose of this research to know influence to use the mixture of fuel biodiesel from the ceiba pentandra seed oil of were performance and opacity on a diesel engine. Testing were engine performance with the methods full open trottle valve with a standard SAE J1349 yaitu "Engine Power Test Code-Spark Ignition and Compression Ignition-Net Power Rating". While testing opacity with a standard SAE-J1167 (Snap Acceleration Test Procedure). By the use of fuel mix with biodiesel (B0, B10, B20, B30, B40, B50 and B60 ) there was an increase in were engine performance maximum with fuel B50 (torque up 18,15 % in 2000 rpm, power up 18,92 % in 3500 rpm, mean effective pressure 17,96 % in 1750 rpm ), a decline in sfc of 23,443% in 2750 rpm and decrease in opacity 48,12 % in 2000 rpm.

Keywords: biodiesel, ceiba pentandra seed oil, performance and opacity

### I. INTRODUCTION

The tendency of energy needs of diesel fuel from year continue to increase, while reserve that is in the earth skids. Impact from this gap in the near future will pose a problem, besides engine gas emissions and opacity increases, so will increase global warming (Wardana, 2015). This should be immediately in find a solution that reliable that dependence with fossil fuels of diminishing, gas emissions and opasitas smoke progressively lower .

Various business had been done by such as increase the efficiency of the use of fuel, technology improve the quality of fuel and looking for alternative fuel that can be renewable. Alternative fuel that can be renewable is now the developing and received support from the government is fuel from vegetable oils (Soerawidjaja, 2011). Vegetable oils containing various fatty acids, good a saturated fatty acid and unsaturated. A saturated fatty acid and unsaturated is very potencial as the fundamental substance of biodiesel. A kind of vegetable oil good as the fundamental substance of biodiesel maker among others from ceiba pentandra seed, the cotton seeds, soybean seeds, peanut seed, sunflower seeds, coconut, moluccana, the soyben seeds (Shereena and Thangaraj 2009, Soerawidjaya 2009, 2011 and Ingle, et. al ., 2011, Demirbas, 2008 ) .

Excess material biodiesel fuel from vegetable oils compared with diesel fuel some of them are of the nature of diesel fuel lubricating better, its flashes point higher, higher cetan number, does not contain sulphur, lower emession, lower opacity (Sathiyagnanam et al. 2011; Shahid, 2011; and Myo , 2008). Time burning biodiesel and their mixtures faster (Sathiyagnanam, Member, Iaeng and Saravanan, 2011). Ignition daely time to light up fuel biodiesel and their mixtures shorter (Anand, et., al., 2009). While a shortage of fuel biodiesel is viscosity higher, combustion space fast dirty, engine efficiency thermis lower, there are still a few containing glycerol (Shahid and Jamal, 2011, Ingle, et. al., 2011, Ali, 2005).

While the results of research concerned with the application of fuel biodiesel used as a mixture of fuel a diesel engine were reported by some researchers among other:Ali in 2005, Anand, et. all.2009, and Ingle, et.al. (2011 ) experiment of biodiesel oil cotton seed on a diesel 1 cylindrical, with the variation of fuel starting from B0, B10, B20, B30, B40, and B50.Results showing that resources and efficiency thermis machine **lower than that of use sdiesel fuel, specific fuel consumption increased 2.5 %** compared to solar, CO<sub>2</sub> emission higher to mix B5 and B10, smoke lower all these a mixture of compared to use solar, and iqntion daely to light up shorter.Rangganathan (2011 ), shahid and Jamal (2011), and Sathiyagnanam, et. al., (2011), experiment biodiesel from oil of cottonseed on a diesel 4 cylindrical.Variation fuel covering B0, B10, B20, B40, B60, B80 and B100.The results first resources and efficiency thermis enginedecline by increasing the ratio biodiesel in a mixture diesel oil and biodiesel, with B100 efficiency thermis fell 10 % compared to to the use of diesel oil, second specific fuel consumption up with increasing the ratio biodiesel in a mixture diesel oil and biodiesel, with B100 specific fuel consumption up 10%, third a decline in emission CO, HC and smoke significant at when the burden high on fuel biodiesel, and fourth burning began early to biodisel and mixtures of diesel oil. Myo (2008), do research discharging fuel biodiesel from coconut oil in a diesel engine 1 cylindrical 4 tak.Fuel variations ranging from B0 , B25, B50, B75, until B100.The results showed the first properties fuel properties near diesel fuel, both resources and efficiency thermis engine declining, third gas **emissions CO, HC and NOx and smoke decreasing compared with the use of diesel oil**, and fourth overall **biodiesel all a mixture of coconut oil can be used as fuel diesel engine without modifying.**The purpose of this research to the characteristics of burning a mixture of biodiesel from of ceiba pentandra seed oil and diesel oil against show employment (torque, power, mean effective pressure, specificfuelconsumptionand opacity) of diesel engines.

## II. METHOD

### a. Equipment and research instruments

Equipment and instrument used to experiments indicated as in Figure 1 .

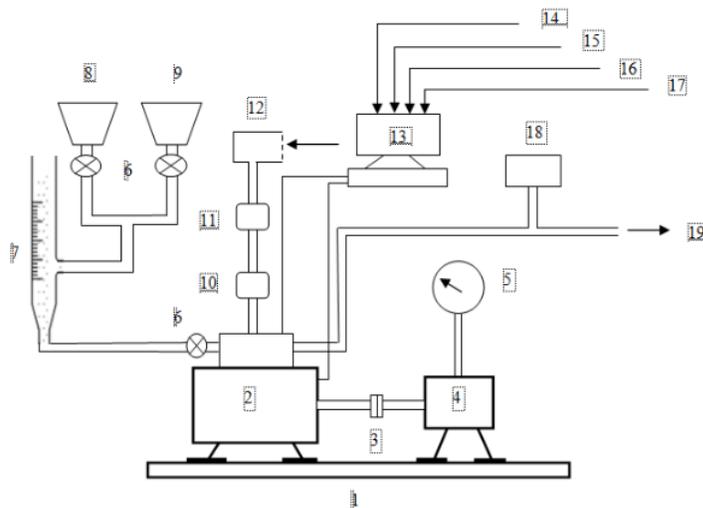


Figure 1: Research instruments and equipment

Explanation:

- |  |                                |
|--|--------------------------------|
| 1. The holder engine and a dynamometer | 11. Measuring the flow of air  |
| 2. Diesel engine                       | 12. Air filter                 |
| 3. Clutch                              | 13. Data system aqusisi        |
| 4. Dynamometer                         | 14. Oil temperature            |
| 5. Torque                              | 15. Pressure the exhaust gases |
| 6. A valve officers fuel               | 16. Cooling water temperature  |
| 7. Tube measuring instrument fuel      | 17. Trotle valve open          |
| 8. Diesel fuel                         | 18. Opacity meter              |
| 9. Biodiesel                           | 19. Channel the exhaust gases  |
| 10. Fuel measuring                     |                                |

a. Research Method

The method testing offered the engine performace with the full open trotle valve with a standard SAE J1349 namely “engine power test code-spark ignition and compression ignition-net power ratings “.While testing opacity with a standard SAE-J1167 (Snap Acceleration Test Procedure). The variation of fuel starting from B0, B10, B20, B30, B40, B50 and B60.

III. DISCUSSION AND RESULTS

a. Torque

The torque generated by engine using a mixture of biodiesel whit diesel fuel has indicated in Figure 2.

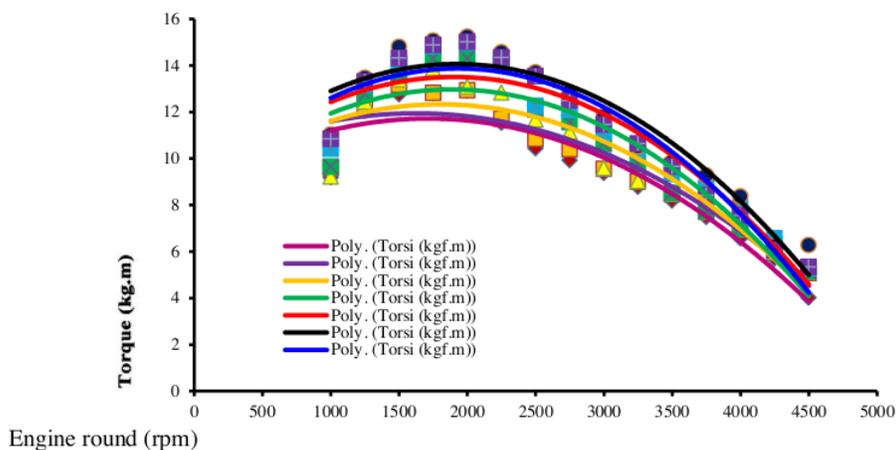


Figure 2. The relationship between torque and round engine



Characteristic of torque as in a Figure 2, where the graph curved up, in the low its torque produced engine is still low, because in the low mixes air and fuel rich, so that combustion not yet dirty. Then between round 1500 rpm until the round 2250 rpm high torque, because mixes air and fuel approaching stioqiometri so combustion are approaching dirty and its torque produced the higher Then torque down start round 2500 rpm until the round 4500 rpm, because the higher round a mixes air and fuel poorer, so that combustion less perfect and friction components engines are becoming high. Its torque produced by a cocktail of fuel oils biodiesel with diesel fuel greater compared to torque on generated by a engine with diesel fuel. The increase in torque highest in fuel B50 of 18,15 % in 2000 rpm, while torque from fuel B60 lower the viscosity has more than standard fuel so atomization fuel not maximum.

#### b. Power

The power generated by a engine by the use of fuel a mixture of biodiesel with diesel fuel as in a Figure 3 .

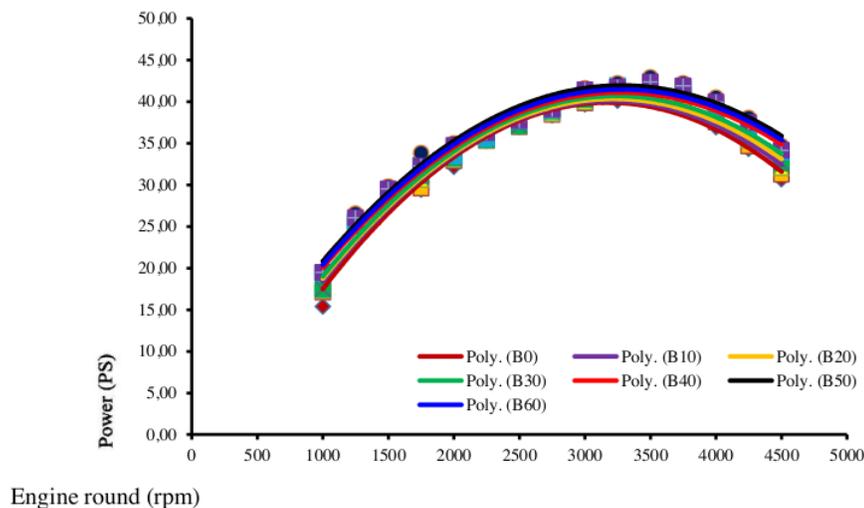
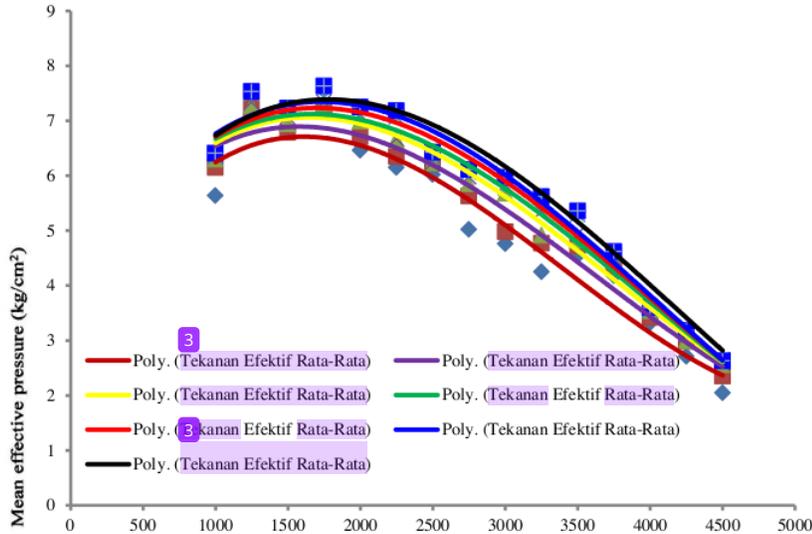


Figure 3. The relationship between power and round engine

Figure 3 shows that the power generated by a engine in the low on rpm 1000 up to 1750 rpm) are still low, then the highest round a power is rising and peaked in the 3500 rpm, because in that is economical round, it means in this round a cocktail of fuel oils approaching a mixture of stoichiometry so that the material fuel burned down and energy the heat produced by the maximum. Then having a round 3500 rpm upward power declining, this is because besides combustion the away from perfect also friction components engine are becoming great that he forgot declining. In general the power generated by a machine by the use of fuel B10 up to B50 engine power are becoming large and peaked in B50 with a rise in of power equal to 18,92 % in rpm 3500, since the fuel biodiesel more containing oxygen so as to combustion faster. While in B60 the power as much as lower, because viscosity B60 has more than standard, so that atomization fuel imperfect.

b. Mean effective pressure

Figure 4 shows that mean effective pressure generated by an engine with using fuel a mixture of biodiesel diesel with fuel.



Engine round (rpm)

Figure 4 .The relationship between mean effective pressure and engine round

The mean effective pressure generated by an engine in the low still, then in round middle (1250 rpm until in 2000 rpm) the mean effective pressure the average effective up and then continue to decline. This happened because in the intermediate combustion occurs approaching perfect so that the pressure resulting be tall. By using a cocktail of fuel oils biodiesel whit diesel fuel effective the average pressure resulting higher if compared to using diesel fuel .The increase in the average mean effective pressure highest happened to B50 is as much as 17,96 % in 1750 rpm.

c. Specific Consumption Fuel

Specific consumption fuel (sfc) generated by an engine the use of fuel a mixture of biodiesel with diesel fuel indicated as in a Figure 5.

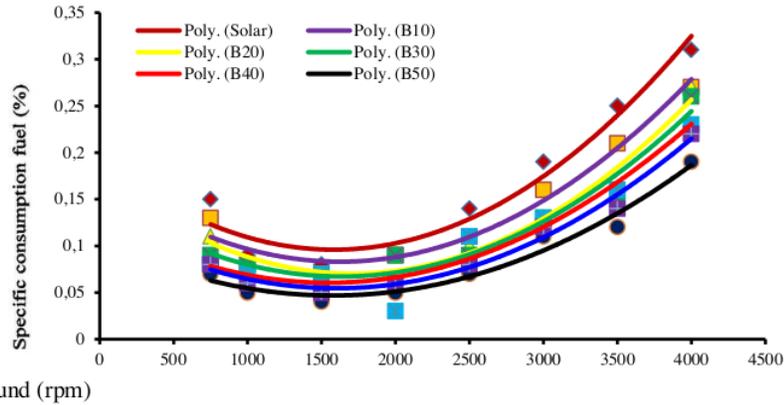


Figure 5. The relationship between specific consumption fuel with engine round

Figure 5 shows specific fuel consumption (sfc) in round a is still low, while in the round medium namely economical round (1250 rpm until the 2500 rpm) declining and the higher revolution sfc is rising. This is induced in round low a cocktail of fuel oils rich and the resulting is still low. Whereas in the economical combustion approaching perfect so that the power who be considered the higher. In the high round combustion less perfect, friction the bigger and the resulting declining. In general by using fuel a mixture of biodiesel with diesel specific fuel consumption the lower, it means the economizes, because combustion faster and he forgot the higher. The decline in specific fuel consumption largest in B50, is as much as 23,443 % in 2750 rpm.

d. Opacity

Opacity generated by an engine the use of fuel a mix of biodiesel produced by using with solar indicated as in a Figure 6.

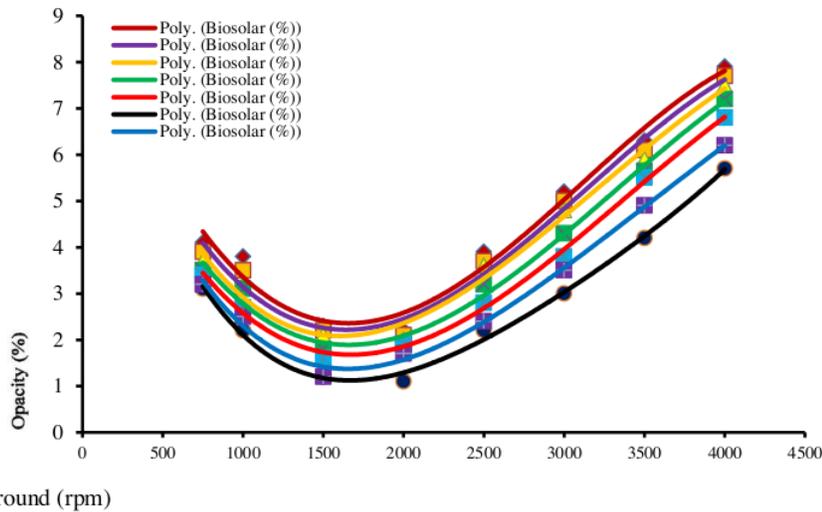


Figure 6. The relationship between opacity with engine round



Figure 6 shows that in the low opacity produced engine is high still, then in the medium opacity low, because in the of these processes combustion the better, so that opacity produced the less. While the higher revolution opacity produced rising, because combustion less perfect. In general by using fuel a mixture of biodiesel and solar opacity recorded are more low if compared to using diesel fuel. Because biodiesel not containing sulphur and cleaner combustion. The decline in opacity on the highest fuel use B50, is as much as 48,12 % in 2000 rpm.

#### IV. RECOMMENDATIONS AND CONCLUSION

##### a. Conclusion

From the experiment burning with fuel biodiesel of oils of randu seed (ceiba pentandra) with solar obtained conclusion as follows:

- 1). There was an increase in were engine performance, were engine performance, maximum with fuel B50 (torque up 18,15 % in 2000 rpm, power up 18,92 % in 3500 rpm, mean pressure effective the average 17,96 % in 1750 rpm).
- 2). The decrease in sfc of 23,443 % on 2750 rpm
- 3) The decrease in opasitas 48,12 % on 2000 rpm

##### b. Recommendations

The more a mixture of biodiesel, so vikositasnya the high that atomization fuel the more severe. To get the maximal result this research need to be extended with to warm up early fuel before atomized.

#### Acknowledgement

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