

Experimental Investigation on Emission Control Systems

File Number : TAR/2022/000120

Submitted By : Dr. Megavath Vijay Kumar Submission Date : 14-Mar-2022

PROPOSAL DETAILS

(TAR/2022/000120)

Principal Investigator	Mentor & Host Institution				
Dr. Megavath Vijay Kumar	Dr. A. Veeresh Babu				
vijaykumar.iitm37@gmail.com	avbabu@nit.ac.in				
Associate(Mechanical Engineering)	Associate Professor(Mechanical Engineering)				
Malla Reddy Engineering College	National Institute of Technology, Warangal				
[College (Private)] Maisammaguda, dhulapally (post via. kompally), secunderabad, rangareddy dt, Hyderabad, Telangana- 500100	[Institution under central government] NIT Warangal WARANGAL- 506004 (TELANGANA) Contact No. : +9441120203				
Contact No.: +919701339886 Date of Birth : 15-Jun-1987	Registrar Email : director@nitw.ac.in No. of PHD Scholars working : 7 No. Post-Doctoral Fellow working : 0				

Details of Post Doctorate

Ph.D. (Thermal Engineering) [Degree Awarded on : 16-Jul-2018]

STUDIES ON THE IMPROVEMENT OF CI ENGINE PERFORMANCE, COMBUSTION AND EMISSIONS WITH THE USE OF BIODIESEL BLENDS, ADDITIVE AND ENGINE MODIFICATIONS

Research Supervisor/Guide & Institution :

Dr. A. Veeresh Babu & Dr. P. Ravi Kumar

National Institute of Technology Warangal

Brief details of Thesis work :

The diesel engines have high efficiency, reliability and durability together with their low operating cost. These essential features make them be widely used in the transportation, automotive, agricultural application and industrial sector. These vast fields of usage lead to the increasing requirements of diesel fuel and going for depletion of petroleum fuel shortly. The emissions from engine exhaust can cause health problems to human beings and will have an impact on the environment such as climate change, global warming, acid rain, ozone depletion and photochemical smog. Hence, it is essential to go for an alternate fuel to diesel and effective controlling methods such as additives, fuel nozzle hole diameters, exhaust gas recirculation and diesel particulate filter can diminish the pollutions.

The objectives of the research were to study and perform experimental investigations to attain improved performance with a reduction in emissions of NOx and particulate matter using Mahua biodiesel blends. To achieve these goals we have considered locally available Mahua non-edible oil after detailed survey.

The Mahua methyl ester was obtained with less than 1% FFA and attained a maximum yield of 85% by the esterification and transesterification process. The Mahua biodiesel preparation was considered with the concentrations of sulphuric acid, potassium hydroxide, methanol, calcium chloride and distilled water are used for the best yield. The fuel properties of diesel, raw Mahua oil and Mahua methyl ester were tested for its physical properties and compared with the requirement of American Standard for Testing Materials (ASTM-D6751).

The different blends of Mahua methyl ester were investigated on a diesel engine with standard parameters and established that B20 fuel is the optimal biodiesel blend for improved performance and reducing emissions, but with an increase of NOx emissions with B20 to reconfirm the reported works as per the literature reviewed.

Based on the observed NOx values with a simultaneous observation on other emissions, it has proposed with different techniques to reduce NOx levels. Firstly, with a change in fuel composition with the introduction of metal-based additive (Cerium Oxide). The performance of BTE and combustion of pressure data are observed to be enhanced by the addition of metal-based additive. The CO, HC, and smoke are decreased for B20 fuel with nanoparticles. The NOx is reduced by dosing the CeO2 due to the oxidation of unburned CeO2 in the exhaust.

Secondly, using different multi-hole injector orifice diameters (\emptyset 0.28 mm (base), \emptyset 0.31 mm, \emptyset 0.20 mm) with improved B20 fuel. The authentic results were observed by using B20 and smaller orifice NHD. It is observed that smaller orifice NHD improves the air-fuel mixing, atomization, and vaporization which leads to shorter combustion duration. The B20 fuel also showed better results than the baseline diesel. The

combination of B20 with smaller orifice NHD are very much appreciable results were seen, but the only drawback was NOx is found to be increased.

Thirdly, with the introducing of partly cooled exhaust gas recirculation system of 10%, 20%, 30% rates for the best fuel injector orifice diameter (\emptyset 0.20 mm) with B20 fuel. The results observed by the partly cooled EGR of 10% rate for diesel and B20 fuel with smaller orifice NHD, the performance of BTE and BSFC are improved at partial load conditions. As increasing the EGR rates, the NOx is decreasing due to the in-cylinder temperature decreasing. The increasing EGR rate mainly leads to reduce the performance and raise the HC, CO, soot emissions levels.

Finally, investigating the performance with the use of diesel particulate filter along with the partly cooled exhaust gas recirculation system to after noticing the increased levels of soot with partly cooled exhaust gas recirculation investigation. From these, it has resulted that the partly cooled EGR with 10% rate with a combination of DPF is very effective without too many disturbing the performance and exhaust emissions, because of trapping the soot particles in the DPF. For EGR 20% and 30% rate with the combination of DPF, the combustion and emissions are disturbing very badly. Moreover, there is a fluctuation of speed for 30% EGR rate with DPF at higher load condition due to the adverse pressure which is caused by the accumulated soot particles in the DPF.

It has compiled explicit experimental results and made notable conclusions in the domain of alternate fuels focusing majorly on the reduction of NOx from 839 ppm to 645 ppm (With 20% EGR & DPF) and soot emissions from 42.90% to 34.90% (With 10% EGR & DPF).

Technical Details :

Research Area : Mechanical & Manufacturing Engineering & Robotics (Engineering Sciences)

Project Summary :

1. Introduction Diesel engines fuels are most promising and low-cost alternative to gasoline engines worldwide. In the recent years, increased demand for use of conventional diesel engines in various sectors such as power plants and automobile manufacturing across the world is observed. The encouraging anticipation of additional improvements and to meet the demands a necessary upgradation of the technology in terms of power, fuel economy and emissions is to be meet by conventional diesel engine manufacturers. The stringent emission legislations are compelling engine manufacturers to develop technologies to contest exhaust emissions. To fulfill these emission regulations with competitive fuel economy, exhaust gas after-treatment and optimized combustion are necessary. However, it is still under R&D stage globally, which will succeed by considering production and economic feasibility. In order to reduce the levels of emissions which are generally observed in conventional diesel engine, a set of experiments are proposed to study the influence various engine parameters of NOx and exhaust gas re-circulation (EGR) emissions. To estimate the suitable rates of EGR which efficiently controls the rate of NOx emissions. To develop an efficient and small-scale technique which reduces the particulate matter emission using diesel particular filter (DPF). Further, to investigate the role of combined EGR and DPF on reducing the emission levels and thereby improving the performance of the engine. In the first phase of experiments, the EGR rates will be optimized for various engine loading conditions. Effect of EGR on engine performance parameters and emissions namely thermal efficiency, brake specific energy consumption, smoke opacity, carbon monoxide, hydrocarbons, NOx, CO2, etc. will also be investigated. In the second phase of experiments, the DPF will be investigated with various engine loading conditions. A silicon carbide wall-flow filter will be used to control the Soot with its heating of DPF. In the final phase of experiments, the Combination of EGR and heating of DPF will be investigated to find its effects on a diesel engines. Implementation of new techniques for heating DPF, which effectively regenerates the DPF even at low exhaust gas temperatures. To enhance the engine performance by reducing the emission levels a combined used of EGR and modified DPF can be used. Thus the objective of the proposed research work is to reduce the emission levels in a conventional diesel engine by simultaneously utilizing EGR and modified DPF. The main requirement for the Project: a) Computerized Diesel Engine setup b) Exhaust Gas Recirculation (EGR) System c) Diesel particulate filter (DPF) d) Exhaust Gas analyzers e) Smoke meter and necessary accessories.

Objectives :

• To enhance the improvement of Diesel Particulate Filter and Exhaust gas Recirculation systems in a diesel engine for reducing the Particulate matter & Oxides of Nitrogen.

Keywords:

I.C. Engine, DPF, EGR, Performance, Emission.

Expected Output and Outcome of the proposal :

• A critical balance of NOx and particulate matter emissions can be achieved by implementing new techniques. • Feasible portable heating system for DPF can be developed and implemented in real-life applications. • Simultaneous use of exhaust gas recirculation and heating of DPF will probably improve the reduction of combustion chamber temperature aiding to a reduction in emissions. • Enhanced

performance characteristics of the conventional diesel engine can be observed.

Is Ethical Clearance Certificate Required in the proposed research ? :

NO

Is Certificate from Institutional Biosafety Committee Required in the proposed research ? : ${\rm NO}$

Any other relevant information:

Dear sir, We are very much thankful for giving us this opportunity for submitting our proposal and we are looking for a favorable decision. Thank you

Suitability of the proposed work in major national initiatives of the Government:

Not Applicable

Theme of Proposed Work:

Energy, Environment

Experimental Investigation on Emission Control Systems

OBJECTIVE:

To enhance the improvement of Diesel Particulate Filter and Exhaust gas Recirculation systems in a diesel engines for reducing the Particulate matter & Oxides of Nitrogen.

1. Introduction

Diesel engines fuels are most promising and low-cost alternative to gasoline engines worldwide. In the recent years, increased demand for use of conventional diesel engines in various sectors such as power plants and automobile manufacturing across the world is observed.

The encouraging anticipation of additional improvements and to meet the demands a necessary upgradation of the technology in terms of power, fuel economy and emissions is to be meet by conventional diesel engine manufacturers. The stringent emission legislations are compelling engine manufacturers to develop technologies to contest exhaust emissions.

To fulfill these emission regulations with competitive fuel economy, exhaust gas aftertreatment and optimized combustion are necessary. However, it is still under R&D stage globally, which will succeed by considering production and economic feasibility.

2. Background

2.1. Major Emissions in Diesel Engine:

2.1.1. Oxides of Nitrogen (NO_x):

Generally, when the diesel engine combustion chamber temperature reaches the critical temperature NO_x emissions are produced. NO_x comprise of nitric oxide (NO) and nitrogen dioxide (NO₂) and both are considered to be deleterious to humans as well as environmental health. NO_2 is considered to be more toxic than NO. It affects human health directly and is a precursor to ozone formation, which is mainly responsible for smog formation.

EGR application is one of the effective techniques in diesel engines and has an important role in reducing the NO_x emissions. Due to the recirculation of exhaust, the NO_x is reduced with the penalty on HC, CO and smoke emissions. Higher soot generated by EGR leads to long-term usage problems inside the engines such as higher carbon deposits, lubricating oil degradation and enhanced engine wear.

2.1.2. Particulate matter (PM):

PM includes the fine black carbon particles; it is mainly produced by incomplete combustion of an air-fuel mixture in combustion chamber. Soot can consist of acids, chemicals, metals, soils, and dust. The particulate matter has been a serious concern for human health due to its direct and broad impact on the respiratory organs.

The diesel particulate filters (DPF) used in diesel vehicles are designed to ensure that no harm-full particles make their way through the exhaust pipe. Though, the exhaust from newer-

model engines is not hot enough to free the filters from soot particles on a regular basis such as Spontaneous Regeneration, Dynamic Regeneration, and Service Regeneration.

In this methodology let us understand the insights with a real-life example:

Nowadays, there are filters to the capture the largest of these soot particles. If the vehicle travels a longer distance, the accumulates soot in the filter burned off due to the raise in temperature up to 500 to 6000 Celsius and the filter is regenerated. For shorter distance travel, the accumulated soot cannot burn in the filter due to the lower temperature. The problem is Soot particles only burns above the temperatures of 500 to 600 degrees Celsius. Until now the temperature of the truck exhaust is increasingly dropping as part of the effort to minimize emissions of nitric oxides harmful to the environment.

Since EGR mainly emits Soot by reducing the NOx due to its temperature drop and in other cases, if the temperature is increased in combustion chamber Soot gets reduce but NOx will increase. Hence here the major attention is required to reduce the NOx and Soot.

However, advanced technologies like EGR, soot trap and exhaust gas after-treatment process will be essential to cater to the challenges posed by environmental emission legislations.

3. Planned Research work:

In order to reduce the levels of emissions which are generally observed in conventional diesel engine, a set of experiments are proposed to study the influence various engine parameters of NO_x and exhaust gas re-circulation (EGR) emissions. To estimate the suitable rates of EGR which efficiently controls the rate of NO_x emissions. To develop an efficient and small-scale technique which reduces the particulate matter emission using diesel particular filter (DPF). Further, to investigate the role of combined EGR and DPF on reducing the emission levels and thereby improving the performance of the engine.

- In the first phase of experiments, the EGR rates will be optimized for various engine loading conditions. Effect of EGR on engine performance parameters and emissions namely thermal efficiency, brake specific energy consumption, smoke opacity, carbon monoxide, hydrocarbons, NO_x, CO₂, etc. will also be investigated.
- ➢ In the second phase of experiments, the DPF will be investigated with various engine loading conditions. A silicon carbide wall flow filter will be used to control the Soot with its heating of DPF.
- In the final phase of experiments, with the Combination of EGR and heating of DPF will be investigated to find its effects on diesel engine.

Implementation of new techniques for heating DPF, which effectively regenerates the DPF even at low exhaust gas temperatures. To enhance the engine performance by reducing the emission levels a combined used of EGR and modified DPF can be used.

Thus the objective of proposed research work is to reduce the emission levels in a conventional diesel engine by simultaneously utilizing EGR and modified DPF.

Main requirement for the Project:

- a) Computerized Diesel Engine setup
- b) Exhaust Gas Recirculation (EGR) System
- c) Diesel particulate filter (DPF)
- d) Exhaust Gas analyzers

e) Smoke meter and necessary accessories.

4. Expected Outcomes:

- \checkmark A critical balance of NO_x and particulate matter emissions can be achieved by implementing new techniques.
- ✓ Feasible portable heating system for DPF can be developed and implemented in the real life applications.
- ✓ Simultaneous use of exhaust gas re-circulation and heating of DPF will probably improve the reduction of combustion chamber temperature aiding to reduction in emissions.
- ✓ Enhanced performance characteristics of the conventional diesel engine can be observed.

5. Work Plan on Proposed Research Work:

Duration of 3 years will the mentioned objectives will be completed.

Parameters	Duration (3 years)
Literature Survey	2 Months
Selection, designing and procuring of EGR and	2 Months
DPF Systems	
Experimental Investigation	6 Months
Data Analysis	6 Months
Articles Writing	6 Months
Final report preparation and submission.	3 Months
Participation of Conferences	2 Months
Host Institution Attendance	9 Months
Total:	3 Years
Progress work Submissions	Once in Year

Table 1. Work layout on proposed research work

References:

- 1. Y.A. Levendis, I. Pavlatos, R. Abrams, Control of diesel soot, hydrocarbon and NOx emissions with a particulate trap and EGR, in: *SAE* 940460, 1994.
- 2. J.B. Heywood, Internal Combustion Engines Fundamentals, International ed., Mc-Graw Hill, New-York, 1988.
- 3. N. Ladommatos, R. Balian, R. Horrocks, L. Cooper, The effect of exhaust gas recirculation on 4. soot formation in a high-speed direct-injection diesel engine, in: *SAE* 960841, 1996.
- 4. G.H. Abd-Alla, Using exhaust gas recirculation in internal combustion engines: a review, *Energy Conversion Management* 43 (2002) 1027–1042.

- 5. M. Zheng, G.T. Reader, J.G. Hawley, Diesel engine exhaust gas recirculation a review on advanced and novel concept, *Energy Conversion Management* 45 (2004) 883–900.
- 6. G. Stumpp, W. Banzhaf, An exhaust gas recirculation system for diesel engines, in: *SAE* 780222, 1978.
- 7. R.M. Wagner, J.B. Green Jr., T.Q. Dam, K.D. Edwards, J.M. Storey, Simultaneous low engine-out NOx and particulate matter with highly diluted diesel combustion, in: *SAE* 2003-01-0262, 2003.
- 8. Antiopi-Malvina Stamatellou, Anastassios Stamatelos, Overview of Diesel particulate filter systems sizing approaches, *Applied Thermal Engineering* 121 (2017) 537–546.
- Yu Quan-shun, Tan Jian-wei, Ge Yun-shan, Hao Li-jun, Peng Zi-hang, Application of Diesel Particulate Filter on in-use On-road Vehicles, *Energy Procedia* 105 (2017) 1730 – 1736.

CURRCULUM VITAE



PERSONAL DETAILS:

Name	: Dr. M. Vijay Kumar					
Date of Birth	: 15/06/1987 (34 Years)					
Wife Name	: M. Sravanthi					
Father's Name	: Late. M. Bansi					
Mother's Name	: M. Kamala					
Permanent Address	: H.No.: 3534, MIG 2 nd Phase, BHEL, R.C. Puram,					
	Sangareddy-502032. Telangana, India.					
E-Mail	: vijaykumar.iitm37@gmail.com					
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A CADEMIC DETAILS.						
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SCOPUS ID	: 57192940392					
ORCID ID	: 0000-0001-6284-3941					
RESEARCHER ID	: D-5451-2019					
GOOGLE SCHOLAR ID	: BRvSSwIAAAAJ					
Total Teaching Experience (in years)	: 4 years					
Area of Specialization	: Mechanical in Thermal Engineering, Fuels,					
	Combustion and Emission Control Systems.					

CAREER OBJECTIVE:

Looking for a challenging research environment where my knowledge and experience can be shared and enriched.

ARTICLE CITATIONS:

WoS Researcher Citation		Scopus Citation Mendeley Citation		Research Gate Citation		Google Scholar Citation			
Citation	: 133	Citation	: 183	Citation	: 210	Citation	: 256	Citation	: 292
H-Index	: 5	H-Index	: 5	H-Index	: 5	H-Index	: 7	H-Index	: 7
i10-Index	: 0	i10-Index	: 0	i10-Index	: 0	i10-Index	: -	i10-Index	: 7

EXPERIENCES:

Organization	Designation	Period			
		From	То	Total	
IC & SR at IIT Madras, India	Project Associate (Adhoc)	1/8/2011	10/03/2012	7 months, 10 Days	
K. L. University at Guntur, A.P., India	Assistant Professor (Regular)	30/4/2012	14/12/2013	1 year, 7 months, 15 Days	
Malla Reddy Engineering College(A) at Secunderabad, T.S.	Assistant Professor (Regular)	19/7/2018	Presently Working		

EDUCATIONAL QUALIFICATIONS:

Degree	Institute/University	Specialization	Year of passed out
10 th Standard	St. Ann's High School (BHEL Township, Hyderabad, Telangana, India)	Maths, Science and Social	2003
Intermediate	Vignan Vidyalam Junior college, Bachupally, Hyderabad, Telangana, India	n Junior college, erabad, Telangana, Maths, Physics and Chemistry	
Bachelor of Technology (B.Tech)	Gokaraju Rangaraju Institute of Engineering and Technology (GRIET) at Hyderabad, Telangana, India	Mechanical Engineering	2009
Master of Technology (M.Tech)	IIT Madras at Tamil Nadu, India	Thermal Engineering	2011
Doctor of Philosophy (Ph.D)	of Philosophy NIT Warangal at Telangana, India Thermal Engineering		16/07/2018

RESEARCH WORK IN M.TECH:

Title: Experimental Investigations in a Francis Turbine **Guide:** Prof. S. Kumaraswamy @ IIT Madras

RESEARCH WORK IN Ph. D:

Title: Studies on the improvement of CI Engine performance, combustion and emissions with the use of biodiesel blends, additives and Engine modifications C is D and K and D and D

Guide: Dr. A. Veeresh Babu and Prof. P. Ravi Kumar @ NIT Warangal.

FACULTY ACHIEVEMENTS:

1. Received **BEST TEACHER** award of entire Department of Mechanical Engineering at MREC (A) on September 2021 for A.Y. 2019-2020.



2. Received the **Honorarium** for publishing the article/books in **SCI/Scopus/WoS** Indexed Journal at **Malla Reddy Engineering College** (Autonomous).



 Attended as a subject expert for Minutes of the Selection Committee Meeting (SCM) at St. Peter's Engineering College, Secunderabad, Hyderabad, Telangana, India, on 23/12/2019 at 9.00AM.

FDP ORGANIZED:

- Six days Faculty Development Program on "Essential Computational Techniques for Research" at Malla Reddy Engineering College (Autonomous), Hyderabad, India. During 1st – 6th July 2019 (Organized as a Coordinator). Resource Persons:
 - Dr. Kanmani Subbu from IIT Palakkad
 - Dr. Hari Kumar Voruganti from NIT Warangal
 - Dr. M.J. Davidson from NIT Warangal
- Six days Virtual Faculty Development Program on "Recent Innovative Developments in Thermal Engineering" at Malla Reddy Engineering College (Autonomous), Hyderabad, India. During 28th June – 03rd July 2021 (Organized as a Coordinator). Resource Persons:
 - Prof. P.M.V.S. Subbarao Professor, IIT Delhi.
 - Dr. Rahul Dev Assistant Professor, MNNIT, Allahabad.
 - Dr. G. Mohan Murali Krishna Post Doctoral Fellow, University of Munster, Germany.
- Dr. T. V. Arjunan Professor and Head, Guru Ghasidas Vishwavidyalaya (Central University), Chhattisgarh.
- Dr. Tikendra Nath Verma Assistant Professor, MANIT, Bhopal.
- Dr. Shashi Kant Verma Post Doctoral Fellow, Institute for Plasma Research, Ahmedabad.

INSTITUTE LEVEL ADDITIONAL RESPONSIBILITIES:

S. No.	Additional Services rendered to the Institute	College	Level (Central)	Period	Award/Ranking Received
1.	ARIIA-2021 Coordinator	MREC(A), Telangana	Central	A. Y. 2020- 2021	Received "BAND Performer"
2.	ARIIA-2022 Nodal Officer	MREC(A), Telangana	Central	A.Y. 2021- 2022	Under Data Submission
3.	IPR Cell Coordinator	MREC(A), Telangana	Central	A. Y. 2021 - Till Date	- None -

DEPARTMENT LEVEL ADDITIONAL RESPONSIBILITIES:

S. No.	Additional Services rendered to the Institute	College	Level (UG/PG/Departmental)	Semester	Period
1	Department PG	MREC(A),	PG (Thermal Engineering)	Odd & Even	A. Y. 2018 -
1.	Coordinator	Telangana	r G (Thermar Engineering)		Till Date
2.	Department R&D	MREC(A),	LIG & PG	Odd & Even	A. Y. 2019 -
	Coordinator	Telangana	00 & 10		Till Date
3.	Laboratory In-charge for Advanced Heat and Mass transfer	MREC(A), Telangana	PG (Thermal Engineering)	Odd & Even	A. Y. 2018 - Till Date
4	Departmental R&D	MREC(A),	Donortmontol		A. Y. 2019-
4.	NBA Coordinator	Telangana	Departmentar		2021
5	Departmental R&D	MREC(A),	Departmental	Odd & Even	A. Y. 2019-
5.	NAAC Coordinator	Telangana	Departmentar		2021
6	Departmental R&D	MREC(A),	Departmental	Odd & Even	A. Y. 2019-
6.	UGC Coordinator	Telangana	Departmentar		2020

EDITORIAL BOARD MEMBER:

1. Editorial board member in "Progress in Energy & Fuels", 2018, Pisco Med Publishing, ISSN (P): 2251-2640, ISSN (O): 2315-4640.

<u>REVIEWER FOR JOURNALS</u>:

- 1. Reviewer in "Environmental Science and Pollution Research", Springer publications Indexed in SCI.
- 2. Reviewer in "Energy conversion and management", Elsevier publication Indexed in SCI.
- 3. Reviewer in "Journal of the Taiwan Institute of Chemical Engineers", *Elsevier publication Indexed in SCI*.
- 4. Reviewer in "Alexandria Engineering Journal", *Elsevier publications Indexed in Scopus and SCI*.
- 5. Reviewer in "Journal of the Institution of Engineers (India): Series C", Springer publications Indexed in SCI.
- 6. Reviewer in "Heliyon", Elsevier publication Indexed in Scopus.
- 7. Reviewer in "Environmental Technology", *Taylor and Francis publications Indexed in SCI*.
- 8. Reviewer in "Energy Sources, Part A: Recovery, Utilization, and Environmental Effects", *Taylor and Francis publications Indexed in SCI*.
- 9. Reviewer in "Journal of Nanoscience and Nanotechnology Applications", Scholarena EMS Journals *publications*.

RECOGNITIONS IN REVIEWING JOURNALS:

- 1. Received a "Certificate of reviewing" in Heliyon, Awarded on January 2019. *Elsevier publications Indexed in Scopus.*
- 2. Received a "Certificate of reviewing" in Energy conversion and management, Awarded on July 2018. *Elsevier publications Indexed in SCI*.
- 3. Received a "Certificate of outstanding contribution in reviewing" in Alexandria Engineering Journal, Awarded on March 2017. *Elsevier publications Indexed in Scopus and ESCI*.
- 4. Received a "Certificate of reviewing" in Alexandria Engineering Journal, Awarded on October 2016. *Elsevier publications Indexed in Scopus and ESCI*.

<u>RESEARCH INTEREST</u>:

- Low temperature combustion, Advanced clean combustion with high efficiency engines, forward/backward combustion control, Biofuel research, high-power-ignition control, combustion diagnostic, After-treatment control and modeling.
- Solar Power generation with Photovoltaic Technology.
- Micro Channels
- Detection of cavitations through acoustic generation in turbine blades and pump Impellers
- Friction Welding
- Fibre Reinforced polymer composites materials

INTERESTED SUBJECTS:

- Internal Combustion Engine
- Thermal Engineering-1
- Alternative fuels
- Waste to Energy

- Refrigeration and Air Conditioning
- Thermodynamics
- Fluid mechanics and Hydraulic Machines
- Energy Conservation and Energy Management

M.TECH SUPERVISION:

S.No	Student Name & Roll No.	Project Title	College Name	Batch	Year of Completion	Article Published
1.	Mr. U. Gopala Rao (17J41D2117)	Influence of Variable Speed on Performance & Emission characteristics of Diesel Engine Using Fish Oil Biodiesel Blends	MREC(A), Hyderabad	MR17	February, 2020	IJRTE Indexed in Scopus (January, 2020)
2.	K. Eshwara Chary (17J41D2108)	Thermal Investigation of Metal Oxide Based Nano Coolant Used In Automobile Radiators For Enhancing Heat Transfer Characteristics	MREC(A), Hyderabad	MR17	October, 2020	JETIR Indexed in UGC (September, 2020)
3.	M. Nandu	Evaluation of the Performance and Emission of Diesel Engine by using	MREC(A), Hyderabad	MR17	November, 2020	Materials Today Proceedings (Elsevier)

	(17J41D2113)	Sterculia Foetida biodiesel Blend and DMC additive				Indexed in Scopus (January, 2021)
4.	S. Sathya Prakash (18J41D2105)	Numerical Study Of The Heat Dissipation Of Rectangular Heat Sink Under Natural Convection With Different Slots	MREC(A), Hyderabad	MR18	October, 2020	IJMPERD Indexed in Scopus (June, 2020)
5.	N. Sai Ganesh (18J41D2103)	Influence of TBC with Diesel and MME Fuels on a LHR Engine	MREC(A), Hyderabad	MR18	On Going	IOP Conference Series: Materials Science and Engineering Indexed in Scopus (October, 2021)
6.	S.S. Gowtham Reddy (19J41D2107)	Study on the Performance and Emissions of Diesel Engine by Fish Methyl Ester and DEE Additive in a Diesel Engine Fuel	MREC(A), Hyderabad	MR19	On Going	Materials Today Proceedings (Elsevier) Indexed in Scopus (February, 2021)

<u>B.TECH SUPERVISION</u>:

S. No	Student Names & Roll No.	Project Title	College Name	Batch	Year of Completion
1.	Mr. B.V.N.S. Vivek (15J41A03D1)	Agriculture Robot	MREC(A), Hyderabad.	MR15	April, 2019
2.	Mr. Shanmukha Reddy (15J41A03H8) Mr. N. Jaya Prakash (15J41A03G1) & Mr. R. Sai Pranay (15J41A03H0)	Design and Simulation of Torque Converter	MREC(A), Hyderabad.	MR15	April, 2019
3.	Mr. B. Hithesh Rao (15J41A03K1) Mr. B. Jatin (15J41A03K2) Mr. Ch. Srikesh Kumar (15J41A03K6) & Mr. D. Sai Kiran (15J41A03K8)	Design & Fabrication of Hybrid Power Generation	MREC(A), Hyderabad.	MR15	April, 2019
4.	Mr. K. Manish Ashwin (16J41A03L2) Mr. G. Ganesh (16J41A03K7) Priyansh Sharma (16J41A03N0) & T. Annapurna (16J41A03N9)	Investigation of Temperature Separation Phenomenona in the Vertex Chamber	MREC(A), Hyderabad.	MR16	June, 2020
5.	Mr. P. Satish (16J41A03M7) T. Rajitha (16J41A03P0) V.L.S. Deepthi (16J41A03P5) &	Design and Evaluation of Camshaft Used in Multi Cylinder Engine	MREC(A), Hyderabad.	MR16	June, 2020

	T. Pavan Kalyan (16J41A03Q0)				
6.	Mr. P. Nagendra (18J45A0337) Mr. P. Santosh (18J45A0339) Mr. V. Prudhvi (18J45A0341) Mr. T. Suprabath (18J45A0345) & Mr. U. Ramu (18J45A0346)	Design and Analysis of Frictionless Gear Transmission	MREC(A), Hyderabad.	MR18	June, 2021

LIST OF PATENTS PUBLISHED:

National Patent Published: 01

S. No	Title of the Invention	Name of the Applicant/Inventor	Application No.	Publication Date	Year
1.	Automatic Book Placer	Bethi Saneeth Middela Aay Eggam Gayatri Gokam Dinesh Dr A Raveendra Dr Halesh Koti Dr. A. Paul Praveen Dr. M. Vijay Kumar	202141060066	28-01-2022	2021

LIST OF JOURNALS PUBLISHED:

> SCI Indexed: 03 Nos.

- M. Vijay Kumar, A. Veeresh Babu, P. Ravi Kumar. "Influence of metal-based cerium oxide nanoparticle additive on performance, combustion, and emissions with biodiesel in diesel engine". *Environmental Science and Pollution Research* 2019, 26:8; 7651-7664. IF: 2.83. Springer Publications. ISSN: 0960-1481.
- M. Vijay Kumar, A. Veeresh Babu, P. Ravi Kumar. "Experimental investigation on the effects of diesel and mahua biodiesel blended fuel in direct injection diesel engine modified by nozzle orifice diameters". *Renewable energy* 2018, 119: 388-399. IF: 5.43. *Elsevier Publications*. ISSN: 0944-1344.
- 3. M. Vijay Kumar, A. Veeresh Babu, P. Ravi Kumar. "The impacts on combustion, performance and emissions of biodiesel by using additives in direct injection diesel engine:

Review". *Alexandria Engineering Journal* 2018, 57:1; 509-516. IF: 3.69. *Elsevier Publications*. ISSN: 1110-0168.

Emerging SCI/Scopus/WoS Indexed: 09 Nos.

- M. Vijay Kumar, S. Sudhakara Reddy, K. Mallikarjuna. "Experimental Investigation of B20 blend in the DI diesel engine with a modification of smaller orifice injection nozzle and after treatment systems (EGR+DPF)". *International Journal of Ambient Energy* 2021; *Taylor and Francis Publications*. ISSN: 2162-8246. doi.org/10.1080/01430750.2021.1919202
- M. Vijay Kumar, N. Sai Ganesh. "Influence of TBC with Diesel and MME Fuels on a LHR Engine". *IOP Conference Series: Materials Science and Engineering* 2021; *IOP Publications*. ISSN: 1757-8981. Accepted.
- M. Vijay Kumar, S. Sai Gowtham Reddy. "Study on the Performance and Emissions of Diesel Engine by Fish Methyl Ester and DEE Additive in a Diesel Engine Fuel". *Materials Today: Proceedings* 2021; *Elsevier Publications*. ISSN: 2214-7853. DOI: 10.1016/j.matpr.2020.12.648
- M. Vijay Kumar, M. Nandu. "Evaluation of the Performance and Emission of Diesel Engine by using Sterculia Foetida biodiesel Blend and DMC additive". *Materials Today: Proceedings* 2021; *Elsevier Publications*. ISSN: 2214-7853. DOI: 10.1016/j.matpr.2020.11.620
- S. Sathya Prakash, M. Vijay Kumar. "Numerical Study of the Heat Dissipation of Rectangular Heat Sink under Natural Convection with Different Slots". *International Journal of Mechanical and Production Engineering Research and Development* 2020; 10:3; 12085-12096. *Trans Stellar Publications*. ISSN: 2249-6890.
- M. Vijay Kumar, A. Veeresh Babu, P. Ravi Kumar, T. Manoj Kumar Dundi. "Influence of different nozzle hole orifice diameter on performance, combustion, and emissions in a diesel engine". *Australian Journal of Mechanical Engineering* 2020; 18:2; 179-184. *Taylor and Francis Publications*. DOI: 10.1080/14484846.2018.1453975. ISSN: 2204-2253.
- M. Vijay Kumar, A. Veeresh Babu, P. Ravi Kumar. "Production of biodiesel from crude mahua oil by two steps of transesterification process". *Australian Journal of Mechanical Engineering* 2019, 17:1; 2-7. *Taylor and Francis Publications*. ISSN: 2204-2253.
- M. Vijay Kumar, A. Veeresh Babu, P. Ravi Kumar. "Experimental investigation on mahua methyl ester blended with diesel fuel in a compression ignition diesel engine". *International Journal of Ambient Energy* 2019, 40:3; 304-316. *Taylor and Francis Publications*. ISSN: 2162-8246.
- M. Vijay Kumar, A. Veeresh Babu, P. Ravi Kumar, S. Sudhakara Reddy. "Experimental investigation of the combustion characteristics of Mahua oil biodiesel-diesel blend using a DI diesel engine modified with EGR and nozzle hole orifice diameter". *Biofuel Research Journal* 2018, 19; 863-871. *Green Wave Publishing of Canada.* ISSN: 2292-8782.

> <u>UGC Peer-reviewed Journals</u>: 09 Nos.

1. K. Eshwara Chary, **M. Vijay Kumar**. "Thermal Investigation of metal Oxide Based Nano Coolant Used in Automobile Radiators for Enhancing Heat Transfer Characteristics". *Journal of Emerging Technologies and Innovative Research* 2020, 7:9; 777-784. ISSN: 2349-5162.

- M. Vijay Kumar, U. Gopala Rao. "Influence of Variable Speed on Performance and Emission Characteristics of Diesel Engine using Fish Oil Biodiesel Blends". *International Journal of Recent Technology and Engineering* 2020, 8:5; 3950-3954. *Blue Eyes Intelligence Engineering and Sciences Publications*. ISSN: 2277-3878.
- M. Vijay Kumar, A. Veeresh Babu, P. Ravi Kumar, B. Narendra. "Reduction of nitrogen oxides emissions in a single cylinder compression ignition engine using cool exhaust gas recirculation system". *Iranica Journal of Energy and Environment* 2016, 7:3; 268-273. *BUT Publications*. ISSN: 2079-2115.
- P. Ravi Kumar, M. Vijay Kumar, A. Veeresh Babu. "Investigation on a Direct Injection Diesel Engine fuelled with blends of Waste Plastic Oil with a Three hole Fuel Injection Nozzle". *International Journal of Environmental Engineering* 2015; 2(2): ISSN: 2374-1724.
- A. Veeresh Babu, M. Vijay Kumar, P. Ravi Kumar. "Investigation on the Performance and Emission Characteristics of Biodiesel (Animal oil)-Ethanol Blends in a Single Cylinder Diesel Engine". *International Journal of Environmental Engineering* 2015; 2(2): ISSN: 2374-1724.
- Dheeraj Kalra, A. Veeresh Babu, M. Vijay Kumar. "Effects of LPG on the performance and emission characteristics of SI engine - An Overview". *International journal of engineering development and research* 2014; 2(3): ISSN: 2321-9939.
- 7. Jagadeshwar Kandula, **M Vijay Kumar**. "Experimental Analysis on Multi Hole Nozzle Jet Pump". *International Journal of Modern Engineering Research* 2013; 3(1): 193-198.
- V. Manoj Kumar, M. Vijay Kumar. "Six Sigma Approach to Quality Assurance in Global Supply Chains". *International Journal of Science and Research*, 2013; 2(4): ISSN: 2319-7064.
- Rajani Pragada, M. Vijay Kumar, Prasanna Gangaraju. "Micro machining of Metals, Ceramics, Silicon and Polymers Using Nanosecond Lasers". International Journal of Emerging Technology and Advanced Engineering, 2013; 3(4): ISSN 2250-2459.

List of International Conferences: 5 Nos.

- M. Vijay Kumar, Dr. A. Veeresh Babu, Dr. P. Ravi Kumar. "Experimental Investigations on the Performance and Emission Characteristics of Low Heat Rejection Engine using Diesel and Mahua Methyl Ester as a Fuel". *International Conference on Environment and Energy* on 15-17th December 2014 at JNTU Hyderabad, India.
- M. Vijay Kumar, Dr. A. Veeresh Babu, Dr. P. Ravi Kumar. "Evaluation of performance and emission characteristics of biodiesel blends with diesel in a single cylinder DI diesel engine". *Global Conference on Renewable Energy* on 4-6th March 2016 at NIT Patna, India.
- 3. **M. Vijay Kumar**, Dr. A. Veeresh Babu, Dr. P. Ravi Kumar. "Experimental investigations of emissions and performance of a diesel engine using diesel and waste plastic oil by multi fuel injectors". *Global Conference on Renewable Energy* on 4-6th March 2016 at NIT Patna, India.

- 4. **M. Vijay Kumar**, A. Veeresh Babu, P. Ravi Kumar. "Effects of different nozzle hole orifice diameter on performance, combustion, and emissions in a diesel engine". 4th International on advance in computer science and engineering (WARSE organizers) on 15th July 2017 at Hyderabad, India.
- Ganesh S. Warkhade, A. Veeresh Babu, Katam Ganesh Babu, Gopi Gulivindala, M. Vijay Kumar. "Effect of compression ratio on combustion characteristics of an esterified linseed oil fuelled diesel engine". 1st International and 18th ISME conference on Enabling Suatainable Development on 23-25th February at NIT Warangal, India.
- M. Vijay Kumar & Sai Ganesh. "Study on the Performance and Emissions of Diesel Engine by Fish Methyl Ester and DEE Additive in a Diesel Engine Fuel". *International E-Conference on Sustainable Development in Mechanical Engineering* on 30-31 October at VNRVJIET, Hyderabad, India.
- M. Vijay Kumar & Goutham Reddy. "Effect of compression ratio on combustion characteristics of an esterified linseed oil fuelled diesel engine". *International E-Conference on Sustainable Development in Mechanical Engineering* on 30-31 October at VNRVJIET, Hyderabad, India.

WORKSHOP PARTICIPATED:

- 1. Participated in **IUCEE-EPIC Orientation Workshop** at CMR College of Engineering & Technology at Hyderabad, India. Conducted on 4th February 2019.
- Participated in Two day National Workshop on "Advances in Sustainable Energy Studies" organized by the department of mechanical at NIT Warangal, India. During 1st – 2nd November 2014.
- 3. Participated in **NPTEL Workshop** at IIT Madras, India. Conducted on 8th July 2010.

COURSES ATTENDED:

- 1. Participated in **FDP** on "ICT in Advanced Manufacturing Engineering" organized by the E&ICT Academy, NIT Warangal, India. During 27th May- 1st June 2019.
- Participated in GIAN course on "Urban Disaster Risk Reduction Using Geospatial Technologies" organized by the JNTUH College of Engineering Hyderabad, India. During 12th – 21st December 2018.
- Participated in Six days short term training program on "Computational Research Techniques Using MATLAB" organized by the NIT Warangal, India. During 26th – 31st December 2017.
- 4. Participated in **GIAN course** on "Thermal Management of Electronics" organized by the NIT Warangal, India. During 30th October 3rd November 2017.
- Participated in FDP on "Effective methods of teaching the course on Internal Combustion Engines and Alternate Power Sources for Automobiles" organized by the NIT Warangal, India. During 19th October – 24th October 2017.

- 6. Participated in **GIAN course** on "Biofuel engineering" organized by the JNTU Hyderabad, India. During 11th July-15th July 2016.
- Participated in GIAN course on "Advanced material for sustained energy and storage" organized by the department of chemistry at NIT Warangal, India. During 23rd May-3rd June 2016.
- 8. Participated in **Training program** on "PRO/Engineer W.F. 4.0 at MiTsU CAD/CAM Solutions, Hyderabad, India. During August 2008.

PERSONAL STRENGTHS:

- Exceptionally strong sense of professionalism and pride in the work
- Excellent computer skills
- Passionate in Research Work

HOBBIES:

- > Trekking
- Reading News Papers
- > Watching Television and listening to music

Declaration

I hereby declare that the information provided above is correct to the best of my knowledge.

Place: Hyderabad Date: 12/02/2022

Dr. M. Vijay Kumar



Grams : NITWGL FAX : +91-870-2459547 Website: www.nitw.ac.in Phones: +91-870-2462010 +91-870-2459366

NATIONAL INSTITUTE OF TECHNOLOGY WARANGAL – 506 004, Telangana, INDIA

ENDORSEMENT CERTIFICATE FROM THE HOST INSTITUTE

(should be issued in official letterhead or with office seal)

This is to certify that:

- The applicant, Dr. M. VIJAY KUMAR will assume full responsibility for implementing the project. Dr.
 A. VEERESH BABU, Associate Professor, Mechanical Engineering Department can act as mentor for the applicant in case the project proposal is approved for funding.
- II. The associateship will start from the date on which the faculty member joins University / Institute where he / she implements the grant. The mentor will send the joining report to the SERB. SERB will release the funds on receipt of the joining report.
- III. Institute will issue a mandatory 90 days attendance certificate upon completion by the candidate every year for release of fellowship.
- IV. The applicant, if selected as a TARE grantee, will be governed by the rules and regulations of the Universities / Institute and will be under administrative control of the University / Institute for the duration of the grant.
- V. The grant-in-aid by the Science & Engineering Research Board (SERB) will be used to meet the expenditure on the project and for the period for which the project has been sanctioned as indicated in the sanction letter/ order.
- VI. No administrative or other liability will be attached to the Science & Engineering Research Board (SERB) at the end of the Research grant.
- VII. The University/ Institute will provide basic infrastructure and other required facilities to the investigator for undertaking the research objectives.
- VIII. The University/ Institute will take into its books all assets received under this sanction and its disposal would be at the discretion of Science & Engineering Research Board (SERB).
- IX. University/ Institute assume to undertake the financial and other management responsibilities of the project.
- X. The University/Institute shall settle the financial accounts to the SERB as per the prescribed guidelines within the three months from the date of termination of the Research grant.

Signature of the Mentor (DK A . Veeresh Rebu)

Signature of the Head of

Sighature of the Head of the Institute / Registrar

निदेशक राष्ट्रीय प्रौधोगिकी संस्थान, वरंगल Director National Institute of Technology, Warangal.



Malla Reddy Engineering College

(An UGC Autonomous Institution approved by AICTE and affiliated to JNTU Hyderabad, Accredited by NAAC with 'A' Grade (II - cycle) NBA Accredited Programmes - UG (CE, EEE, ME, ECE & CSE) PG (CE - Structural Engg., EEE-Electrical Power Systems, ME - Thermal Engg.).

ENDORSEMENT CERTIFICATE FROM THE PARENT INSTITUTE

This is to certify that:

- I. The applicant <u>Dr. M. VIJAY KUMAR</u> is working as a Associate Professor (designation)* in this institute. We welcome his/her participation in the Project titled: <u>Experimental</u> <u>Investigation on Emission Control Systems</u>
- II. The applicant is in regular position as defined by the term "Regular" in the ECRA eligibility (Please refer www.serb.gov.in).
- III. The applicant, <u>Dr. M. VIJAY KUMAR</u>, will assume full responsibility of implementing the project as Principal Investigator.
- IV. She / He will be allowed to work in the host institute <u>NATIONAL INSTITUTE OF</u> <u>TECHNOLOGY WARANGAL</u> to fulfil the 90 days/year mandatory attendance period required for the research grant.
- V. The date of commencement of the grant starts from the date on which the University/Institute receives the bank draft/cheque from the Science & Engineering Research Board (SERB).
- VI. The grant-in-aid by the Science & Engineering Research Board (SERB) will be used to meet the expenditure on the project and for the period for which the project has been sanctioned as indicated in the sanction letter/ order.
- VII. No administrative or other liability will be attached to the Science & Engineering Research Board (SERB) at the end of the Research grant.
- VIII. The University/ Institute will provide basic infrastructure and other required facilities to the investigator for undertaking the research objectives.
- IX. The University/ Institute will take into its books all assets received under this sanction and its disposal would be at the discretion of Science & Engineering Research Board (SERB).
- X. University/ Institute assume to undertake the financial and other management responsibilities of the project.
- XI. The University/ Institute shall settle the financial accounts to the SERB as per the prescribed guidelines within the three months from the date of termination of the Research grant.

Dated: 14/03/2022

Signature of the Registrar of University, Head of Institute Maisammaguda, Dhulapally,

(Post Via Kompally), Sec'bad-500100,

SHORT CV OF MENTOR

A short CV not exceeding five pages must be upload in the online portal.

Should carry the information regarding the academic and research qualification and accomplishments of the mentor.

Should carry the details about no. Ph.D. and Postdoctoral fellows (from all sources) working at present with the mentor.

Should have the list of papers published (only in SCI indexed journals) in the last five year.

Undertaking by the Principal Investigator

То

The Secretary SERB, New Delhi

Sir

1 Dr. M. Vijay Kumar herby certify that the research proposal titled <u>Emission</u> Control Systems by Using After Treatment Process in Diesel Engines submitted for possible funding by SERB, New Delhi is my original idea and has not been copied/taken verbatim from anyone or from any other sources. I further certify that this proposal has been checked for plagiarism through a plagiarism detection tool i.e. <u>TURNITIN SOFTWARE</u> approved by the Institute and the contents are original and not copied/taken from any one or many other sources. I am aware of the UGCs Regulations on prevention of Plagiarism i.e. University Grant Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulation, 2018. I also declare that there is no plagiarism charges established or pending against me in the last five years. If the funding agency notices any plagiarism or any other discrepancies in the above proposal of mine, I would abide by whatsoever action taken against me by SERB, as deemed necessary.

14/03/2022 Signature of the PI with date

Name: **Dr. M. Vijay Kumar** Designation: **Associate Professor**

CERTIFICATE FROM THE INVESTIGATOR

I, Dr. M. Vijay Kumar, Associate Professor from MALLA REDDY ENGINEERING COLLEGE (Autonomous) (University / college / institute) agree to undertake the following, if I am offered the SERB – TARE, research grant.

- 1. I shall abide by the rules and regulations of SERB during the entire tenure of the grant.
- 2. I shall also abide by the rules, discipline of the institutions where I will be implementing my grant.
- 3. I shall devote adequate time to fulfil the requirements of the programme to execute the research work during the tenure of the grant.
- 4. I shall prepare the progress report at the end of each year and communicate the same to SERB duly certified by the mentor.
- 5. I shall send two copies and one soft copy (PDF file) of the consolidated progress report duly certified by the mentor at the end of the grant.

03 2022 Date: 14

Signature plicant