

Experimental Study on Synthesis of Cerium Oxide Nano Particles, Extraction of Bio Diesel from Algae and Comparison of Fuels with Cerium Oxide Nano Particles

R.Shanmugavelan, S.Mekala, S.Mohanapriya, MSc, M. Phil, BEd,

B. E Student, Department of Mechanical Engineering, Er.Perumal Manimekalai College of Engineering,
Tamil Nadu, India

MSC Student, Department of Chemistry, Kailash Women's College, Salem, Tamil Nadu, India

Head of the Department, Department of Chemistry, Kailash Women's College Salem, Tamil Nadu, India

Abstract: In our project, we have synthesized nano particles of cerium oxide and use as a fuel additive in conventional fuel and bio diesel. We have also extract biodiesel from algae for this experiment. And we compare the efficiency results and pollution report of various cases like conventional fuel and biodiesel and also with presence of Nano particle additives and absence of nano particle additives. We are using alternative method for cerium oxide nano particle synthesize process using Gloriosso Superba Leaf. For biodiesel extraction, we are using green algae from sea water and a mixed proportion of fresh water algae for observing a unique result than the common biofuel from algae. The efficiency results and pollution reports are taken by experimenting the composition in a mechanical test equipment laboratory.

I. INTRODUCTION

In this project, we have studied and experimented about the synthesis of Cerium oxide (CeO_2) nanoparticles from Gloriosso Superba Leaf, extraction of Bio Diesel from algae and effects of adding Cerium oxide nanoparticles in the conventional fuel and Biodiesel and comparison of results between conventional fuel and biodiesel with and without the fuel additives. We have involved in nanoscience, organic chemistry and environmental science for this experimental studies.

Generally, Cerium Oxide is synthesized by using various methodologies either by conventional process or alternative methods.

On next to the synthesis of Cerium Oxide nano particles, extraction of Biodiesel from algae was carried out.

After the biodiesel extraction and cerium oxide synthesis, we have experiment the following cases for efficiency and pollution in the environment. We have not done this for commercial purpose and completely used for experimental studies.

- i) Conventional fuel without additives
- ii) Biodiesel fuel without additives
- iii) Conventional fuel with additives
- iv) Biodiesel fuel with additives

Aim and Objective

The aim and objective of our experiment is to apply the nano chemistry in organic and environmental field and introduce an alternative fuel for environmental care by reducing pollution from the conventional fuel usage in the day

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 12, December 2018

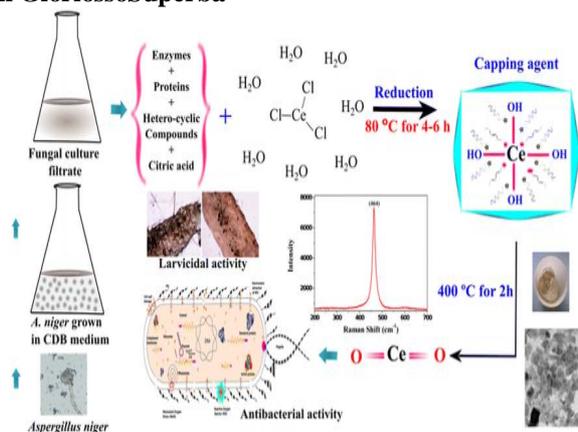
to day life. And by introducing an alternative fuel will save the fossil fuel sources from extinction. This will be implemented in the day to day life for transportation, energy production, experimental purpose and laboratories etc. And another objective is to use alternative methodologies in synthesis process and implementation in the experimental methodology. By using alternative methodology for synthesis and extraction process will save conventional energy and costs less than the conventional process. But the limitation of alternative process of synthesis is obtaining lower yield than the conventional process.

II. MATERIALS AND METHODS

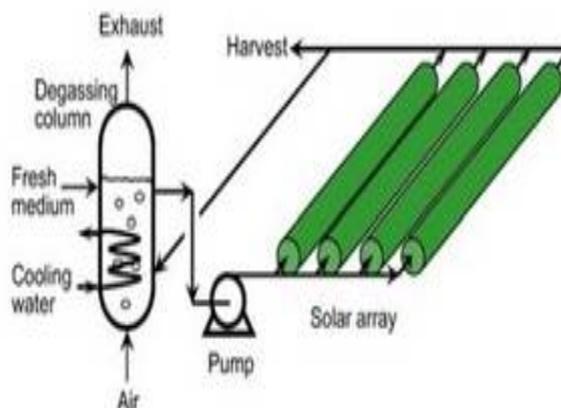
The materials we are using for this experimental study are

- i) GloriossoSuperba Leaf for cerium oxide synthesis
- ii) Algae for Bio diesel extraction
- iii) Test rig for efficiency result and pollution report

Synthesis of cerium oxide from GloriossoSuperba



Extraction of Bio diesel from Algae



The photosynthesis process generates oxygen. In an open-raceway system, this is not a problem as the oxygen is simply returned to the atmosphere. However, in the closed photobioreactor, the oxygen levels will build up until they inhibit and poison the algae. The culture must periodically be returned to a degassing zone, an area where the algal

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 12, December 2018

broth is bubbled with air to remove the excess oxygen. Also, the algae use carbon dioxide, which can cause carbon starvation and an increase in pH.

III. COMPARATIVE ANALYSIS OF DIESEL AND BIO DIESEL

Representation of Biodiesel Blend according to the proportion

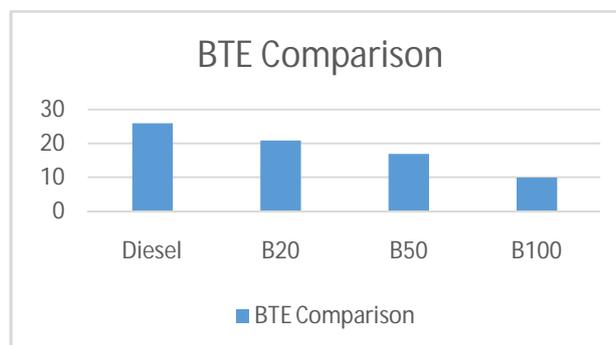
The representation is shown in the following table:

Representation	Diesel	Bio Diesel
Diesel	100	0
B20	80	20
B50	50	50
B100	0	100

Table 1

Brake Thermal Efficiency

Brake Thermal Efficiency is defined as break power of a heat engine as a function of the thermal input from the fuel. It is used to evaluate how well an engine converts the heat from a fuel to mechanical energy.



Graph 1

The Graph 1 represents the brake thermal efficiency comparison between the various proportions of Biodiesel blending proportion as per the table 1.

Efficiency Result

The efficiency result of various proportions of bio diesel and diesel are discussed below on two criteria(with cerium oxide as additives and without additives).

i) Without Additives

The efficiency of our considered proportion of Diesel and Biodiesel are shown in the table and Graph as follows.

Representation	Efficiency (Km/L)
Diesel	6
B20	6.09
B50	5.97
B100	5.43

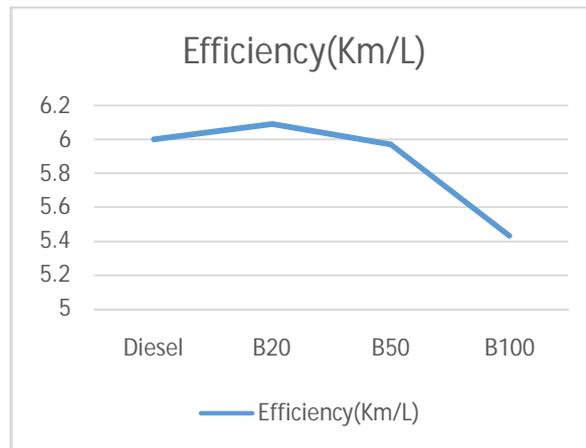
Table 2

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 12, December 2018



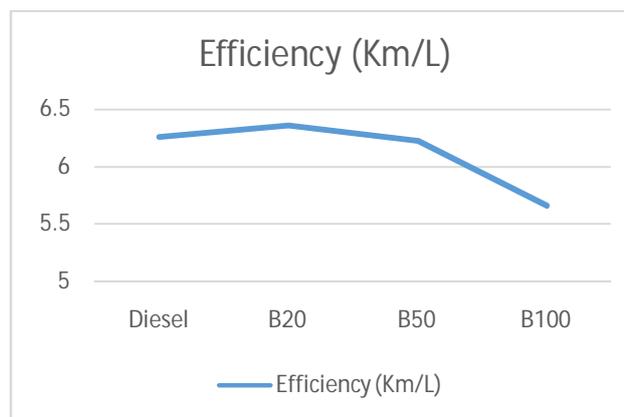
Graph 2

ii) With Additives

The efficiency of our considered proportion of Diesel and Biodiesel with cerium oxide nano particles as fuel additives are shown in the table and Graph as follows.

Representation	Efficiency (Km/L)
Diesel	6.263
B20	6.362
B50	6.230
B100	5.655

Table 3



Graph 3

Efficiency Comparison

From our test results, we have found some differences in the results. Efficiency of fuel was increased by 4.13 % when we add Cerium Oxide Nano particles as fuel additives in the ratio of 1:10. The comparison is shown in the table and graph below.

International Journal of Innovative Research in Science, Engineering and Technology

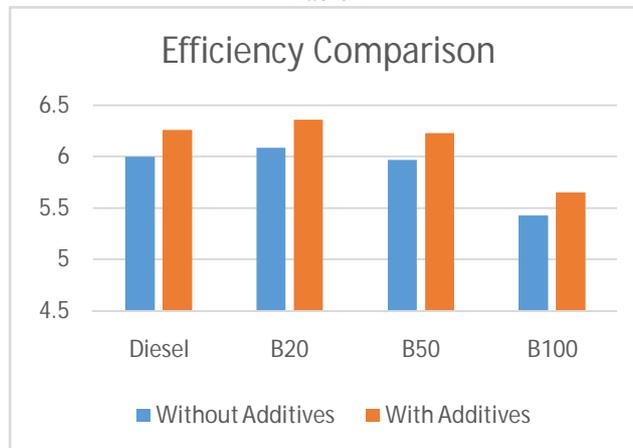
(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 12, December 2018

Representation	Efficiency (Km/L)	
	Without Additives	With Additives
Diesel	6	6.263
B20	6.09	6.362
B50	5.97	6.230
B100	5.43	5.655

Table 4



Graph 4

Pollution Report

The pollution report is especially based on the Carbon monoxide emission because the Cerium oxide nano particles reacts with the emission gases only bonding with the carbon monoxide particles in the exhaust gases.

i) Without Additives

The emission of Carbon monoxide in our considered proportion of Diesel and Biodiesel are shown in the table and Graph as follows. This pollution report is completely based on our test rig report done for this experimental study.

Representation	Carbon Monoxide (mg/m ³)				
	Engine Load (%)				
	0	25	50	75	100
Diesel	24	33	54	56	59
B20	22	31	49	52	56
B50	22	29	45	46	54
B100	19	26	36	39	46

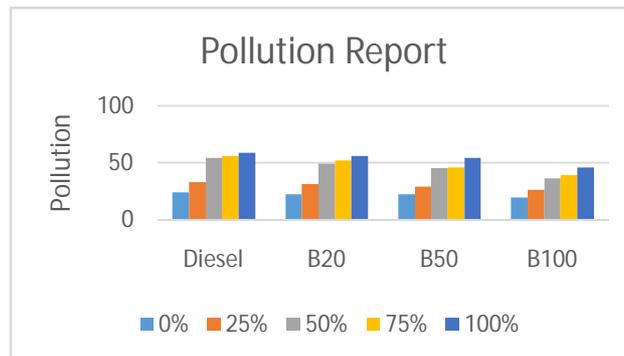
Table 5

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 12, December 2018



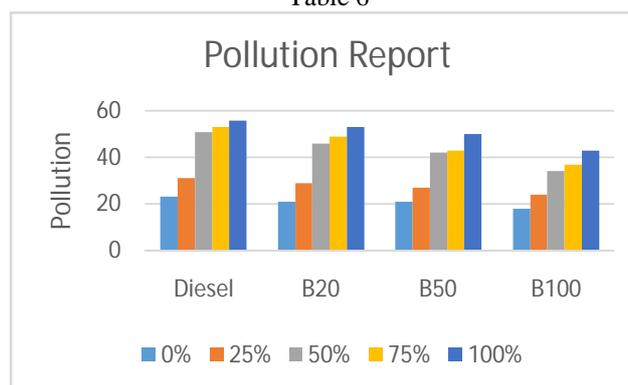
Graph 5

ii) With Additives

The emission of Carbon monoxide in our considered proportion with fuel additive are shown in the table and Graph as follows.

Representation	Carbon Monoxide (mg/m ³)				
	Engine Load (%)				
	0	25	50	75	100
Diesel	23	31	51	53	56
B20	21	29	46	49	53
B50	21	27	42	43	50
B100	18	24	34	37	43

Table 6



Graph 6

Pollution Comparison

From our test results, we have found some differences in the results. Carbon monoxide in the emission was reduced by 6 % when we add Cerium Oxide Nano particles as fuel additives in the ratio of 1:10.

International Journal of Innovative Research in Science, Engineering and Technology

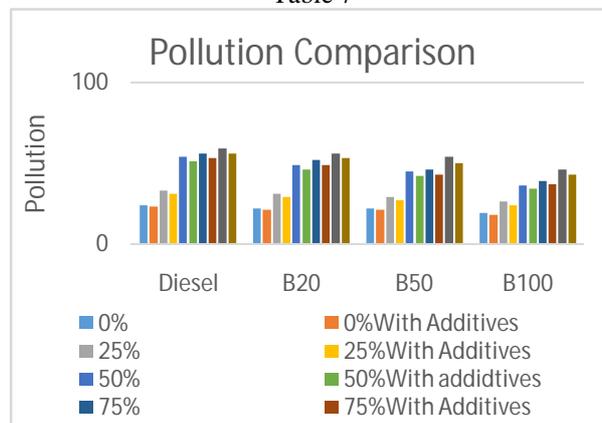
(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 12, December 2018

Representation	Carbon Monoxide (mg/m ³)					Carbon Monoxide (mg/m ³)				
	Engine Load (%)					Engine Load (%)				
	0	25	50	75	100	0	25	50	75	100
Diesel	24	33	54	56	59	23	31	51	53	56
B20	22	31	49	52	56	21	29	46	49	53
B50	22	29	45	46	54	21	27	42	43	50
B100	19	26	36	39	46	18	24	34	37	43

Table 7



Graph 7

IV. RESULT

The results of the experiment was biodiesel produce lower emission than conventional fuel. The efficiency of the biodiesel is also nearly merging with the conventional fuel. When we are adding the cerium oxide in the fuel as 1:10 ratio, we will observe 4.13% of more efficiency and 6% lower emission.

V. FUTURE SCOPE

The future scope of this experimental study is extracting the biodiesel with more calorific value, efficiency and lower emissions. And also extract the fuel to use in the conventional engine without modifications which can be very useful to make the people switch to biodiesel for saving the fossil fuel source from extinction and environment from pollution.

REFERENCES

- [1] Sitha A, Kumar A and Mahla S. K (2012) Utilization of Argemone Oil Biodiesel in Commercial DI-CI Engine vol. 3(2), pp. 19–23.
- [2] Sajith V, Sobhan C. B and Peterson G. P (2010) Experimental investigations on the effects of cerium oxide nanoparticle fuel additives on biodiesel, Advances in Mechanical Engineering.
- [3] Jindal S (2010) Effect of engine parameters on NOx emissions with Jatropha biodiesel as fuel, International Journal of Energy and Environment (IJEE), vol. 1(2), pp. 343–350.
- [4] Nagdeote D. D and Deshmukh M. M (2012) Experimental Study of Diethyl Ether and Ethanol Additives with Biodiesel-Diesel Blended Fuel Engine, vol. 2(3), pp. 195–199.
- [5] Azam M. M, Waris A, and Nahar N. M (2005) Prospects and potential of fatty acid methyl esters of some non-traditional seed oils for use as biodiesel in India, Biomass and Bioenergy, vol. 29(4), pp. 293–302.
- [6] Al-Dawody M. F and Bhatti S. K (2014) Effect of variable compression ratio on the combustion, performance and emission parameters of a diesel engine fuelled with diesel and soybean biodiesel blending, World Applied Sciences Journal, vol. 30(12), pp. 1852– 1858.



ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 12, December 2018

- [7] Kumar B. B, Rajesh M and Srinivas K (2014) Performance and Emission Analysis of Flex Seed Oil Blended With Diesel Using Methyl Esters as Additive On VCR Engine, vol. 17(3), pp. 103–108. [8] Imtenan S, Masjuki H. H, Varman M, Arbab M. I and Sajjad H (2014) Emission and performance improvement analysis of biodiesel-diesel blends with additives, *Procedia Engineering*, vol. 90, pp. 472–477.
- [9] Shavi V, Ramapuri A, Mirje C and Mathapati M (2015) Study of Characteristics Performance of VCR Engine for Different Fuels, vol. 4(6), pp. 12492–12498.
- [10] Nagane G and Choudhari C (2015) Emission Characteristics of Diesel Engine Fueled With Algae Biodiesel-Diesel Blends, pp. 1587–1592.