DISSERTATION REPORT

on

SOLAR POWER ADSORPTION REFRIGERATION SYSTEM

Submitted by

Mr. AVINASH VITTHAL KANADE

PG Student

Under the Guidance of

Prof. A. V. KULKARNI

in partial fulfilment for the award of

Master Degree in Mechanical Engineering - Heat Power

of

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

AURANGABAD (M.S.)

Department of Mechanical Engineering

Shreeyash College of Engineering and Technology, Aurangabad

Maharashtra state, India

(2015)

CERTIFICATE

This is to certify that, the dissertation entitled **"Solar Power Adsorption Refrigeration System"**, which is being submitted herewith for the award of the **'Master of Engineering'** in **'Mechanical Engineering – Heat Power'** of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra State. This is the result of the original research work and contribution by **'Mr. Avinash Vitthal Kanade'** under my supervision and guidance. The work embodied in this dissertation has not formed earlier for the basis of the award of any degree or compatible certificate or similar title of this any other diploma/examination body or university to the best of knowledge and belief.

Place: Aurangabad

Date: 23/oc/2015

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DISSERTATION REPORT

on

"DESIGN & FINITE ELEMENT ANALYSIS OF GUIDE PILLAR FOR COMPOUND PRESS TOOL"

Submitted by

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DISSERTATION REPORT

on

EXPERIMENTAL INVESTIGATION OF THE SUITABILITY OF ORANGE PEEL OIL AS A BLEND WITH COTTON SEED OIL AS ALTERNATE FUEL FOR DIESEL ENGINES

Submitted by

Miss. JYOTI MADHAV PHATE

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Experimental Investigation of the Suitability of Orange Peel Oil as a Blend with Cotton Seed Oil as Alternate Fuel for Diesel Engines

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stract— As a renewable, sustainable and alternative fuel for pression ignition engines, biodiesel instead of diesel has been easingly fueled to study its effects on engine performances and issions in the recent 10 years. But these studies have been rarely iewed to favor understanding and popularization for biodiesel so In this work, reports about biodiesel engine performances blished by highly rated journals in scientific indexes, were cited ferentially since 2000 year. From these reports, the effect of odiesel on engine power, economy, durability and the rresponding effect factors are surveyed and analyzed in detail. The e of biodiesel leads to the imperceptible power loss, the increase in el consumption and increase in break thermal efficiency in nventional diesel engines with no or fewer modification. And it rors to reduce carbon deposit and wear of the key engine parts. herefore, the blends of biodiesel with small content in place of troleum diesel can help in controlling air pollution and easing the ssure on scarce resources without significantly sacrificing engine wer and economy. However, many further researches about timization and modification on engine, low temperature rformances of engine, new instrumentation and methodology for asurements, etc., should be performed when petroleum diesel is bstituted completely by biodiesel.

dex Term—Bio-fuel, Performance, Emissions, alternative fuel

I. INTRODUCTION

Diesel engine will be the major power source for tomobiles in the twenty-first century. To reduce emissions nd solve the energy crisis, designing diesel engines with low mission and less energy consumption has always be an bjective for researchers across the globe. However, with the evelopment of new technologies, today's diesel engines have etter emission characteristics and the less energy nsumption compared with its predecessor. But, there is still t to do on diesel engines aimed to achieve our goal of clean nd effective diesel engine. Accordingly, research on a clean rning fuel instead of conventional fuel is advisable, which uld not only decrease exhaust gas to a great extent, but, also ovide more options of energy sources. The use of alternative els for internal combustion engines has attracted a great deal f attention due to fossil fuel crisis and also GHG impact. lternative fuels should be easily available, environment iendly, and techno-economically competitive. Successful lternative fuel should fulfill environmental and energy ecurity needs without sacrificing engine operating erformance. Renewable resources offer the opportunity to tap ocal resources and reduce dependency on fossil energy esources. Most biodiesel oils, particularly of the nonedible type can be used as fuel in diesel engines. One of the promising alternative fuels considered for diesel engine is biodiesel.

Biodiesel fuels are renewable, as the carbon released by the burning of biodiesel fuel is used when the oil crops undergo photosynthesis. Biodiesel also offers the advantage of being able to readily use in existing diesel engines without engine modifications. The alkyl monoester of fatty acids as bio-diesel which was obtained from renewable oil and fats materials by transesterification reaction is a good alternative. Biodiesel can be obtained from raw vegetable oil by transesterification with methanol or ethanol after chemical reactions. Vegetable oils present a very promising alternative to diesel oil since they are renewable and have similar properties as of diesel. Many researchers have studied the use of vegetable oils in diesel engines. This recommends the intensive studies on the use of alternative fuels especially renewable ones like vegetable oils and alcohols. Biodiesels such as Jatropha, Karanja, Sunflower and cottonseed are some of the popular biodiesels currently considered as substitute for diesel.

When biodiesel is used as a substitute for diesel, it is highly essential to understand the parameters that affect the combustion phenomenon which will in turn have direct impact on thermal efficiency and emission. In the present energy scenario lot of efforts is being focused on improving the thermal efficiency of IC engines with reduction in emissions. The problem of increasing demand for high brake power and the fast depletion of the fuels demand severe controls on power and a high level of fuel economy.

II. LITERATURE SURVEY

2.1 Diesel Engine

A **diesel engine** (a type of **compression-ignition engine**) is an internal combustion engine that uses the heat of compression to initiate ignition and burn the fuel that has been injected into the combustion chamber. This contrasts with spark-ignition engines such as a petrol engine (gasoline engine) or gas engine (using a gaseous fuel as opposed to gasoline), which use a spark plug to ignite an air-fuel mixture. The engine was developed by German inventor Rudolf Diesel in 1893.

The diesel engine has the highest thermal efficiency of any standard internal or external combustion engine due to its very high compression ratio.

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"Experimental Investigation of the Suitability of Orange Peel Oil as a Blend with Cotton Seed Oilas Alternate Fuel for Diesel Engines: A Review"

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Abstract: As a renewable, sustainable and alternative fuel for compression ignition engines, biodiesel instead ofdiesel has been increasingly fueled to study its effects on engine performances and emissions in therecent 10 years. But these studies have been rarely reviewed to favor understanding and popularizationfor biodiesel so far. In this work, reports about biodiesel engine performances and emissions, published byhighly rated journals in scientific indexes, were cited preferentially since 2000 year. From these reports,the effect of biodiesel on engine power, economy, durability and emissions including regulated andnon-regulated emissions, and the corresponding effect factors are surveyed and analyzed in detail. Theuse of biodiesel leads to the substantial reduction in PM, HC and CO emissions accompanying with theimperceptible power loss, the increase in fuel consumption and the increase in NOx emission on conventionaldiesel engines with no or fewer modification. And it favors to reduce carbon deposit and wear ofthe key engine parts. Therefore, the blends of biodiesel with small content in place of petroleum dieselcan help in controlling air pollution and easing the pressure on scarce resources without significantlysacrificing engine power and economy. However, many further researches about optimization and modificationon engine, low temperature performances of engine, new instrumentation and methodology formeasurements, etc., should be performed when petroleum diesel is substituted completely by biodiesel.

Keywords: Biofuel,Performance,Emissions,alternative fuel

I. INTRODUCTION

Diesel engine will be the major power source for automobiles in the twenty-first century. To reduce emissions and solve the energy crisis, designing diesel engines with low emission and less energy consumption has always be an objective for researchers across the globe. However, with the development of new technologies, today's diesel engines have better emission characteristics and the less energy consumption compared with its

DISSERTATION REPORT

On

"PERFORMANCE ANALYSIS AND INVESTIGATION OF EMISSIONS OF C.I. ENGINE USING BIODIESEL AND ITS BLENDS"

Submitted by

Mr. NAIK GANESH GORAKH

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Experimental Investigation of the Suitability of Orange Peel Oil, Neem Oil and Cotton Seed Oil as Alternate Fuel for Diesel Engines: A Review

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Abstract: *In 1979 due to sudden increase in prices of the petroleum products by the supplying countries, attention was diverted to find out substitute indigenous vegetable oils as substitute fuel to diesel oil. Lot of work is going on different types of vegetable oils. The major advantage of vegetable oils as fuel is that they are non exhaustible and renewable. Since 10 years, researchers are studying on the effects of biodiesel on engine performance and emissions. The use of biodiesel leads to the substantial reduction in PM, HC and CO emissions accompanying with the imperceptible power loss, the increase in fuel consumption and the increase in NOx emission on conventional diesel engines with no or fewer modification. And it favors to reduce carbon deposit and wear of the key engine parts. Therefore, the blends of biodiesel with small content in place of petroleum diesel can help in controlling air pollution and easing the pressure on scarce resources without significantly sacrificing engine power and economy. However, many further researches about optimization and modification on engine, low temperature performances of engine, new instrumentation and methodology for measurements, etc., should be performed when petroleum diesel is substituted completely by biodiesel. This review has been taken up for identifying the effect of blending neem oil, orange peel oil and cotton seed oil with diesel on engine performance and emissions of CI engine.*

Keywords: biodiesel, Cotton seed oil, Neem oil, Orange peel oil, Performance, Emissions, alternative fuel

1. Introduction

When you submit your paper print it in two-column format, including figures and tables [1]. In addition, designate one author as the "corresponding author". This is the author to whom proofs of the paper will be sent. Proofs are sent to the corresponding author only [2].

Diesel engine will be the major power source for automobiles in the twenty-first century. To reduce emissions and solve the energy crisis, designing diesel engines with low emission and less energy consumption has always be an objective for researchers across the globe. However, with the development of new technologies, today's diesel engines have better emission characteristics and the less energy consumption compared with its predecessor. But, there is still lot to do on diesel engines aimed to achieve our goal of clean and effective diesel engine. Accordingly, research on a clean burning fuel instead of conventional fuel is advisable, which could not only decrease exhaust gas to a great extent, but, also provide more options of energy sources. The use of alternative fuels for internal combustion engines has attracted a great deal of attention due to fossil fuel crisis. Alternative fuels should be easily available, environment friendly, and techno-economically competitive. Successful alternative fuel should fulfill environmental and energy security needs without sacrificing engine operating performance. Renewable resources offer the opportunity to tap local resources and reduce dependency on fossil energy resources. Most biodiesel oils, particularly of the non-edible type can be used as fuel in diesel engines. One of the promising alternative fuels considered for diesel engine is biodiesel.

Biodiesel fuels are renewable, as the carbon released by the burning of biodiesel fuel is used when the oil crops undergo photosynthesis. Biodiesel also offers the advantage of being able to readily use in existing diesel engines without engine modifications. The alkyl monoester of fatty acids as bio-diesel which was obtained from renewable oil and fats materials by transesterification reaction is a good alternative. Biodiesel can be obtained from raw vegetable oil by transesterification with methanol or ethanol after chemical reactions. Vegetable oils present a very promising alternative to diesel oil since they are renewable and have similar properties as of diesel. Many researchers have studied the use of vegetable oils in diesel engines. This recommends the intensive studies on the use of alternative fuels especially renewable ones like vegetable oils and alcohols. Biodiesels such as Jatropha, Karanja, Sunflower and cottonseed are some of the popular biodiesels currently considered as substitute for diesel.

When biodiesel is used as a substitute for diesel, it is highly essential to understand the parameters that affect the combustion phenomenon which will in turn have direct impact on thermal efficiency and emission. In the present energy scenario lot of efforts is being focused on improving the thermal efficiency of IC engines with reduction in emissions. The problem of increasing demand for high brake power and the fast depletion of the fuels demand severe controls on power and a high level of fuel economy.

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Performance Analysis and Investigation of Emissions of C.I. Engine Using Biodiesel and Its Blends

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Abstract— In 1979 due to sudden increase in prices of the petroleum products by the supplying countries, attention was diverted to find out substitute indigenous vegetable oils as substitute fuel to diesel oil. Lot of work is going on different types of vegetable oils. The major advantage of vegetable oils as fuel is that they are non exhaustible and renewable. Since 10 years, researchers are studying on the effects of biodiesel on engine performance and emissions. The use of biodiesel leads to the substantial reduction in PM, HC and CO emissions accompanying with the imperceptible power loss, the increase in fuel consumption and the increase in NOx emission on conventional diesel engines with no or fewer modification. And it favors to reduce carbon deposit and wear of the key engine parts. Therefore, the blends of biodiesel with small content in place of petroleum diesel can help in controlling air pollution and easing the pressure on scarce resources without significantly sacrificing engine power and economy. However, many further researches about optimization and modification on engine, low temperature performances of engine, new instrumentation and methodology for measurements, etc., should be performed when petroleum diesel is substituted completely by biodiesel.

In this report combination of three biodiesels such as CSOME, NOME and OPOME are taken for performance analysis and investigation of exhaust emission of C.I. engine. These three biodiesels are combined to form biodiesel in proportions of 2:1:1 and their blends as B10 and B20 with diesel are taken for performance analysis and investigation of exhaust emissions of C.I. engine. The results show that SFC increases and exhaust gas emission decreases with increase in blend.

Keywords- *biodiesel, Cotton seed oil, Neem oil, Orange peel oil, Performance, Emissions, alternative fuel*

*****

I. INTRODUCTION

Diesel engine will be the major power source for automobiles in the twenty-first century. To reduce emissions and solve the energy crisis, designing diesel engines with low emission and less energy consumption has always be an objective for researchers across the globe. However, with the development of new technologies, today's diesel engines have better emission characteristics and the less energy consumption compared with its predecessor. But, there is still lot to do on diesel engines aimed to achieve our goal of clean and effective diesel engine. Accordingly, research on a clean burning fuel instead of conventional fuel is advisable, which could not only decrease exhaust gas to a great extent, but, also provide more options of energy sources. The use of alternative fuels for internal combustion engines has attracted a great deal of attention due to fossil fuel crisis. Alternative fuels should be easily available, environment friendly, and techno-economically competitive. Successful alternative fuel should fulfill environmental and energy security needs without sacrificing engine operating performance. Renewable resources offer the opportunity to tap local resources and reduce dependency on fossil energy resources. Most biodiesel oils, particularly of the non-edible type can be used as fuel in diesel engines. One of the promising alternative fuels considered for diesel engine is biodiesel.

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DISSERTATION REPORT

on

DETERMINATION OF THE TEMPERATURE DISTRIBUTION OF CNT COATED PERFORATED FIN UNDER NATURAL CONVECTION

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A Review on Effect of Perforation and Carbon Nanotubes Coating on Heat Transfer Augmentation

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Abstract: It is very important to dissipate unwanted heat generated in mechanical devices such as IC engines, radiators, electronic IC's etc. to the atmosphere. Extended surfaces are widely use in many engineering application because of easy in construction, require less space, light weight. Many new techniques are adopted to improve its effectiveness by reducing the thermal boundary layer thickness and increasing the heat transfer surface area. One of this is perforation through fin body. Limitations of active techniques overcome by passive techniques and researchers find compound techniques is new emerging technique to enhance heat transfer. Now day's nanotechnology is used in typical cooling applications in many industries by nanostructured coatings, nano porous and nano fin over the surface. It has high thermal conductivity (2000 w/m-k).This article provides a detailed review of heat transfer enhancement by perforation and CNT coating.

Keywords: Heat transfer augmentation, Passive technique, Extended surfaces, perforation, CNT coating.

I. INTRODUCTION

The removal of excessive heat from system components is essential to avoid the damaging effects of burning or overheating. Therefore, the enhancement of heat transfer is an important subject in thermal engineering. The heat transfer from surfaces may in general be enhanced by increasing the heat transfer coefficient between a surface and its surroundings, by increasing the heat transfer area of the surface, or by both. In most cases, the area of heat transfer is increased by utilizing the extended surfaces in the form of fins attached to walls and surfaces. Extended surfaces are used to enhance heat transfer in a wide range of engineering applications and offer a practical means for achieving a large total heat transfer surface area. Fins are commonly applied for heat management in electrical appliances such as computer power supplied, or other applications include IC engine cooling such as fins in a car radiator [1], [2].
Heat transfer inside flow passages can be enhanced by using passive surface modifications such as rib tabulators, protrusions, pin fins, and dimples. These heat transfer enhancement techniques have practical. Application for internal cooling of turbine airfoils, combustion chamber liners and electronics cooling devices, biomedical devices and heat exchangers. The heat transfer can be increased by the following different Augmentation Techniques. They are broadly classified into three different categories: (i) Passive Techniques (ii) Active Techniques (iii) Compound Techniques [3], [4].

A. Passive techniques

These techniques generally use surface or geometrical modifications to the flow channel by incorporating inserts or additional devices. They promote higher heat transfer coefficients by disturbing or altering the existing flow behavior (except for extended surfaces) which also leads to increase in the pressure drop.
In case of extended surfaces, effective heat transfer area on the side of the extended surface is increased. Passive techniques hold the advantage over the active techniques as they do not require any direct input of external power. These techniques do not require any direct input of external power; rather they use it from the system itself which ultimately leads to an increase in fluid pressure drop. They generally use surface or geometrical modifications to the flow channel by incorporating inserts or additional devices. They promote higher heat transfer coefficients by

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Finite Element Analysis of Convective Heat Transfer Augmentation from Rectangular Fin by Circular Perforation

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Abstract- It is very important to dissipate unwanted heat generated in mechanical devices such as IC engines, radiators, electronic IC's etc. to the atmosphere. Extended surfaces are widely use in many engineering application because of easy in construction, require less space, light weight. This study examines heat transfer augmentation from a rectangular fin embedded with circular perforation under natural convection compared to the equivalent solid (none perforated) fin using ANSYS 10. Fins with different diameters of hole and number of perforation keeping length constant are examined. The parameters considered were geometrical dimension and thermal properties of fin such as material properties, convective heat transfer coefficient. Study showed that as perforations increases heat transfer rate also increases up to certain dimension and then starts decreasing. Heat transfer enhancement of the perforated fin increases with increase in diameter of perforation and number of perforation.

Keywords- *Element Analysis, ANSYS, Heat Transfer Enhancement, Natural Convection, Perforated Fin*

*****

I. INTRODUCTION

The removal of excess heat from system components is essential to avoid damaging effects of overheating. Therefore, the enhancement of heat transfer is an important subject of thermal engineering. Heat transfer between a surface (T_o) and the fluid surrounding it (T_s) is given by $Q = h A (T_o - T_s)$. Heat transfer rate may be increased by increasing the heat transfer coefficient between a surface and its surrounding, or by increasing the heat transfer area of the surface. In most cases, the area of heat transfer is increased by extending surfaces. These extended surfaces are called as fins. Fins are used to enhance convective heat transfer in a wide range of engineering applications and offer a practical means for achieving a large total heat transfer surface area without the use of an excessive amount of primary surface area. Fins are commonly applied for heat management in electrical appliances such as computer power supplies or substation transformers. Other applications include engine cooling, condensers in refrigeration and air conditioning [1].

Fins as heat transfer enhancement devices have been quite common. The different materials like Mild steel, Stainless Steel, Aluminum, Silver and Copper *etc.* are used for making fins. As the extended surface technology continues to grow, new design ideas have been emerged including fins made of anisotropic composites, porous media, interrupted and perforated plates. Due to the high demand for lightweight, compact, and economical fins, the optimization of fin size is of great importance. Therefore, fins must be designed to achieve maximum heat removal with minimum material expenditure taking into account the ease of the fin manufacturing. The improvement in heat transfer coefficient is attributed to the restarting of the thermal boundary layer after each interruption. Thus perforated plates and fins represent an example of surface interruption [1].

II. LITERATURE SURVEY

Abdullah H. AlEssa [6] Heat transfer dissipation from a horizontal rectangular fin embedded with equilateral triangular perforations is compared numerically using one-dimensional finite element technique. The heat dissipation of the perforated fin is computed and compared with that of the solid one of the same dimensions and same thermal properties. The comparison refers to acceptable results and heat dissipation enhancement due to certain perforations.

Abdullah H. Al Essa et al. [8] has study and examine the heat transfer enhancement from a horizontal rectangular fin embedded with triangular perforations (their bases parallel and toward the fin tip) under natural convection. They considered geometrical dimensions and thermal properties as parameter of the fin and the perforations. The temperature drop is studied for perforation dimension and space between them. The experimentation results shows that gain in heat transfer enhancement for certain values of triangular dimensions is increase with its dimensions and is proportional to the fin thickness and its thermal conductivity. They state that the gain in the heat dissipation rate for the perforated fin is a strong function of both the perforation diameter and lateral spacing which attain maximum at optimum perforation dimension and spacing respectively. With perforation it reduces the fin expenditure of material.

M.R.Shaeri, M.Yaghoubi, K.Jafarpur [7] Fluid flow and conjugate conduction-convective heat transfer from a three-dimensional array of rectangular perforated fins with square windows that are arranged in lateral surface of fins are studied numerically.Results show that perforated fins have higher total heat transfer and considerable weight reduction in comparison with solid fins.

Wadhah Hussein Abdul Razzaq Al- Doori et al. [5] has study and investigate heat transfer rate from rectangular fin

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Analysis of Natural Convection Heat Transfer from Rectangular Fin with Different Forms of Perforation Using Finite Element Analysis

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Abstract-*This study examines the natural convective heat transfer from rectangular fins with different forms of perforations under natural convection. In this analysis six different forms of perforations are used with including non perforated fin. The different forms are circle, square, triangle, Ellipse and hexagon and having same cross sectional area of 113mm². These perforations distributed on 3 columns and 6 rows. The parameters considered were geometrical dimension and thermal properties of fin such as material properties, convective heat transfer coefficient. The fins are design with the help of Creo-Parametric software. Analysis is carried out using Autodesk Simulation Mechanical 2014.In this steady state thermal analysis and temperature variations with respect to distance at which heat flow occur through the fin is analyzed.*
Keywords- *Element Analysis, Heat Transfer Rate, Natural Convection, Perforated Fin*

I. INTRODUCTION

The removal of excessive heat from system components is essential to avoid the damaging effects of burning or overheating. Therefore, the enhancement of heat transfer is an import subject of thermal engineering. The heat transfer from surfaces may in general be enhanced by increasing the heat transfer coefficient between a surface and its surroundings, by increasing the heat transfer area of the surface, or by both. In most cases, the area of heat transfer increased by utilizing extended surfaces in the form of fins attached to walls and surfaces [1]. Extended surfaces (fins) frequently used in heat exchanging devices for the purpose of increasing the heat transfer between a primary surface and the surrounding fluid.

Fins as heat transfer enhancement devices have been quite common. As the extended surface technology continues to grow, new design ideas emerge, including fins made of anisotropic composites, porous media, and perforated and interrupted plates [2]. One popular heat transfer augmentation technique involves the use of rough or interrupted surfaces of different configurations. The surface roughness or interruption aims at promoting surface turbulence that is intended mainly to increase the heat transfer coefficient rather than the surface area [3]. It was reported that non-flat surfaces have free convection coefficients that are 50% to 100% more than those of flat surfaces [4]. Several other researchers reported a similar trend for interrupted, perforated, and serrated surfaces, attributing the improvement to the restarting of the thermal boundary layer after each interruption, indicating that the increase in convection coefficient is even more than enough to offset lost area [3].

In 2007 A. M. &, the other [5] study the natural convection heat transfer from perforated fins. The temperature distribution was examined for an array of rectangular fins (15 fins) with uniform cross-sectional area (100x270 mm) embedded with different vertical body perforations that extend through the fin thickness. The patterns of perforations include 18 circular perforations (holes). Experiments were carried out in an experimental facility that was specifically design and constructed for this purpose. They observed that heat transfer rate and the coefficient of heat transfer increases with perforation diameter increased.

Raaid R. Jassem [6] has study and examines natural convection heat transfer from rectangular fin with different forms of perforations (circle, square, triangle, and hexagon) with having same cross sectional area of 113mm². He found that fin having triangular perforation has maximum heat transfer rate.Kumbhar D.G, Dr. N K Sane, Chavan S T [7] has observed that heat transfer rate increases with perforations as compared to fins of similar dimensions without perforations. It is noted that in case of triangular perforations optimum heat transfer is achieved. they also concluded that heat transfer rate is different for different materials or heat transfer rate changes with change in thermal conductivity. The perforation of fins enhances the heat dissipation rates and at the same time decreases the expenditure for fin materials also. Results obtained by ANSYS and experimentation support each other. Rupali v. dhanadhya, abhay s. nilawar and yogesh yenarkar [8] in this they study and examines the heat transfer augmentation from horizontal rectangular fins with circular perforations under natural convection compared with solid fins and Fins with different thickness keeping length constant are also examined. They use Finite element analysis using ANSYS 11 to find out heat transfer rate. Study found that as the number of perforations increases heat transfer rate increases. Heat transfer rate is found maximum in fin with 12 perforations.

DISSERTATION REPORT

on

PERFORMANCE ANALYSIS AND INVESTIGATION OF EMISSIONS OF C.I. ENGINE USING BIODIESEL AS BLENDING AGENT

Submitted by

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PG Student

[61811610]

Under the Guidance of

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Master Degree inMechanical Engineering - Heat Power

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(2015)

CERTIFICATE

This is to certify that, the dissertation entitled **"Performance Analysis and Investigation of Emissions of C.I. Engine Using Biodiesel as Blending Agent"**, which is being submitted herewith for the award of the **'Master of Engineering'** in **'Mechanical Engineering– Heat Power'** of Dr.Babasaheb Abedkar Marathwada University, Aurangabad, Maharashtra State. This is the result of the original research work and contribution by **'Mr. Santoshkumar Dnyaneshwar Bhopale** under my supervision and guidance. The work embodied in this dissertation has not formed earlier for the basis of the award of any degree or compatible certificate or similar title of this any other diploma/examination body or university to the best of knowledge and belief.

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Performance Analysis and Investigation of Emissions of C.I. Engine Using Cottonseed Oil as Blending Agent: Review

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Abstract

The industrialization of the world has led to a sharp rise for the demand of petroleum products. The fast depletion in the petroleum reserve and uncertainty in supply due to political and economical reasons are causing hike in petroleum prices. Environmental pollution due to burning of these fuels has stimulated the search for alternative fuels to petroleum fuels. High dependance on non-renewable sources presents a window of opportunity for looking at alternative fuels. Biodiesel can be cosidered as one of the potential renewable energy sources for diesel engines. Biodiesel can be used directly or in blended form of diesel. In the present review, reports about engine performances and emissions using biodiesel published by journals regarding the effect of biodiesel on engine power and emissions of a four strokes compression ignition engine are surveyed and analyzed in detail.

Keywords: Bio-diesel,Cottonseed oil, Diesel Engine Performance, Exhaust Emissions, Optimization technique.

1. Introduction

Bio-diesel can be used as an alternative diesel fuel, is made from renewable biological sources such as vegetable oil and animal fats. It is biodegradable, non-toxic and possesses low emission profiles. The uses of bio-fuels are environmentally beneficial.

Use of conventional diesel fuel causes serious problem of air pollution and effects on the environment leading to effect like green house, some factors in diesel fuel results in high emission in diesel engine. The stringent emission norms have been an important driving force to develop the CI engines more environment friendly. The main pollutants from diesel engines are carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx) and Smoke intensity. The problem of increasing demand for high brake power and the fast depletion of the fuels demand severe controls on power and a high level of fuel economy. Because of this many innovative technologies are developed to tackle these problems [1, 2].

This needed the intensive studies on the use of alternative fuels especially renewable ones like vegetable oils and alcohols. The use of vegetable oils as an alternative fuel for diesel engine is not a new concept. In fact, Rudolf Diesel operated his first engine using peanut oil in 1911. In a developing country like India where mass transportation plays an important role, the suitability of alternate fuels for a diesel fuel engine application has to be thoroughly investigated. Vegetable oils plays a prominent role in substituting diesel, since they are renewable and are easily produced in rural areas.

Vegetable oils are either edible or non-edible. Some of the edible oils are sunflower oil, palm oil, rice bran oil, and cottonseed oil. The non-edible oils are mahua oil, jatropha oil, rubber seed oil, etc. As rice bran and cottonseed oil (CSO) are not very much in use for cooking purpose, these can be used as substitute for diesel in CI engines. Cottonseed oil has several properties closer to that of diesel but certain properties such as high viscosity and low volatility pose problem when used as an alternate fuel for C.I engines. When biodiesel is used as a substitute for diesel, it is highly essential to understand the parameters that affect the combustion phenomenon which will in turn have direct impact on thermal efficiency and emission. In the present energy scenario lot of efforts is being focused on improving the thermal efficiency of IC engines with reduction in emissions. The

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Performance Analysis and Investigation of Emissions of C.I. Diesel Engine using Neem oil as Blending Agent: Review

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Abstract: *The depletion of world petroleum reserves and the increased environmental concern have stimulated the search of alternative fuel which is to be environment friendly. Bio-fuels have the potential to become alternative fuel for fossil fuels. Biodiesel is a fuel comprised of mono alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. Biodiesel is reliable, renewable, biodegradable and regarded as a clean alternative fuel to reduce exhaust emissions. Vegetable oil like Neem oil is considered as alternate fuels to diesel. This review has been taken up to identify the performance and emission characteristics of CI engine using Neem biodiesel.*

Keywords: Neem oil, Biodiesel, Performance, Blends, Emissions

I. INTRODUCTION

Conventional energy sources such as oil, coal and natural gas have limited reserves that are expected not to last for an extended period. World primary demand is projected to increase by 1.5% per year from 2007 to 2030, from just over 12,000 million tonnes of oil equivalent to16800 million tones-as overall increase of 40%. As world reserves of fossil fuels and raw material are limited, it has stimulated active research interest in non petroleum and non polluting fuels. Diesel engines are the major source of power generation and transportation hence diesel is being used extensively, but due to the gradual impact of environmental pollution there is an urgent need for suitable alternate fuels for use in diesel engine without any modification. There are different kinds of vegetable oils and biodiesel have been tested in diesel engines its reducing characteristic for green house gas emissions. Its help on reducing a country's reliance on crude oil imports its supportive characteristic on agriculture by providing a new market for domestic crops, its effective lubricating property that eliminates the need of any lubricate additive and its wide acceptance by vehicle manufacturers can be listed as the most important advantages of biodiesel fuel. There are more than 350 oil bearing crops identified, among which only Jatropha, ongamia, sunflower, Soyabean, cottonseed, rapeseed, palm oil and peanut oil are considered as potential alternative fuels for diesel engines. The present study aims to investigate the use of neem oil blend with diesel as an alternate fuel for compression ignition engine.

A. Bio-diesel

Bio-diesel is fatty acid methyl or ethyl ester made from virgin or used vegetable oils (both edible & non-edible) and animal fats. The main commodity sources for bio- diesel in India can be non-edible oils obtained from plant species such as Jatropha Curcas, Karanj, Neem, Mahua etc. Bio-diesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a bio-diesel blend or can be used in its pure form. Just like petroleum diesel, bio-diesel operates in compression ignition engine; which essentially require very little or no engine modifications because bio-diesel has properties similar to petroleum diesel fuels. It can be stored just like the petroleum diesel fuel and hence does not require separate infrastructure. The use of bio-diesel in conventional diesel engines results in substantial reduction of un-burnt hydrocarbons, carbon monoxide and particulate matters. Bio-diesel is considered clean fuel since it has al-most no sulphur, no aromatics and has about 10% built-in oxygen, which helps it to burn fully. Its higher cetane number improves the ignition quality even when blended in the petroleum diesel. It provides significant lubricity improvement over petroleum diesel fuel. Lubricity results of bio-diesel and petroleum diesel using industry test

DISSERTATION REPORT

on

EXPERIMENTAL ANALYSIS OF CONVECTIVE HEAT TRANSFER IN DIVERGENT CHANNEL

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Under the Guidance of

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CERTIFICATE

This is to certify that, the dissertation entitled **"Experimental Analysis of Convective Heat Transfer in Divergent Channel"**, which is being submitted herewith for the award of the **'Master of Engineering'** in **'Mechanical Engineering– Heat Power'** of Dr. Babasaheb Abedkar Marathwada University, Aurangabad, Maharashtra State. This is the result of the original research work and contribution by **'Mr. Avinash Shesherao Patil** under my supervision and guidance. The work embodied in this dissertation has not formed earlier for the basis of the award of any degree or compatible certificate or similar title of this any other diploma/examination body or university to the best of knowledge and belief.

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Heat Transfer Enhancement of Flow through Divergent Channel in Force Convection - A Review

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ABSTRACT

The present paper is reviewed on progress with the passive enhancement techniques in the recent &past and it will be useful to designers implementing passive enhancement techniques in heat exchange. Heat transfer enhancement techniques (passive, active or a combination of passive and active methods) are commonly used in areas such as process industries, heating and cooling in evaporators, thermal power plants, air-conditioning equipment, refrigerators, radiators for space vehicles, automobiles, etc. Passive techniques, where inserts are used in the flow passage to enhancement the heat transfer rate, are advantageous compared with active techniquesbecause of the insert manufacturing process is simple and these techniques can be easily employed in an existing heat exchanger. In design of compact heat exchangers, passive techniques of heat transfer enhancement can play an important role if a proper passive insert configuration can be selected according to the heat exchanger working condition (both flow and heat transfer conditions). In the past decade, several studies on the passive techniques of heat transfer enhancement have been reported.

Keywords: *Heat Transfer Enhancement, Divergent Channel, Bumps, Heat Transfer Rate, Nusselt Number.*

I. INTRODUCTION

The development of high performance thermal systems has stimulated interest inmethods to improve heat transfer. The study of improved heat transfer is referred to as heat transfer enhancementor intensification.The performance of conventional heat exchanger can be substantially improved by a number of enhancement techniques. A great deal of research effort has been devoted to developing apparatus and performing experiments to define the conditions under which an enhancement technique will improve heat transfer. Heat transfer enhancement technology has been widely applied to heat exchanger applications in refrigeration, automobile, process industries etc. The goal of enhanced heat transfer is to encourage or accommodate high heat fluxes. That result in reduction of heat exchanger size, which generally leads to less capital cost. Another advantage is the reduction of temperature driving force, which reduces the entropy generation and increases the second law efficiency. In addition, the heat transfer enhancement enables heat

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Experimental analysis of convective heat transfer in divergent channel

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Abstract- Many heat transfer enhanced techniques have simultaneously been developed for the improvement of energy consumption, material saving, size reduction and pumping power reduction. The effect of divergent channels is a good way to promote the flow mixing in channel flow. When if we use divergent channel then we get flow difference means low pressure drop it is also called pressure recovery. By using bump in the divergent channel it can help us to increase the heat transfer enhancement and bump surface present the highest performance of the heat transfer enhancement. The bump surface act as extended surface (fin surface) and the main purpose of extended surface to increase the heat transfer rate. The advantages of the divergent channel with internal Bumps are fluid mixing is more as compared to cylindrical pipe, pressure drop is less and boundary layer separation occurs as well as the heat transfer coefficient increases 25 to 35 % as compare to plain divergent channel. where inserts are used in the flow passage to intensify the heat transfer rate, are advantageous compared with active techniques, because the insert manufacturing process is simple and these techniques can be easily employed in an existing heat exchanger.

Keywords -Heat transfer enhancement, Divergent channel, Bump, Heat transfer rate, Heat transfer coefficient.

I INTRODUCTION

The development of high performance thermal systems has stimulated interest in methods to improve heat transfer. The study of improved heat transfer is referred to as heat transfer enhancement or intensification. The performance of conventional heat exchanger can be substantially improved by a number of enhancement techniques. A great deal of research effort has been devoted to developing apparatus and performing experiments to define the conditions under which an enhancement technique will improve heat transfer. Heat transfer enhancement technology has been widely applied to heat exchanger applications in refrigeration, automobile, process industries etc. The goal of enhanced heat transfer is to encourage or accommodate high heat fluxes. That result in reduction of heat exchanger size, which generally leads to less capital cost. Another advantage is the reduction of temperature driving force, which reduces the entropy
Generation and increases the second law efficiency. In addition, the heat transfer enhancement enables heat exchangers to operate at smaller velocity, but still achieve the same or even higher heat transfer coefficient. This means that a reduction of pressure drop, corresponding to less operating cost, may be achieved.

Use of divergent channel:

In the divergent channel, the plumes produced are greater and not stable. In addition, the acceleration of flow can effectively lead to the local increase of Gr/Re. Therefore, stronger interaction with the neighboring plumes and vortices are observed and form a complicated flow structure. This leads to a greater enhancement in the heat transfer.

In the convergent channel, it is on the contrary. The acceleration of flow can effectively lead to the local decrease of Gr/Re. The plumes produced are smaller and stable. No interactions between plumes are found. This leads a less enhancement in the heat transfer. However, the deceleration flow in the divergent channel and the acceleration in the convergent make the average Nusselt numberS approach the results of the parallel plate channel, especially when the Reynolds number is higher.

We used divergent channels for heat transfer because of it is a good way to promote the flow mixing in channel flow also if use divergent channel then we get flow difference means low pressure drop it is also called pressure recovery also the new concept we using bumps in the divergent channel it can help us to increase the heat transfer enhancement and bump surface present the highest performance of the heat transfer enhancement. The Bumps surface it can also called as artificial surface act as extended surface (fin surface) and the main purpose of extended surface to increase the heat transfer rate. The advantages of the divergent channel with internal bumps are fluid mixing is more as compared to cylindrical pipe, pressure drop is less and boundary layer separation occurs in divergent channel which will help in heat transfer.

All these advantages have made heat transfer enhancement technology attractive in heat exchanger applications. For shell and tube heat exchangers, the tube insert technology is one of the most common heat transfer enhancement technologies, particularly for the retrofit situation. With tube insert technology, additional exchangers can often be avoided and thus significant cost saving becomes possible. Furthermore as a heat exchanger becomes older, the resistance to heat transfer increases owing to fouling or scaling. These problems are more common for heat exchangers used in chemical industries and marine applications. In this case the heat transfer rate

DISSERTATION REPORT

on

NUMERICAL AND EXPERIMENTAL INVESTIGATION OF STAGGERED INTERRUPTED FIN ARRANGEMENT IN A NATURAL CONVECTION FIELD

Submitted by

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This is to certify that, the dissertation entitled **"Numerical and experimental investigation of staggered interrupted fin arrangement in a natural convection field"**, which is being submitted herewith for the award of the **'Master of Engineering'** in **'Mechanical Engineering– Heat Power'** of Dr. Babasaheb Abedkar Marathwada University, Aurangabad, Maharashtra State. This is the result of the original research work and contribution by **'Mr. Bhushan Sopan Rane'** under my supervision and guidance. The work embodied in thisdissertation has not formed earlier for the basis of the award of any degree or compatible certificate or similar title of this any other diploma/examination body or university to the best of knowledge and belief.

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Date-29th November, 2016

TO WHOM MAY IT CONCERN:

This is to certify that ***Miss. Punam M. Sonawane***, a ME student of Shreeyash College of Engineering & Technology- centre for Engineering Studies, has successfully completed her project titled **"Comparative Thermal Analysis between Water & Al_2O_3 Nanofluid as Coolant on Sintered Copper Heat Pipe using Hybrid Vortex Al Cold Plate"** in our company, with reference to the partial fulfillment of the requirements of the Master Degree Course of Dr, Babasaheb Ambedkar Marathwada Univercity, Aurnagabad.

All necessary details were provided from our side for the establishment of this Project.

We wish her the very best in all her endeavors.

Thanking You,
With Regards,

Yours faithfully

For PARAMOUNT INDUSTRIES

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International Journal of Engineering and Applied Sciences

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Certificate of Publication

Is hereby awarding this certificate to

P M Sonawane

in recognition of the paper entitled

Effect of Nanofluids on Heat Pipe Thermal Performance: A Review of the Recent Literature

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Effect of Nanofluids on Heat Pipe Thermal Performance: A Review of the Recent Literature

P M Sonawane, M D Shende, V P Baisane

Abstract— **Normally conventional fluids are used in heat pipes to remove the heat based on a temperature range for its particular operating conditions [1] (see Fig.2). The addition of the nano particles to the base fluid is one of the significant issues to enhance the heat transfer of heat pipes. The purpose of this review is to summarize the research done on heat pipes using nanofluids as working fluids in recent years (2012 to 2013). This review article provides additional information for the design of heat pipes with optimum conditions regarding the heat transfer characteristics of nanofluids in heat pipes. Moreover, this paper identifies several important issues that should be considered further in future works.**

Index Terms— **Heat pipes, Nanofluids, Thermal resistance, Heat transfer.**

I. INTRODUCTION

Nowadays heat pipes find numerous applications such as in solar energy, air conditioning systems, waste heat recovery to save energy and prevent global warming, designing compact electronic components, space applications, telecommunications, food industries, geothermal systems, etc. Based on these applications, "lightweight" and "high performance" becomes the key goals for current heat pipe design, especially for applications in the electronic industries.

A heat pipe is a simple device used to transfer the heat from one place to the other. The advantage of using a heat pipe over the other ordinary methods to heat transfer is that a heat pipe can have an extremely high thermal conductance in steady state operation, and hence known as "super thermal conductors". The heat pipe consists of evaporator section, adiabatic section and condenser section (Fig.1). The heat is transferred as latent heat energy by evaporating the working fluid in the evaporator (hot side) and condensing the vapor in the condenser (cool side), the circulation is completed by the forces, such as capillary force, gravitational force (in the thermosyphon heat pipes), electrostatic force, or other forces directly acting on the liquid flow. Adiabatic section is fully insulated. Because the middle region of the heat pipe is regarded as an adiabatic zone, the amount of heat transfer to ambient is low. Regardless of the classifications of heat pipes, which might depend on the geometries, applications, and so on, the basic principles are the same.

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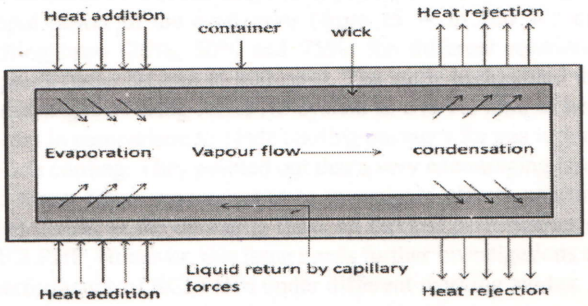

Figure 1.Schematic diagram of heat pipe.

The lower thermal conductivity of these working fluids limits the thermal performance enhancement of the heat pipes. Nowadays, nanofluids play an important role in heat pipes to increase the heat transfer compared to conventional fluids. The research on application of nanofluids in heat pipes was firstly published in 2003 [2].

Recently, many researchers have presented the heat transfer characteristics of heat pipe using nanofluids. Most of the research works are carried out experimentally to focus on finding out the key factors affecting the reliable application of nanofluids in the heat pipes. The type, size of heat pipes and operating conditions of heat pipes, the kind of the base fluids, the material and size of nanoparticles all varied in very wide ranges among these experiments.

The observations based on the reviewed literature showed that the theoretical investigations on nanofluids in heat pipes are very few and hence validating the experimental findings is difficult [3-6]. However, many issues such as the transfer of nanoparticles by the vapour phase during heat pipe operation can be investigated only with adequate experiments.
This paper compiles the recent researches on the heat transfer characteristics of nanofluids in heat pipes and identifies many issues that are open or even not commenced to investigate.

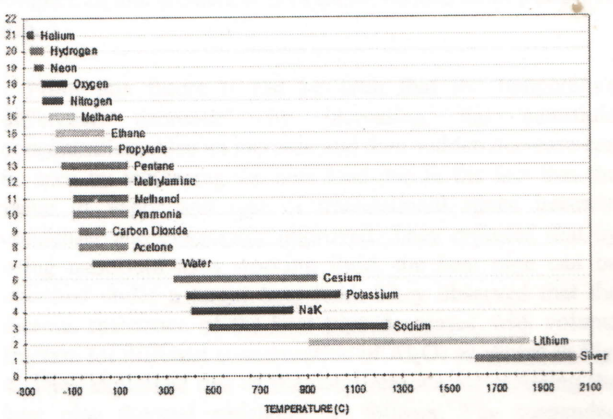

Figure 2. Operating temperature range of common working fluids [1]