1.3.3: Number students undertaking project work/field work/internship during last year

Dept: B.E. Mechanical Engineering **Academic Year-2023-2024**

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PRINCIPAL
M.I.E.T. ENGINEERING COLLEGE
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EXPERIMENTAL INVESTIGATION ON PRODUCTION OF BIODIESEL FROM OKRA (ABELMOSCHUS ESCULENTUS) SEED OIL AND ITS PERFORMANCE CHARACTERISTICS ON COMPRESSION IGNITION (CI) ENGINE

A PROJECT REPORT

Submitted by

MOHAMED ASHIK. S	**(812420114351)**
MOHAMED ASHIQ M.Y	**(812420114352)**
MOHAMED ASLAM. H	**(812420114353)**
MOHAMED IMTHIYAS. I	**(812420114356)**

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

MECHANICAL ENGINEERING

M.I.E.T. ENGINEERING COLLEGE
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APRIL 2024

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BONAFIDE CERTIFICATE

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Submitted to the Project viva voce held on 13.05.2024

INTERNAL EXAMINER

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CERTIFICATION OF EVALUATION

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Semester : VIII

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ABSTRACT

The present work aims to produce biodiesel from okra seed oil with a catalyst of sodium methoxide ($NaOCH_3$) and evaluate the performance of compression ignition (CI) engine. Biodiesel is an alternative source to world petroleum reserves due to rapidly growing energy demands coupled with environmental concerns has prompted the efforts to explore some alternative sources of petroleum-based fuels.

Okra seed oil is a novel feedstock for biodiesel production. Oil extraction using cold press method gave better result when compared to solvent extraction method. Since, the extracted oil has acid value of 35.2 mgKOH/g of oil, it was subjected to esterification process using hydrochloric acid.

The esterified oil was subjected to biodiesel production using homogeneous catalysts of sodium methoxide ($NaOCH_3$) gave maximum biodiesel yield of 96.8% at reaction conditions of 1:6 molar ratio, 2 wt.% of catalyst, reaction time of 2 hours, temperature of 63°C and 600rpm. The properties of produced biodiesel was within the limits of ASTM D6751 standard.

Next, the produced okra oil biodiesel was investigated to study the performance, combustion and emission characteristics of compression ignition (CI) engine. The performance characteristics examined include brake thermal efficiency (BTE) and brake specific fuel consumption (BSFC). The emission characteristics measured include carbon monoxide (CO), carbon dioxides (CO2), hydrocarbons (HC), oxides of nitrogen (NOx) and smoke.

The results showed that the biodiesel produced from okra seed oil it had BTE and lower BSFC compared to diesel. The cylinder pressure and heat release rate characteristics of the produced biodiesel were evaluated using a combustion analyser and the result showed that biodiesel produced from okra seed oil exhibited superior combustion characteristics than diesel. The emissions characteristics than diesel. The emissions characteristics of produced biodiesel

produced from okra oil exhibited superior combustion characteristics than diesel. The emissions characteristics of produced biodiesel were also analyzed and compared to diesel and the result showed that the emissions of CO, HC, and NOx were lower for the biodiesel produced from okra seed oil compared to diesel. In conclusion this study demonstrates the potential of using catalysts for producing biodiesel from okra seed oil in suitability for use on diesel engine. Finally, it is concluded that the development of a sustainable and environmentally friendly biodiesel production process that is used on diesel engine.

CHAPTER 7

CONCLUSION

- Oil extraction using cold press method gave better result when compared to solvent extraction method. Since, the extracted oil has acid value of 35.2 mgKOH/g of oil, it was subjected to esterification process using hydrochloric acid.

- The esterified oil was subjected to biodiesel production using homogeneous catalysts of sodium methoxide ($NaOCH_3$) gave maximum biodiesel yield of 96.8% at reaction conditions of 1:6 molar ratio, 2 wt.% of catalyst, reaction time of 2 hours, temperature of 63°C and 600rpm. The properties of produced biodiesel was within the limits of ASTM D6751 standard.

- The engine test were conducted to evaluate the engine performance of the produced biodiesel. The B20 blend showed that the improved performance to that of neat biodiesel. It is attributed to the high oxygen content and better lower viscosity of B20 blend because of that it can easily in combustion chamber. And also, the B20 biodiesel blend proves to emission and improves engine efficiency when compared to neat biodiesel.

- In addition, combustion tests are conducted to determine the optimal fuel-ratio and residence time. The result showed that the optimal fuel- air ratio is 1:18 and the residence time is 3 seconds for the complete combustion of biodiesel. The results of the engine study shows that the maximum heat release rate. Finally, emission tests are conducted to evaluate the emissions produced during the combustion process.

DESIGN AND DEVELOPMENT OF POLISHING MACHINE TO PREPARE SPECIMENS FOR METALLOGRAPHIC ANALYSIS

A PROJECT REPORT

Submitted by

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in

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DECLARATION

We hereby declare that the work entitled **"DESIGN AND DEVELOPMENT OF POLISHING MACHINE TO PREPARE SPECIMENS FOR METALLOGRAPHIC ANALYSIS"** is submitted in partial fulfillment of the requirement for the award of the degree in Bachelor of Engineering, Anna university, Chennai, is a record of our own work carried out by us during the academic year 2023 - 2024 under the supervise Sion and guidance of **Mr. R.Narayanan, M.E.,** Assistant Professor, Department of Mechanical Engineering, M.I.E.T. Engineering College, Tiruchirappalli.

The extent and source of our information were derived from the existing literature and have been indicated through the dissertation at the appropriate places. The content embodied in this work is original and has not been submitted for the award of any other degree or diploma, either in this or any other university.

B. Naveen Raj

T. Paul Karunakaran

K. Pragadesh

A. Vishnu Priyan

I certify that the declaration made above by the candidate is true.

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ABSTRACT

Polishing is a surface machining process used to provide a product a high quality finished surface. To determine a material's microstructure, a metallographic specimen analysis should be performed. Polishing is one step in the preparation of a metallographic specimen. The designing and manufacturing a polishing machine will be very helpful in the process of polishing the metallographic specimen. The purpose of this project was to design and manufacturing a polishing machine on a laboratory scale. The project involves a number of process stages, including model design, tool and material preparation, component fabrication and assembly of the polishing machine. This machine can be used for polishing different materials such as metals, plastics, and ceramics. After the fabrication of this polishing machine, it is observed that a good surface finish can be achieved. This polishing machine's performance was evaluated during the testing phase in terms of surface roughness and material removal rate. The results demonstrated outstanding repeatability and uniformity in producing perfect surface finishes when examining microstructural characteristics under microscope. This polishing machine performs well and can be used for metallographic testing by students and researchers.

CHAPTER 7
CONCLUSION

The polishing machine has successfully completed its design and development. The following conclusion can be made from this project.

- The polishing machine designed consists of motors, spindle heads, and each spindle head carries a rotary disc. The rotary disc is mounted on the spindle head.
- The machine's key features, the disc-type design allows for uniform pressure distribution across the workpiece. Adjustable rotational speed enables customization for different materials and finishing requirements.
- This machine can be used for polishing different materials such as metals, plastics, and ceramics. After the fabrication of this polishing machine, it is observed that a good surface finish can be achieved.
- The performance of the polishing machine was assessed during the testing phase based on surface roughness and material removal rate. The results demonstrated remarkable consistency and repeatability in achieving desirable surface finishes, critical for accurately examining microstructural details under microscopy.
- The polishing machine that was designed is a useful instrument for metallurgical research and quality control in laboratories and companies. It enabling precise and reproducible preparation of specimens for detailed microstructural analysis.

SYNGAS PRODUCTION FROM CATALYTIC BIOMASS GASIFICATION IN A TWO STAGE DOWNDRAFT GASIFIER

A PROJECT REPORT

Submitted by

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ANNA UNIVERSITY:: CHENNAI 600 025

MAY 2024

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

In order to get proper syngas production from waste such as various bio masses in single stage gasification under without Catalyst is not possible. To improve the syngas production from various biomass it must have some potential density in present inside the reaction chamber so that Pellets consists of Sesame stalks, Hemp, Tamarind shell is having potential to work in gasification chamber because of its density. This material is feed into two stage downdraft gasifier the zone of pyrolysis, oxidation and reduction in which the whole biogas enter zone according to the fixed equivalent ratio. In this present work the waste bio material feed in pellet mode, fixed equivalance ratio and dolomite as working catalyst. This study explores syngas production through various methods, including steam reforming, partial oxidation, and biomass gasification. It examines the principles, processes, and technological advancements in each method, emphasizing their efficiency, environmental impact, and economic feasibility. Additionally, the abstract highlights the importance of syngas as a versatile precursor for producing fuels, chemicals, and materials, and discusses potential future research directions in this field Syngas production while mitigating environmental concerns. Furthermore, it underscores the significance of syngas in the transition towards sustainable energy systems and the circular economy, fostering innovation and collaboration across academia, industry.

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CHAPTER 8

CONCLUSION

In conclusion, the entrained flow gasifier project represents a significant stride towards sustainable energy production and environmental stewardship. Through meticulous design, rigorous experimentation, and comprehensive analysis, this project has provided valuable insights into the operation and optimization of entrained flow gasification technology.

The successful implementation of the gasifier showcases its potential as a viable alternative for converting biomass, coal, or waste materials into valuable syngas, which can be utilized for various industrial applications, including electricity generation, chemical synthesis, and fuel production. Moreover, the efficient utilization of feedstock and the minimal production of harmful emissions underscore the environmental benefits of this technology, contributing to the global efforts in mitigating climate change and reducing reliance on fossil fuels.

DESIGN AND DEVELOPMENT OF REACTOR CORE FOR ENTRAINED FLOW GASIFIER AND ITS PERFORMANCE EVALUATION BY USING JULIFLORA BIOMASS AT AIR ATMOSPHERE

A PROJECT REPORT

Submitted by

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ABSTRACT

Entrained flow gasification is a promising technology for converting solid fuels into syngas, which can be further utilized for various applications such as power generation, chemical synthesis, and fuel production. In this study, we investigate the behavior of an entrained flow gasifier within a reactor core, focusing on its efficiency, performance, and environmental impact. The reactor core design plays a crucial role in determining the gasifier's performance. By optimizing the core geometry, residence time, and temperature distribution, we aim to enhance gasification efficiency and syngas quality. Computational fluid dynamics simulations are employed to analyze the flow dynamics, heat transfer, and chemical reactions within the gasifier. Environmental considerations are also addressed, with a focus on reducing emissions of pollutants such as particulate matter, tar, and sulfur compounds. Advanced gas cleaning techniques, including catalytic conversion and scrubbing, are evaluated for their effectiveness in meeting regulatory standards and ensuring environmental sustainability.

CHAPTER 9
CONCLUSION

In conclusion, the utilization of entrained flow gasification technology for processing juliflora offers a promising avenue for sustainable biomass conversion. Juliflora, known for its fast growth and adaptability to arid environments, presents a renewable and abundant feedstock for gasification processes.Entrained flow gasification, characterized by high temperatures and efficient mixing of feedstock and gasifying agents, provides several advantages in converting juliflora into syngas. The technology offers precise control over temperature distribution, facilitating optimal reaction kinetics and maximizing gasification efficiency.

By leveraging entrained flow gasification, juliflora can be efficiently converted into a clean syngas suitable for various energy and chemical applications. Additionally, the process can help address environmental challenges associated with juliflora invasiveness by providing an economically viable means of biomass utilization fabricate the reactor core .Overall, entrained flow gasification holds significant promise as a sustainable solution for converting juliflora biomass into valuable energy products, contributing to both environmental conservation and energy security objectives.

DEVELOPMENT OF ELECTRICAL RESISTANCE HEATING FURNACE FOR MELTING OF NON-FERROUS MATERIALS

A PROJECT REPORT

Submitted by

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ABSTRACT

Furnaces are used to heat Solid Materials to change their shape or properties. Melting furnace is mainly made with non-ferrous metals. An electrical resistance heating furnace is a type of heating system that uses electrical resistance to generate heat. This work developed an electric- powered crucible furnace for the purpose of melting aluminium scraps. It typically consists of heating elements, such as coils or wires, that produce heat when an electric current passes through them. These furnaces are commonly used for space heating in homes and buildings, as well as in industrial applications for processes like melting metals or drying materials. The heating process is fundamentally based on electromagnetic means and graphite was selected as the crucible material. This furnace is a modified model appropriate for labs and workshops. The furnace is intended to provide efficient and controlled heating for various materials, including metals, ceramics, and composites. The liquid aluminium is poured to a desired shape and size either a aluminium block or final product.

CHAPTER 7
CONCLUSION

A custom-designed electrical resistance heating furnace was developed specifically for melting non-ferrous materials. During testing, aluminum weighing 0.5 kg was melted, with continuous recording of temperature and timing as the furnace ramped up. The heating and melting rates were found to be comparable to those of standard furnaces, achieving temperatures well over 950°C within 210 minutes and melting the initial charge in approximately the same time frame. Following the furnace's successful performance, sand and die casting samples were prepared and subjected to hardness testing using a machine. The results revealed a hardness value of 215gm, representing approximately 71.66% compared to established standards, indicating a favorable outcome.

DESIGN AND DEVELOPMENT OF PORTABLE DIRECT EXTRUSION MACHINE

A PROJECT REPORT

Submitted by

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MOHAMED ARSATH. M	(812420114349)
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INTERNAL EXAMINER

EXTERNAL EXAMINER

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1.	JONES SEBASTIN.K (812420114333)	DESIGN AND DEVELOPMENT OF PORTABLE DIRECT EXTRUSION MACHINE	Dr. B. SELVAM, M.Tech., Ph.D. Professor & Head Department Of Mechanical Engineering M.I.E.T. Engineering College Tiruchirappalli-620007
2.	MOHAMED ARIF.B (812420114348)		
3.	MOHAMED ARSATH.M (812420114349)		
4.	AMOHAMED RIYAZ (812420114359)		

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Submitted for the Anna University examination held on 13-05-2024

INTERNAL EXAMINER

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13.5.24

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ABSTRACT

Many researchers required secondary machining processes for casted components such as forging and direct extrusion for developing material data. The existing direct extrusion machines are larger in size so it is not able to move from one place to another place. The direct extrusion machine contains two major processes such as heating the billet and loading the unit. In this research heating chamber is only planned to designed and developed as a portable unit and load can be applied by using a Universal testing machine (UTM). Direct extrusion stands as a fundamental metal working process so this study aims the model and simulate of direct extrusion process. The heating chamber with die setup is produced for temperatures up to 500°C. The metals having re crystallization temperatures up to 350°C can be extruded with an direct extrusion ratio 64:1. The setup is designed and developed. The extruded metal is characterized by measuring the properties such as, hardness, impact strength and Density. The performance of the direct extrusion setup through the measured properties. The toughness, hardness, relative density of AA6063 are 22.3 joules, 51.2 HRB and 98.14% respectively. The determined mechanical properties are more closure to the theoretical values of AA6063 alloy so this portable direct extrusion machine can be used for producing extruded rods.

CHAPTER 5
CONCLUSION

5.1 Conclusion

The portable direct extrusion machine was designed and developed for making extrusion of various non-ferrous alloys having recrystallization temperature of 500°C . Mechanical tests such as density, hardness and toughness for extruded aluminium alloy 6063 and the following conclusions are made from the experimental investigations.

1. The portable direct extrusion machine can be used to the maximum billet heating temperature of 500°C.
2. Extrusion of various non-ferrous metals and alloys billets can be made into rods,
3. The maximum relative density of 98.14% was obtained and it can be applied as secondary manufacturing process.
4. The portable machine is capable to measure the heating coil temperature as well as inside billet temperature.
5. The extruded AA6063 alloy hardness was very closure to the actual theoretical hardness value. The relative hardness value of 96.67% was determined after extrusion.
6. There was no cracks and hot tears were not identified on the extruded AA6063.
7. The toughness value of AA6063 was determined and it is very closure to the other researcher values.

DESIGN AND FABRICATION OF COCONUT ENDOSPERM SCRAPPING MACHINE

A PROJECT REPORT

Submitted by

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MOHAMED FAHED. A	**(812420114355)**
MOHAMED SUHAIL. M	**(812420114361)**
MOHAMMED ASHIK. S	**(812420114364)**

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in

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ABSTRACT

Coconut is widely used from cooking to beauty products. In food industry, large amount of coconut is used and it requires more effort to scrap the endosperm from the coconut shell. The existing coconut scrapping machines are not fully automated and it still needs to hold the coconut shell to scrap the endosperm which is used from household application to commercial application. The existing scrapping machine causes injury to hand and not safe while scrapping the endosperm from the coconut shell. It is a labour intensive and time consuming process. To avoid this, a special device is required to scrap out the endosperm from the coconut shell. In this project, a coconut gripper is designed and fabricated to hold any shape and size of a coconut shell. Then a multipoint blade is designed and fabricated with required stiffness to scrap the coconut endosperm. The scrapping blade is fixed at left end and the gripper is moved to the blade from the right end. The motors are used to provide the linear and rotary motion of the gripper based on speed and torque requirements. The screw rod is also used in between the supporting shafts which helps the gripper to move linear motion. Then the control switch setup is arranged to control the gripper at forward and reverse direction. Finally, a coconut scrapping machines is designed and fabricated which reduces the risk of injury, increasing the productivity to scrap the endosperm and reducing the need to hold the coconut shell while scrapping which is benefited to both household and commercial application.

CHAPTER 6

CONCLUSION

The coconut endosperm scrapping machine is a essential equipment to scrapping the endosperm from coconut shell. This coconut scrapper is might be suitable for household appliance and it can be used for commercial application. In this project, a coconut endosperm scrapping machine in designed and fabrication with a low cost for commercial and household appliance.

This coconut endosperm scrapping machine consists of frame, motor, lead screw rod, operating swithes and blades

- The frame is designed and fabricated according to the total load acting on the frame.
- The motor set up is designed and fabricated to rotate the coconut shell holder and drive the lead screw mechanism.
- The lead screw rod is designed and fabricated to drive the coconut shell holder block in forward and backward motion.
- The blade is designed and fabricated such a way that, it scrapping the endosperm from the coconut shell.

The scrapping machine parts are assembled and final equipment was obtained. The performance of the setup was examined and it scrap the coconut endosperm efficiently.

DESIGN AND IMPLEMENTATION OF HEAT EXCHANGER AND SCRUBBER UNIT FOR ENTRAINED FLOW GASIFIER AND PRODUCTION OF SYNGAS BY USING SESAME WASTE

A PROJECT REPORT

Submitted by

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ABSTRACT

Biomass gasification has emerged as a promising technology for converting organic materials into clean energy sources such as syngas, biofuels, and hydrogen. This process involves the partial oxidation of biomass in a controlled environment to produce a synthesis gas rich in hydrogen and carbon monoxide.

The produced syngas can be utilized for various applications, including power generation, heat production, and biofuel synthesis, offering a versatile solution for energy needs. This abstract provides an overview of biomass gasification technology, its operating principles, and key process parameters.

It discusses the types of biomass feedstocks suitable for gasification and explores the various reactor configurations and gasification methods employed. Furthermore, it highlights the environmental benefits of biomass gasification, including reduced greenhouse gas emissions and mitigation of waste disposal issues.

The abstract also addresses the challenges associated with biomass gasification, such as feedstock variability, tar formation, and reactor fouling, along with ongoing research efforts and technological advancements aimed at overcoming these obstacles.

Moreover, the project report highlights the environmental benefits and economic feasibility of EFG technology, showcasing its potential to convert diverse feedstock into valuable syngas while minimizing emissions and waste. Insights gleaned from this study contribute to advancing the understanding the optimization of EFG systems, paving the way for their widespread adoption in sustainable energy production and industrial application.

CHAPTER 9

CONCLUSION

In conclusion, the entrained flow gasifier project represents a significant stride towards sustainable energy production and environmental stewardship. Through meticulous design, rigorous experimentation, and comprehensive analysis, this project has provided valuable insights into the operation and optimization of entrained flow gasification technology.

The successful implementation of the gasifier showcases its potential as a viable alternative for converting biomass, coal, or waste materials into valuable syngas, which can be utilized for various industrial applications, including electricity generation, chemical synthesis, and fuel production. Moreover, the efficient utilization of feedstock and the minimal production of harmful emissions underscore the environmental benefits of this technology, contributing to the global efforts in mitigating climate change and reducing reliance on fossil fuels.

Furthermore, the collaborative efforts involved in this project, spanning across multidisciplinary teams and stakeholders, exemplify the importance of cooperation and knowledge sharing in advancing technological solutions for a sustainable future.

Thus, the experiment is conducted and the amount of heat transfer and the effectiveness of heat transfer is calculated. From our project we have shown that the spiral tube heat exchanger's effectiveness is more than the normal parallel flow heat exchanger.

The conclusion from their investigations is that scrubber efficiency depends on energy input per unit of gas flow, whether energy is supplied to the air or the water (contact power theory). This conclusion applies only to well designed equipment when the energy is expended in the gas-liquid contacting.

PERFORMANCE AND COMBUSTION CHARACTERISTICS IN DIESEL ENGINE BY USING MIXED BIODIESEL ALONG WITH ANTIOXIDANT ADDITIVE

A PROJECT REPORT

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ABSTRACT

Development of sustainable energy resources is the need of present day in view of the depleting energy resources and increase in the energy demand throughout the world. On the other hand, fossil fuel combustion emits harmful pollutants like oxides of carbon, sulfur, nitrogen and particulate matters, which causes atmospheric pollution. Biodiesel as alternative fuels have various advantages over the fossil fuels such as its renewability, lesser emission of atmospheric pollutants and flexibility to produce from variety of feedstock. Waste cooking oil can be used as a potential feedstock for biodiesel production. Disposal of waste cooking oil itself an environmental challenge due to its adverse environmental impact. Transesterification is the key process for synthesis of biodiesel production with low cost and under mild reaction condition.

The objective of the present work is to produce biodiesel from waste cooking oil mixed with okra seed oil using a homogeneous catalyst. Since the extracted oil has acid value of 12.5 mg KOH/g of oil, it was subjected to esterification process using hydrochloric acid. The maximum biodiesel yield of 97% was obtained under the optimum conditions of molar ratio of 1:6, catalyst concentration of 1.5wt.% (KOH), reaction time of 1.5 hours, at temperature 62°C and 500rpm stirring speed. The biodiesel properties meet the ASTM D7651 standards.

The second objective of the works is to investigate the working characteristics of the produced biodiesel on a compression ignition engine, including its performance, combustion, and emission. In addition, the antioxidant (propyl gallate) 1% was added to the biodiesel and investigated for engine performance. The performance characteristics examined include brake

CHAPTER 7

CONCLUSION

- The present work focused on the production of biodiesel from waste cooking oil and okra oil. The results of FTIR confirmed that complete transformation of biodiesel

- Furthermore, the yield of the esterification process using WCO and okra feedstock was optimised under specific conditions, resulting in a yield of 97%. Similarly, the transesterification process using Potassium hydroxide as catalyst and waste cooking oil and okra seed oil as feedstock is optimised, resulting in an even higher yield of biodiesel at 97%. The results revealed that maximum biodiesel yield of 97% is achieved using eggshell as a catalyst at 1:6MR, 1.5wt % of catalyst concentration, fixed stirrer speed of 500 rpm and 1.5 hours reaction time.

- Finally, emission tests are conducted to evaluate the emissions produced during the combustion process. The results showed that CO, HC and FSN of the B100 and its blends are lower than neat diesel and B20 biodiesel (20% WCO and okra biodiesel and 80% petroleum diesel) is the optimum fuel, as it significantly reduces emissions of carbon monoxide and nitrogen oxides, which are major environmental pollutants while having better performance than B100.

- It is concluded that, this research work successfully demonstrated the suitability of using waste cooking oil and okra as feedstock and catalysts, respectively, for the production of biodiesel. The engine performance, combustion and emission results show that blending biodiesel with diesel is a promising approach to reduce emissions and improve engine

efficiency. The findings of this work are useful for the development of a sustainable biodiesel production process using waste cooking oil and okra oil

7.1 FUTURE SCOPE OF WORK

With a growing global demand for alternative energy sources, the development and optimization of biodiesel production from waste chicken fat and eggshells can offer a promising solution to the energy crisis. The following future scope proposes several directions for innovation and research to ensure the viability of this approach.

- Technological advances and efficiency gains-higher biomass yields per acre and more gallons of biofuel per ton of biomass-could steadily reduce the economic cost and environmental impacts of biofuel production.
- Biofuel production will likely be most profitable and environmentally benign in tropical areas where growing seasons are longer, per acre biofuel yields are higher, and fuel and other input costs are lower.
- Explore the use of different types of feedstocks, such as mustard or jackfruit seed oil.
- Investigate the impact of the process parameters such as reaction temperature, reaction time, and methanol to WCO and okra ratio on the yield.

EXPERIMENTAL INVESTIGATION OF PROTON EXCHANGE MEMBRANE BASED FUEL CELL

A PROJECT REPORT

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ABSTRACT

Proton Exchange Membrane (PEM) fuel cells have garnered significant attention due to their high efficiency and clean energy production. This paper presents a comprehensive overview of a PEM fuel cell setup, detailing its components, operation, and applications. The setup comprises five main components the anode, cathode, proton exchange membrane, bipolar plates, and gas diffusion layers. Hydrogen gas is fed to the anode side, where it undergoes catalytic oxidation, releasing protons and electrons. Protons migrate through the PEM to the cathode, while electrons travel through an external circuit, generating electrical power. At the cathode, oxygen gas reacts with protons and electrons, forming water as the only byproduct. Key factors affecting the performance of the PEM fuel cell include temperature, humidity, pressure, and catalysts. Proper control and optimization of these parameters are essential for maximizing efficiency and durability. Applications of PEM fuel cells range from portable electronics and backup power systems to transportation and stationary power generation. Their versatility, high power density, and low emissions make them a promising solution for clean energy needs.

CHAPTER 9
CONCLUSION

In conclusion, proton exchange membrane fuel cells (PEMFCs) offer a promising solution to the world's energy needs, providing clean and efficient power generation with minimal environmental impact. Through their ability to convert chemical energy directly into electrical energy, PEMFCs hold great potential for widespread adoption in various applications, from transportation to stationary power generation.

Despite their numerous advantages, challenges remain, including cost reduction, durability improvement, and infrastructure development. However, ongoing research and technological advancements are steadily addressing these obstacles, paving the way for PEMFCs to become a key player in the transition towards a sustainable energy future.

Overall, the PEM fuel cell technology shows great potential in the production of electricity sustainable energy source. With further advancements and continued research, it has the capacity to contribute significantly to the transition towards a low-carbon and renewable energy future.

As we continue to invest in the development and deployment of PEMFC technology, it is crucial to prioritize collaboration between industry, academia, and government agencies to accelerate progress and ensure the widespread adoption of this clean energy solution. With concerted efforts, PEMFCs can play a vital role in reducing greenhouse gas emissions, mitigating climate change, and securing a more sustainable energy landscape for future generations.

EXPERIMENTAL INVESTIGATION OF HYDROGEN PRODUCTION USING DRY CELL ELECTROLYSIS PROCESS

A PROJECT REPORT

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DECLARATION

We hereby declare that the work entitled **"EXPERIMENTAL INVESTIGATION OF HYDROGEN PRODUCTION USING DRY CELL ELECTROLYSIS PROCESS"** is submitted in partial fulfillment of the requirement for the award of the degree in Bachelor of Engineering, Anna university, Chennai, is a record of our own work carried out by us during the academic year 2023 - 2024 under the supervision and guidance of MR. R.MANICKAM,M.E.,(Ph.D).
Assistant Professor, Department of Mechanical Engineering, M.I.E.T. Engineering College, Tiruchirappalli.

The extent and source of our information were derived from the existing literature and have been indicated through the dissertation at the appropriate places. The content embodied in this work is original and has not been submitted for the award of any other degree or diploma, either in this or any other university.

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MANIKANDAN.R

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SHRIVARSHAN.B

I certify that the declaration made above by the candidate is true.

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ABSTRACT

At this present modern day, continuous consumption of fossil fuel and consequent harmful emissions demand is the need for alternative fuel. Water electrolysis is the most promising method to produce a Hydrogen-Oxygen (HHO) mixture. However the less energy consumption is aimed to maximize the HHO production. The aim of the research is to produce the maximum gas flow rate from dry cell by modified design configurations. HHO is produced by water electrolysis in parallel plates are brass plate and rubber gasket using different concentration of NaOH and KOH. It is also aimed to study the effects of different parameters such as electrolyte type (NaOH and KOH), electronic concentration, electrode spacing, electrolyte temperature, applied current voltage and operating time to maximize the gas yield in dry cell. Effects of flow current, voltage, electrolyte concentration, temperature, operating time and electrolyte types on HHO flow rate were studied. The voltage increase from 2 to 4 VDC led to the electrolyser efficiency increase to 50% but after that it was decreased. The applied voltage increase from 2 to 11 VDC increased the HHO flow rate from 120 to 460 ml/min. The current increase from 8 to 14 A, produced the electrolyser efficiency of 72 % and decreased after that. The current increase from 6 to 18A, led the actual flow rate increase from 137 to 654 ml/min. After operating time of 30 min., the HHO flow rate reached the highest stable values of 866, 985, 1040 and 1090 ml/min at 5, 10, 15 and 20 g NaOH concentrations, respectively. The electrolyte concentration of 5 g NaOH in cell configuration [4C3A19N] and supplied current of 14 A led to the highest HHO productivity of 866 ml/min and electrolyser efficiency of 72.1%. HHO dry cell is economical and efficient.

Keywords :- AC to DC Converter , NaOH and KOH , Dry Cell stack , Silicon gasket , Acrylic tube , Brass Plate , Electrolyte, HHO.

CHAPTER 10
CONCULSION

In conclusion, the dry cell electrolyzer is a technology that holds great promise in the field of hydrogen production. It is an electrochemical device that uses water as a feedstock to produce hydrogen gas, which can be used as a clean and renewable energy source. The dry cell electrolyzer operates by passing an electric current through water, causing the water molecules to split into hydrogen and oxygen gases through a process known as electrolysis. This technology offers several advantages, including high efficiency, scalability, and the ability to utilize a wide range of water sources. One of the key advantages of the dry cell electrolyzer is its high efficiency in hydrogen production. It has the potential to achieve high conversion rates, meaning that a significant amount of the input energy can be effectively converted into hydrogen gas. This efficiency makes the dry cell electrolyzer an attractive option for large-scale hydrogen production, which is crucial for meeting the growing demand for clean energy. Further more, the dry cell electrolyzer is a scalable technology, meaning it can be adjusted to different production capacities based on the required hydrogen output. This scalability makes it suitable for various applications, from small-scale installations for residential or industrial use to large-scale hydrogen production for transportation or energy storage. Additionally, the dry cell electrolyzer has the advantage of being able to utilize different water sources, including freshwater, seawater, and wastewater. This versatility allows for flexibility in locating the electrolyzer units and reduces the strain on freshwater resources, making it a more sustainable option for hydrogen production. However, it is important to note that there are still challenges that need to be addressed for widespread adoption of dry cell electrolyzers. These challenges include the cost of

materials, durability of the electrodes, and the overall system's long-term stability. Ongoing research and development efforts are focused on addressing these challenges and improving the performance and cost effectiveness of dry cell electrolyzers. Overall, the dry cell electrolyzer technology shows great potential in the production of hydrogen as a clean and sustainable energy source. With further advancements and continued research, it has the capacity to contribute significantly to the transition towards a low-carbon and renewable energy future. The electrolysis process offers significant potential for various industrial, environmental, and energy applications In conclusion, electrolysis represents a promising pathway for sustainable energy production, environmental protection, and industrial innovation. With ongoing advancements and support, electrolysis has the potential to become a cornerstone of the clean energy landscape, driving positive impacts for society and the planet. Electrolysis, driven by renewable energy sources, enables the clean and efficient generation of hydrogen gas without carbon emissions. This method offers versatility across industries, from transportation to industry and energy storage, fostering a transition away from fossil fuels. As electrolyser technologies continue to advance and costs decline, the scalability and commercial viability of hydrogen production are steadily improving. applicable in transportation, industry, and energy storage. Its environmental benefits lie in its potential to decarbonize sectors traditionally reliant on fossil fuels. Advancements in electrolyser technology, coupled with the increasing availability of renewable energy sources, Embracing electrolytic hydrogen production not only reduces reliance on finite resources but also mitigates environmental impacts, contributing to efforts to combat climate change. By investing in and adopting electrolysis for hydrogen production, we can pave the way for a cleaner, greener future powered by renewable energy and sustainable practices.

EXPERIMENTATION OF SYN GAS PRODUCTION FROM WASTE BIO MATERIAL IN TWO STAGE GASIFIER BY AIR AND STEAM MEDIUM

A PROJECT REPORT

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ABSTRACT

At present scenario agricultural waste bio material are not mostly used in the production of Syn gas. So we are using agricultural waste bio material to produce Syn gas. In downdraft gasifier with two stage gasification along with the steam medium is not widely used. In this present work steam and air working as a gasification medium to improve carbon conversion efficiency, tar reduction, gasifier working efficiency.

The experimentation of syn gas from waste bio-material using a two-stage gasifier employing both air and steam as mediums is a promising avenue for sustainable energy production. This study aims to investigate the feasibility and efficiency of this process, offering insights into its potential as an eco-friendly energy solution.

The two-stage gasification process involves the sequential utilization of air and steam as gasification agents. This approach aims to optimize gas yield while minimizing undesired by-products such as tar and char. The choice of waste bio-material as feedstock underscores the environmental benefits of utilizing renewable resources for energy generation.

CHAPTER 8

CONCLUSION

The experimentation of syn gas production from waste bio-material in a two-stage gasifier utilizing both air and steam as mediums holds significant promise in addressing environmental and energy challenges. Through our research, we have observed the feasibility of this approach in efficiently converting waste biomass into valuable synthesis gas, which can be utilized for various industrial applications, including electricity generation and chemical synthesis.

The two-stage gasification process offers several advantages, including improved gas quality, higher gas yield, and better control over the reaction parameters. By incorporating steam into the gasification process, we have demonstrated enhanced gasification efficiency and reduced tar content in the produced syn gas, thereby enhancing its suitability for downstream applications.

DESIGN AND FABRICATION OF CYCLONE SEPARATOR AND ASH COLLECTION BOX FOR CIRCULATING BED GASIFIER

A PROJECT REPORT

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ABSTRACT

To design a cyclone separator abatement system for particulate control, it for circulating fluidized bed gasifier application. In this present work, new the methods for computing travel distance, numbers of turns and cyclone pressure drop are studied. The flow pattern and cyclone dimensions determine the travel is tancein a cyclone. The number of turns is calculated based on this travel distance. The new theoretical analysis of cyclone pressure drop is tested against measured data at different inlet velocities and gave excellent agreement. The results show that cyclone vary with cyclone diameter Cyclone cut-points for different dusts are traced measured cyclone overall collection efficiencies and the theoretical model for calculating cyclone overall efficiency. The cut-point correction models 2D cyclones are developed through regression fit from traced and theoretical cut points Diameter. Experimental results indicated optimal cyclone design velocities, which are for 2D cyclones, is determined based on standard air density. It is important to consider the air density effect on cyclone performance in the design of cyclone abatement systems. The tangential inlet generates the swirling motion of the gas stream, which forces particles toward the outer wall where they spiral in the downward direction. Eventually, the particles are collected in the dust bin locate the bottom of the conical section of the cyclone body. The cleaned gas leaves through the exit pipe at the top. The ash content are collected by an ash collection box, it's fitted in the bottom of cyclone separator.

CHAPTER 7

CONCLUSION

It is observed from the efficiency formula that an increase in the density. Number of turns increases the device's efficiency which is similar to the conclusion which can be made from centrifugal force equation (i.e., increase in particle weight increases centrifugal force which helps in better separation).

Cyclone separators are mechanical systems that control particulate emissions by use of centrifugal separation process. Static pressure drop is the most important factor in evaluating the performance of this pollutant control device. Other factors such as particulate size, Cyclone dimensions, inlet particulate speed and particulate concentration in air are very essential in evaluating the cyclone collection performance. The cyclone particulates collection efficiency increases with increasing particulate size. Thus large diameter cyclones are most effective removing large particulates from large particulates – laden gas steam. Cyclonic separation remains one of the most effective particulate pollutant control measures. If the size of sample is the collection efficiency is almost same for the sample. With an increase in density of the sample, collection efficiency increases linearly. For the same velocity (or for the same power consumption). Highly dense particles are removes with higher collection efficiency compare to low dense particles.

DESIGN AND DEVELOPMENT OF BLENDING MACHINE FOR A VIBRATING BALL MILL USED IN POWDER METALLURGY

A PROJECT REPORT

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ABSTRACT

This project presents the design and fabrication of a ball mill integrated with a vibrating step-up mechanism. Powder metallurgy (PM) is increasingly favored for its efficient output across various industries. The study delves into the application of vibrating ball mills within PM processing, emphasizing their pivotal role in enhancing powder mixing and grinding. The vibrating ball mill showcases notable advantages, including heightened mixing efficiency, reduced processing durations, and operability under controlled atmospheres. However, a significant challenge lies in the time-consuming nature of powder processing conditioning. Traditional ball mills for powder blending often prolong the process, hindering efficiency. To address this drawback, a vibrating source is introduced to facilitate easier blending. The project assesses the time required for powder blending and outlines procedures to optimize efficiency in powder metallurgy processing. By introducing innovative methodologies, this project seeks to streamline the powder blending process, thereby enhancing productivity and output quality in powder metallurgy applications.

CHAPTER 7

CONCLUSION

The integration of double-axis movement and vibration into our powder metallurgy blinding machine represents a significant advancement in powder processing technology. We have demonstrated the tangible benefits of these innovations, including enhanced mixing and blending efficiency, improved material homogeneity, and reduced processing time. By introducing movements in we achieved better dispersion of powder particles leading to a more uniform blend and eliminating the risk of uneven distribution. Additionally,the incorporation of vibration effectively broke up agglomerates, ensuring thorough inter-particle interactions and further enhancing the homogeneity of the final mixture. These enhancements not only improve the quality of powdered materials but also contribute to increased productivity and cost-effectiveness in powder metallurgy processes. Moving forward, the success of this project underscores the importance of continuous innovation in manufacturing technologies, driving advancements that elevate the performance and reliability of industrial processes. With further refinement and optimization, the principles demonstrated in this project hold the potential to revolutionize powder processing methodologies and pave the way for future developments in the field of metallurgy and beyond.

DESIGN AND FABRICATION OF SHELL AND TUBE HEAT EXCHANGER AND SCRUBBER FOR CIRCULATING FLUIDIZED BED GASIFIER

A PROJECT REPORT

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ABSTRACT

Biomass gasification is a promising technology that converts organic materials such as agricultural residues, forest residues, and energy crops into clean, renewable energy sources such as syngas and biochar. This process involves thermo chemical conversion in a controlled environment, resulting in the production of a combustible gas primarily composed of hydrogen, carbon monoxide, and methane. The syngas generated can be utilized for various applications including electricity generation, heat production, and biofuels synthesis. Biomass gasification offers several advantages including reduced greenhouse gas emissions, potential for waste valorization, and energy security. However, challenges such as feedstock availability, technological complexity, and economic viability need to be addressed for widespread adoption. This abstract provides an overview of biomass gasification technology, its applications, benefits, challenges, and future prospects in the transition towards a sustainable energy future.

Circulating Fluidized Bed (CFB) gasification has emerged as a versatile and efficient technology for converting various feedstock's into valuable syngas. This abstract delves into the fundamental principles and operational mechanisms of CFB gasifier, highlighting their unique capabilities in handling a wide range of biomass, coal, and waste materials. By suspending particles in a fluidized state, CFB gasifier offer enhanced heat and mass transfer, facilitating through conversion and minimizing tar formation. This abstract explores recent developments, challenges, and future prospects of CFB gasification, emphasizing its role in advancing towards a cleaner and more sustainable energy landscape.

CHAPTER 8

CONCLUSION

In conclusion, the design and fabrication of the shell-and-tube heat exchanger and wet scrubber have been successfully completed. Through careful consideration of factors such as heat transfer requirements, material selection, and operational efficiency, both systems have been tailored to meet the specific needs of the application. The shell-and-tube heat exchanger provides efficient heat transfer between two fluids, while the wet scrubber effectively removes pollutants from gas streams. The fabrication process adhered to industry standards, ensuring reliability and safety. Overall, these systems represent reliable and efficient solutions for heat transfer and pollution control in industrial processes.

EXPERIMENTAL INVESTIGATION ON PRODUCTION OF BIODIESEL FROM OKRA (ABELMOSCHUS ESCULENTUS) SEED OIL AND ITS PERFORMANCE CHARACTERISTICS ON COMPRESSION IGNITION (CI) ENGINE

A PROJECT REPORT

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ABSTRACT

The present work aims to produce biodiesel from okra seed oil with a catalyst of sodium methoxide ($NaOCH_3$) and evaluate the performance of compression ignition (CI) engine. Biodiesel is an alternative source to world petroleum reserves due to rapidly growing energy demands coupled with environmental concerns has prompted the efforts to explore some alternative sources of petroleum-based fuels.

Okra seed oil is a novel feedstock for biodiesel production. Oil extraction using cold press method gave better result when compared to solvent extraction method. Since, the extracted oil has acid value of 35.2 mgKOH/g of oil, it was subjected to esterification process using hydrochloric acid.

The esterified oil was subjected to biodiesel production using homogeneous catalysts of sodium methoxide ($NaOCH_3$) gave maximum biodiesel yield of 96.8% at reaction conditions of 1:6 molar ratio, 2 wt.% of catalyst, reaction time of 2 hours, temperature of 63°C and 600rpm. The properties of produced biodiesel was within the limits of ASTM D6751 standard.

Next, the produced okra oil biodiesel was investigated to study the performance, combustion and emission characteristics of compression ignition (CI) engine. The performance characteristics examined include brake thermal efficiency (BTE) and brake specific fuel consumption (BSFC). The emission characteristics measured include carbon monoxide (CO), carbon dioxides (CO2), hydrocarbons (HC), oxides of nitrogen (NOx) and smoke.

The results showed that the biodiesel produced from okra seed oil it had BTE and lower BSFC compared to diesel. The cylinder pressure and heat release rate characteristics of the produced biodiesel were evaluated using a combustion analyser and the result showed that biodiesel produced from okra seed oil exhibited superior combustion characteristics than diesel. The emissions characteristics than diesel. The emissions characteristics of produced biodiesel

produced from okra oil exhibited superior combustion characteristics than diesel. The emissions characteristics of produced biodiesel were also analyzed and compared to diesel and the result showed that the emissions of CO, HC, and NOx were lower for the biodiesel produced from okra seed oil compared to diesel. In conclusion this study demonstrates the potential of using catalysts for producing biodiesel from okra seed oil in suitability for use on diesel engine. Finally, it is concluded that the development of a sustainable and environmentally friendly biodiesel production process that is used on diesel engine.

CHAPTER 7

CONCLUSION

- Oil extraction using cold press method gave better result when compared to solvent extraction method. Since, the extracted oil has acid value of 35.2 mgKOH/g of oil, it was subjected to esterification process using hydrochloric acid.

- The esterified oil was subjected to biodiesel production using homogeneous catalysts of sodium methoxide ($NaOCH_3$) gave maximum biodiesel yield of 96.8% at reaction conditions of 1:6 molar ratio, 2 wt.% of catalyst, reaction time of 2 hours, temperature of 63°C and 600rpm. The properties of produced biodiesel was within the limits of ASTM D6751 standard.

- The engine test were conducted to evaluate the engine performance of the produced biodiesel. The B20 blend showed that the improved performance to that of neat biodiesel. It is attributed to the high oxygen content and better lower viscosity of B20 blend because of that it can easily in combustion chamber. And also, the B20 biodiesel blend proves to emission and improves engine efficiency when compared to neat biodiesel.

- In addition, combustion tests are conducted to determine the optimal fuel-ratio and residence time. The result showed that the optimal fuel- air ratio is 1:18 and the residence time is 3 seconds for the complete combustion of biodiesel. The results of the engine study shows that the maximum heat release rate. Finally, emission tests are conducted to evaluate the emissions produced during the combustion process.

DESIGN AND DEVELOPMENT OF POLISHING MACHINE TO PREPARE SPECIMENS FOR METALLOGRAPHIC ANALYSIS

A PROJECT REPORT

Submitted by

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in partial fulfillment for the award of the degree

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in

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DECLARATION

We hereby declare that the work entitled **"DESIGN AND DEVELOPMENT OF POLISHING MACHINE TO PREPARE SPECIMENS FOR METALLOGRAPHIC ANALYSIS"** is submitted in partial fulfillment of the requirement for the award of the degree in Bachelor of Engineering, Anna university, Chennai, is a record of our own work carried out by us during the academic year 2023 - 2024 under the supervise Sion and guidance of **Mr. R.Narayanan, M.E.,** Assistant Professor, Department of Mechanical Engineering, M.I.E.T. Engineering College, Tiruchirappalli.

The extent and source of our information were derived from the existing literature and have been indicated through the dissertation at the appropriate places. The content embodied in this work is original and has not been submitted for the award of any other degree or diploma, either in this or any other university.

B. Naveen Raj

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I certify that the declaration made above by the candidate is true.

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ABSTRACT

Polishing is a surface machining process used to provide a product a high quality finished surface. To determine a material's microstructure, a metallographic specimen analysis should be performed. Polishing is one step in the preparation of a metallographic specimen. The designing and manufacturing a polishing machine will be very helpful in the process of polishing the metallographic specimen. The purpose of this project was to design and manufacturing a polishing machine on a laboratory scale. The project involves a number of process stages, including model design, tool and material preparation, component fabrication and assembly of the polishing machine. This machine can be used for polishing different materials such as metals, plastics, and ceramics. After the fabrication of this polishing machine, it is observed that a good surface finish can be achieved. This polishing machine's performance was evaluated during the testing phase in terms of surface roughness and material removal rate. The results demonstrated outstanding repeatability and uniformity in producing perfect surface finishes when examining microstructural characteristics under microscope. This polishing machine performs well and can be used for metallographic testing by students and researchers.

CHAPTER 7
CONCLUSION

The polishing machine has successfully completed its design and development. The following conclusion can be made from this project.

- The polishing machine designed consists of motors, spindle heads, and each spindle head carries a rotary disc. The rotary disc is mounted on the spindle head.
- The machine's key features, the disc-type design allows for uniform pressure distribution across the workpiece. Adjustable rotational speed enables customization for different materials and finishing requirements.
- This machine can be used for polishing different materials such as metals, plastics, and ceramics. After the fabrication of this polishing machine, it is observed that a good surface finish can be achieved.
- The performance of the polishing machine was assessed during the testing phase based on surface roughness and material removal rate. The results demonstrated remarkable consistency and repeatability in achieving desirable surface finishes, critical for accurately examining microstructural details under microscopy.
- The polishing machine that was designed is a useful instrument for metallurgical research and quality control in laboratories and companies. It enabling precise and reproducible preparation of specimens for detailed microstructural analysis.

SYNGAS PRODUCTION FROM CATALYTIC BIOMASS GASIFICATION IN A TWO STAGE DOWNDRAFT GASIFIER

A PROJECT REPORT

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ABSTRACT

In order to get proper syngas production from waste such as various bio masses in single stage gasification under without Catalyst is not possible. To improve the syngas production from various biomass it must have some potential density in present inside the reaction chamber so that Pellets consists of Sesame stalks, Hemp, Tamarind shell is having potential to work in gasification chamber because of its density. This material is feed into two stage downdraft gasifier the zone of pyrolysis, oxidation and reduction in which the whole biogas enter zone according to the fixed equivalent ratio. In this present work the waste bio material feed in pellet mode, fixed equivalance ratio and dolomite as working catalyst. This study explores syngas production through various methods, including steam reforming, partial oxidation, and biomass gasification. It examines the principles, processes, and technological advancements in each method, emphasizing their efficiency, environmental impact, and economic feasibility. Additionally, the abstract highlights the importance of syngas as a versatile precursor for producing fuels, chemicals, and materials, and discusses potential future research directions in this field Syngas production while mitigating environmental concerns. Furthermore, it underscores the significance of syngas in the transition towards sustainable energy systems and the circular economy, fostering innovation and collaboration across academia, industry.

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CHAPTER 8

CONCLUSION

In conclusion, the entrained flow gasifier project represents a significant stride towards sustainable energy production and environmental stewardship. Through meticulous design, rigorous experimentation, and comprehensive analysis, this project has provided valuable insights into the operation and optimization of entrained flow gasification technology.

The successful implementation of the gasifier showcases its potential as a viable alternative for converting biomass, coal, or waste materials into valuable syngas, which can be utilized for various industrial applications, including electricity generation, chemical synthesis, and fuel production. Moreover, the efficient utilization of feedstock and the minimal production of harmful emissions underscore the environmental benefits of this technology, contributing to the global efforts in mitigating climate change and reducing reliance on fossil fuels.

DESIGN AND DEVELOPMENT OF REACTOR CORE FOR ENTRAINED FLOW GASIFIER AND ITS PERFORMANCE EVALUATION BY USING JULIFLORA BIOMASS AT AIR ATMOSPHERE

A PROJECT REPORT

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ABSTRACT

Entrained flow gasification is a promising technology for converting solid fuels into syngas, which can be further utilized for various applications such as power generation, chemical synthesis, and fuel production. In this study, we investigate the behavior of an entrained flow gasifier within a reactor core, focusing on its efficiency, performance, and environmental impact. The reactor core design plays a crucial role in determining the gasifier's performance. By optimizing the core geometry, residence time, and temperature distribution, we aim to enhance gasification efficiency and syngas quality. Computational fluid dynamics simulations are employed to analyze the flow dynamics, heat transfer, and chemical reactions within the gasifier. Environmental considerations are also addressed, with a focus on reducing emissions of pollutants such as particulate matter, tar, and sulfur compounds. Advanced gas cleaning techniques, including catalytic conversion and scrubbing, are evaluated for their effectiveness in meeting regulatory standards and ensuring environmental sustainability.

CHAPTER 9
CONCLUSION

In conclusion, the utilization of entrained flow gasification technology for processing juliflora offers a promising avenue for sustainable biomass conversion. Juliflora, known for its fast growth and adaptability to arid environments, presents a renewable and abundant feedstock for gasification processes.Entrained flow gasification, characterized by high temperatures and efficient mixing of feedstock and gasifying agents, provides several advantages in converting juliflora into syngas. The technology offers precise control over temperature distribution, facilitating optimal reaction kinetics and maximizing gasification efficiency.

By leveraging entrained flow gasification, juliflora can be efficiently converted into a clean syngas suitable for various energy and chemical applications. Additionally, the process can help address environmental challenges associated with juliflora invasiveness by providing an economically viable means of biomass utilization fabricate the reactor core .Overall, entrained flow gasification holds significant promise as a sustainable solution for converting juliflora biomass into valuable energy products, contributing to both environmental conservation and energy security objectives.

DEVELOPMENT OF ELECTRICAL RESISTANCE HEATING FURNACE FOR MELTING OF NON-FERROUS MATERIALS

A PROJECT REPORT

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ABSTRACT

Furnaces are used to heat Solid Materials to change their shape or properties. Melting furnace is mainly made with non-ferrous metals. An electrical resistance heating furnace is a type of heating system that uses electrical resistance to generate heat. This work developed an electric- powered crucible furnace for the purpose of melting aluminium scraps. It typically consists of heating elements, such as coils or wires, that produce heat when an electric current passes through them. These furnaces are commonly used for space heating in homes and buildings, as well as in industrial applications for processes like melting metals or drying materials. The heating process is fundamentally based on electromagnetic means and graphite was selected as the crucible material. This furnace is a modified model appropriate for labs and workshops. The furnace is intended to provide efficient and controlled heating for various materials, including metals, ceramics, and composites. The liquid aluminium is poured to a desired shape and size either a aluminium block or final product.

CHAPTER 7
CONCLUSION

A custom-designed electrical resistance heating furnace was developed specifically for melting non-ferrous materials. During testing, aluminum weighing 0.5 kg was melted, with continuous recording of temperature and timing as the furnace ramped up. The heating and melting rates were found to be comparable to those of standard furnaces, achieving temperatures well over 950°C within 210 minutes and melting the initial charge in approximately the same time frame. Following the furnace's successful performance, sand and die casting samples were prepared and subjected to hardness testing using a machine. The results revealed a hardness value of 215gm, representing approximately 71.66% compared to established standards, indicating a favorable outcome.

DESIGN AND DEVELOPMENT OF PORTABLE DIRECT EXTRUSION MACHINE

A PROJECT REPORT

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ABSTRACT

Many researchers required secondary machining processes for casted components such as forging and direct extrusion for developing material data. The existing direct extrusion machines are larger in size so it is not able to move from one place to another place. The direct extrusion machine contains two major processes such as heating the billet and loading the unit. In this research heating chamber is only planned to designed and developed as a portable unit and load can be applied by using a Universal testing machine (UTM). Direct extrusion stands as a fundamental metal working process so this study aims the model and simulate of direct extrusion process. The heating chamber with die setup is produced for temperatures up to 500°C. The metals having re crystallization temperatures up to 350°C can be extruded with an direct extrusion ratio 64:1. The setup is designed and developed. The extruded metal is characterized by measuring the properties such as, hardness, impact strength and Density. The performance of the direct extrusion setup through the measured properties. The toughness, hardness, relative density of AA6063 are 22.3 joules, 51.2 HRB and 98.14% respectively. The determined mechanical properties are more closure to the theoretical values of AA6063 alloy so this portable direct extrusion machine can be used for producing extruded rods.

CHAPTER 5
CONCLUSION

5.1 Conclusion

The portable direct extrusion machine was designed and developed for making extrusion of various non-ferrous alloys having recrystallization temperature of 500°C . Mechanical tests such as density, hardness and toughness for extruded aluminium alloy 6063 and the following conclusions are made from the experimental investigations.

1. The portable direct extrusion machine can be used to the maximum billet heating temperature of 500°C.
2. Extrusion of various non-ferrous metals and alloys billets can be made into rods,
3. The maximum relative density of 98.14% was obtained and it can be applied as secondary manufacturing process.
4. The portable machine is capable to measure the heating coil temperature as well as inside billet temperature.
5. The extruded AA6063 alloy hardness was very closure to the actual theoretical hardness value. The relative hardness value of 96.67% was determined after extrusion.
6. There was no cracks and hot tears were not identified on the extruded AA6063.
7. The toughness value of AA6063 was determined and it is very closure to the other researcher values.

DESIGN AND FABRICATION OF COCONUT ENDOSPERM SCRAPPING MACHINE

A PROJECT REPORT

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Submitted to the Project viva voce held on 13-05-2024

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EXTERNAL EXAMINER

PRINCIPAL
M.I.E.T. ENGINEERING COLLEGE
GUNDUR, TIRUCHIRAPALLI - 620 007

CERTIFICATION OF EVALUATION

College Name : M.I.E.T. ENGINEERING COLLEGE
Department : MECHANICAL ENGINEERING
Semester : VIII

S.No	Name of students	Title of project	Name of the Supervisor with Designation
1.	**MOHAMED EMTHIYAS. S** (812420114354)	**DESIGN AND FABRICATION OF COCONUT ENDOSPERM SCRAPPING MACHINE**	**Dr. K. PANNEER SELVAM, M.E.,Ph.D,** Associate professor Department of Mechanical Engineering M.I.E.T Engineering college Tiruchirapalli-620007
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4.	**MOHAMMED ASHIK. S** (812420114364)		

The report of the project work submitted by the above students in partial Fulfilment of the award of Bachelor of Engineering Degree in Mechanical Engineering of Anna University was evaluated and confirmed to be the report of the work done by the above students.

Submitted for the anna university examination held on 13-05-2024

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ABSTRACT

Coconut is widely used from cooking to beauty products. In food industry, large amount of coconut is used and it requires more effort to scrap the endosperm from the coconut shell. The existing coconut scrapping machines are not fully automated and it still needs to hold the coconut shell to scrap the endosperm which is used from household application to commercial application. The existing scrapping machine causes injury to hand and not safe while scrapping the endosperm from the coconut shell. It is a labour intensive and time consuming process. To avoid this, a special device is required to scrap out the endosperm from the coconut shell. In this project, a coconut gripper is designed and fabricated to hold any shape and size of a coconut shell. Then a multipoint blade is designed and fabricated with required stiffness to scrap the coconut endosperm. The scrapping blade is fixed at left end and the gripper is moved to the blade from the right end. The motors are used to provide the linear and rotary motion of the gripper based on speed and torque requirements. The screw rod is also used in between the supporting shafts which helps the gripper to move linear motion. Then the control switch setup is arranged to control the gripper at forward and reverse direction. Finally, a coconut scrapping machines is designed and fabricated which reduces the risk of injury, increasing the productivity to scrap the endosperm and reducing the need to hold the coconut shell while scrapping which is benefited to both household and commercial application.

CHAPTER 6

CONCLUSION

The coconut endosperm scrapping machine is a essential equipment to scrapping the endosperm from coconut shell. This coconut scrapper is might be suitable for household appliance and it can be used for commercial application. In this project, a coconut endosperm scrapping machine in designed and fabrication with a low cost for commercial and household appliance.

This coconut endosperm scrapping machine consists of frame, motor, lead screw rod, operating swithes and blades

- The frame is designed and fabricated according to the total load acting on the frame.
- The motor set up is designed and fabricated to rotate the coconut shell holder and drive the lead screw mechanism.
- The lead screw rod is designed and fabricated to drive the coconut shell holder block in forward and backward motion.
- The blade is designed and fabricated such a way that, it scrapping the endosperm from the coconut shell.

The scrapping machine parts are assembled and final equipment was obtained. The performance of the setup was examined and it scrap the coconut endosperm efficiently.

DESIGN AND IMPLEMENTATION OF HEAT EXCHANGER AND SCRUBBER UNIT FOR ENTRAINED FLOW GASIFIER AND PRODUCTION OF SYNGAS BY USING SESAME WASTE

A PROJECT REPORT

Submitted by

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in partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

in

MECHANICAL ENGINEERING M.I.E.T. ENGINEERING COLLEGE
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APRIL 2024

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Certified that this project report **"DESIGN AND IMPLEMENTATION OF HEAT EXCHANGER AND SCRUBBER UNIT FOR ENTRAINED FLOW GASIFIER AND PRODUCTION OF SYNGAS BY USING SESAME WASTE"** is the Bonafide work of **N.MOHAMED NIZARUDEEN (812420114358), S.PRAVIN JOSEPH (812420114374), S.RAVI KUMAR (812420114377)** and **M.SURYA (812420114390)** who carried out the project work under my supervision.

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ABSTRACT

Biomass gasification has emerged as a promising technology for converting organic materials into clean energy sources such as syngas, biofuels, and hydrogen. This process involves the partial oxidation of biomass in a controlled environment to produce a synthesis gas rich in hydrogen and carbon monoxide.

The produced syngas can be utilized for various applications, including power generation, heat production, and biofuel synthesis, offering a versatile solution for energy needs. This abstract provides an overview of biomass gasification technology, its operating principles, and key process parameters.

It discusses the types of biomass feedstocks suitable for gasification and explores the various reactor configurations and gasification methods employed. Furthermore, it highlights the environmental benefits of biomass gasification, including reduced greenhouse gas emissions and mitigation of waste disposal issues.

The abstract also addresses the challenges associated with biomass gasification, such as feedstock variability, tar formation, and reactor fouling, along with ongoing research efforts and technological advancements aimed at overcoming these obstacles.

Moreover, the project report highlights the environmental benefits and economic feasibility of EFG technology, showcasing its potential to convert diverse feedstock into valuable syngas while minimizing emissions and waste. Insights gleaned from this study contribute to advancing the understanding the optimization of EFG systems, paving the way for their widespread adoption in sustainable energy production and industrial application.

CHAPTER 9

CONCLUSION

In conclusion, the entrained flow gasifier project represents a significant stride towards sustainable energy production and environmental stewardship. Through meticulous design, rigorous experimentation, and comprehensive analysis, this project has provided valuable insights into the operation and optimization of entrained flow gasification technology.

The successful implementation of the gasifier showcases its potential as a viable alternative for converting biomass, coal, or waste materials into valuable syngas, which can be utilized for various industrial applications, including electricity generation, chemical synthesis, and fuel production. Moreover, the efficient utilization of feedstock and the minimal production of harmful emissions underscore the environmental benefits of this technology, contributing to the global efforts in mitigating climate change and reducing reliance on fossil fuels.

Furthermore, the collaborative efforts involved in this project, spanning across multidisciplinary teams and stakeholders, exemplify the importance of cooperation and knowledge sharing in advancing technological solutions for a sustainable future.

Thus, the experiment is conducted and the amount of heat transfer and the effectiveness of heat transfer is calculated. From our project we have shown that the spiral tube heat exchanger's effectiveness is more than the normal parallel flow heat exchanger.

The conclusion from their investigations is that scrubber efficiency depends on energy input per unit of gas flow, whether energy is supplied to the air or the water (contact power theory). This conclusion applies only to well designed equipment when the energy is expended in the gas-liquid contacting.

PERFORMANCE AND COMBUSTION CHARACTERISTICS IN DIESEL ENGINE BY USING MIXED BIODIESEL ALONG WITH ANTIOXIDANT ADDITIVE

A PROJECT REPORT

Submitted by

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ABSTRACT

Development of sustainable energy resources is the need of present day in view of the depleting energy resources and increase in the energy demand throughout the world. On the other hand, fossil fuel combustion emits harmful pollutants like oxides of carbon, sulfur, nitrogen and particulate matters, which causes atmospheric pollution. Biodiesel as alternative fuels have various advantages over the fossil fuels such as its renewability, lesser emission of atmospheric pollutants and flexibility to produce from variety of feedstock. Waste cooking oil can be used as a potential feedstock for biodiesel production. Disposal of waste cooking oil itself an environmental challenge due to its adverse environmental impact. Transesterification is the key process for synthesis of biodiesel production with low cost and under mild reaction condition.

The objective of the present work is to produce biodiesel from waste cooking oil mixed with okra seed oil using a homogeneous catalyst. Since the extracted oil has acid value of 12.5 mg KOH/g of oil, it was subjected to esterification process using hydrochloric acid. The maximum biodiesel yield of 97% was obtained under the optimum conditions of molar ratio of 1:6, catalyst concentration of 1.5wt.% (KOH), reaction time of 1.5 hours, at temperature 62°C and 500rpm stirring speed. The biodiesel properties meet the ASTM D7651 standards.

The second objective of the works is to investigate the working characteristics of the produced biodiesel on a compression ignition engine, including its performance, combustion, and emission. In addition, the antioxidant (propyl gallate) 1% was added to the biodiesel and investigated for engine performance. The performance characteristics examined include brake

CHAPTER 7

CONCLUSION

- The present work focused on the production of biodiesel from waste cooking oil and okra oil. The results of FTIR confirmed that complete transformation of biodiesel

- Furthermore, the yield of the esterification process using WCO and okra feedstock was optimised under specific conditions, resulting in a yield of 97%. Similarly, the transesterification process using Potassium hydroxide as catalyst and waste cooking oil and okra seed oil as feedstock is optimised, resulting in an even higher yield of biodiesel at 97%. The results revealed that maximum biodiesel yield of 97% is achieved using eggshell as a catalyst at 1:6MR, 1.5wt % of catalyst concentration, fixed stirrer speed of 500 rpm and 1.5 hours reaction time.

- Finally, emission tests are conducted to evaluate the emissions produced during the combustion process. The results showed that CO, HC and FSN of the B100 and its blends are lower than neat diesel and B20 biodiesel (20% WCO and okra biodiesel and 80% petroleum diesel) is the optimum fuel, as it significantly reduces emissions of carbon monoxide and nitrogen oxides, which are major environmental pollutants while having better performance than B100.

- It is concluded that, this research work successfully demonstrated the suitability of using waste cooking oil and okra as feedstock and catalysts, respectively, for the production of biodiesel. The engine performance, combustion and emission results show that blending biodiesel with diesel is a promising approach to reduce emissions and improve engine

efficiency. The findings of this work are useful for the development of a sustainable biodiesel production process using waste cooking oil and okra oil

7.1 FUTURE SCOPE OF WORK

With a growing global demand for alternative energy sources, the development and optimization of biodiesel production from waste chicken fat and eggshells can offer a promising solution to the energy crisis. The following future scope proposes several directions for innovation and research to ensure the viability of this approach.

- Technological advances and efficiency gains-higher biomass yields per acre and more gallons of biofuel per ton of biomass-could steadily reduce the economic cost and environmental impacts of biofuel production.
- Biofuel production will likely be most profitable and environmentally benign in tropical areas where growing seasons are longer, per acre biofuel yields are higher, and fuel and other input costs are lower.
- Explore the use of different types of feedstocks, such as mustard or jackfruit seed oil.
- Investigate the impact of the process parameters such as reaction temperature, reaction time, and methanol to WCO and okra ratio on the yield.

EXPERIMENTAL INVESTIGATION OF PROTON EXCHANGE MEMBRANE BASED FUEL CELL

A PROJECT REPORT

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Submitted for the Anna University examination held on 13.5.24

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ABSTRACT

Proton Exchange Membrane (PEM) fuel cells have garnered significant attention due to their high efficiency and clean energy production. This paper presents a comprehensive overview of a PEM fuel cell setup, detailing its components, operation, and applications. The setup comprises five main components the anode, cathode, proton exchange membrane, bipolar plates, and gas diffusion layers. Hydrogen gas is fed to the anode side, where it undergoes catalytic oxidation, releasing protons and electrons. Protons migrate through the PEM to the cathode, while electrons travel through an external circuit, generating electrical power. At the cathode, oxygen gas reacts with protons and electrons, forming water as the only byproduct. Key factors affecting the performance of the PEM fuel cell include temperature, humidity, pressure, and catalysts. Proper control and optimization of these parameters are essential for maximizing efficiency and durability. Applications of PEM fuel cells range from portable electronics and backup power systems to transportation and stationary power generation. Their versatility, high power density, and low emissions make them a promising solution for clean energy needs.

CHAPTER 9
CONCLUSION

In conclusion, proton exchange membrane fuel cells (PEMFCs) offer a promising solution to the world's energy needs, providing clean and efficient power generation with minimal environmental impact. Through their ability to convert chemical energy directly into electrical energy, PEMFCs hold great potential for widespread adoption in various applications, from transportation to stationary power generation.

Despite their numerous advantages, challenges remain, including cost reduction, durability improvement, and infrastructure development. However, ongoing research and technological advancements are steadily addressing these obstacles, paving the way for PEMFCs to become a key player in the transition towards a sustainable energy future.

Overall, the PEM fuel cell technology shows great potential in the production of electricity sustainable energy source. With further advancements and continued research, it has the capacity to contribute significantly to the transition towards a low-carbon and renewable energy future.

As we continue to invest in the development and deployment of PEMFC technology, it is crucial to prioritize collaboration between industry, academia, and government agencies to accelerate progress and ensure the widespread adoption of this clean energy solution. With concerted efforts, PEMFCs can play a vital role in reducing greenhouse gas emissions, mitigating climate change, and securing a more sustainable energy landscape for future generations.

EXPERIMENTAL INVESTIGATION OF HYDROGEN PRODUCTION USING DRY CELL ELECTROLYSIS PROCESS

A PROJECT REPORT

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DECLARATION

We hereby declare that the work entitled **"EXPERIMENTAL INVESTIGATION OF HYDROGEN PRODUCTION USING DRY CELL ELECTROLYSIS PROCESS"** is submitted in partial fulfillment of the requirement for the award of the degree in Bachelor of Engineering, Anna university, Chennai, is a record of our own work carried out by us during the academic year 2023 - 2024 under the supervision and guidance of MR. R.MANICKAM,M.E.,(Ph.D).
Assistant Professor, Department of Mechanical Engineering, M.I.E.T. Engineering College, Tiruchirappalli.

The extent and source of our information were derived from the existing literature and have been indicated through the dissertation at the appropriate places. The content embodied in this work is original and has not been submitted for the award of any other degree or diploma, either in this or any other university.

LOGESH.M

MANIKANDAN.R

OMKAILESHWARAN.T

SHRIVARSHAN.B

I certify that the declaration made above by the candidate is true.

Mr. R.MANICKAM, M.E.,(Ph.D).

Assistant Professor

Department of Mechanical Engineering

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ABSTRACT

At this present modern day, continuous consumption of fossil fuel and consequent harmful emissions demand is the need for alternative fuel. Water electrolysis is the most promising method to produce a Hydrogen-Oxygen (HHO) mixture. However the less energy consumption is aimed to maximize the HHO production. The aim of the research is to produce the maximum gas flow rate from dry cell by modified design configurations. HHO is produced by water electrolysis in parallel plates are brass plate and rubber gasket using different concentration of NaOH and KOH. It is also aimed to study the effects of different parameters such as electrolyte type (NaOH and KOH), electronic concentration, electrode spacing, electrolyte temperature, applied current voltage and operating time to maximize the gas yield in dry cell. Effects of flow current, voltage, electrolyte concentration, temperature, operating time and electrolyte types on HHO flow rate were studied. The voltage increase from 2 to 4 VDC led to the electrolyser efficiency increase to 50% but after that it was decreased. The applied voltage increase from 2 to 11 VDC increased the HHO flow rate from 120 to 460 ml/min. The current increase from 8 to 14 A, produced the electrolyser efficiency of 72 % and decreased after that. The current increase from 6 to 18A, led the actual flow rate increase from 137 to 654 ml/min. After operating time of 30 min., the HHO flow rate reached the highest stable values of 866, 985, 1040 and 1090 ml/min at 5, 10, 15 and 20 g NaOH concentrations, respectively. The electrolyte concentration of 5 g NaOH in cell configuration [4C3A19N] and supplied current of 14 A led to the highest HHO productivity of 866 ml/min and electrolyser efficiency of 72.1%. HHO dry cell is economical and efficient.

Keywords :- AC to DC Converter , NaOH and KOH , Dry Cell stack , Silicon gasket , Acrylic tube , Brass Plate , Electrolyte, HHO.

CHAPTER 10
CONCULSION

In conclusion, the dry cell electrolyzer is a technology that holds great promise in the field of hydrogen production. It is an electrochemical device that uses water as a feedstock to produce hydrogen gas, which can be used as a clean and renewable energy source. The dry cell electrolyzer operates by passing an electric current through water, causing the water molecules to split into hydrogen and oxygen gases through a process known as electrolysis. This technology offers several advantages, including high efficiency, scalability, and the ability to utilize a wide range of water sources. One of the key advantages of the dry cell electrolyzer is its high efficiency in hydrogen production. It has the potential to achieve high conversion rates, meaning that a significant amount of the input energy can be effectively converted into hydrogen gas. This efficiency makes the dry cell electrolyzer an attractive option for large-scale hydrogen production, which is crucial for meeting the growing demand for clean energy. Further more, the dry cell electrolyzer is a scalable technology, meaning it can be adjusted to different production capacities based on the required hydrogen output. This scalability makes it suitable for various applications, from small-scale installations for residential or industrial use to large-scale hydrogen production for transportation or energy storage. Additionally, the dry cell electrolyzer has the advantage of being able to utilize different water sources, including freshwater, seawater, and wastewater. This versatility allows for flexibility in locating the electrolyzer units and reduces the strain on freshwater resources, making it a more sustainable option for hydrogen production. However, it is important to note that there are still challenges that need to be addressed for widespread adoption of dry cell electrolyzers. These challenges include the cost of

materials, durability of the electrodes, and the overall system's long-term stability. Ongoing research and development efforts are focused on addressing these challenges and improving the performance and cost effectiveness of dry cell electrolyzers. Overall, the dry cell electrolyzer technology shows great potential in the production of hydrogen as a clean and sustainable energy source. With further advancements and continued research, it has the capacity to contribute significantly to the transition towards a low-carbon and renewable energy future. The electrolysis process offers significant potential for various industrial, environmental, and energy applications In conclusion, electrolysis represents a promising pathway for sustainable energy production, environmental protection, and industrial innovation. With ongoing advancements and support, electrolysis has the potential to become a cornerstone of the clean energy landscape, driving positive impacts for society and the planet. Electrolysis, driven by renewable energy sources, enables the clean and efficient generation of hydrogen gas without carbon emissions. This method offers versatility across industries, from transportation to industry and energy storage, fostering a transition away from fossil fuels. As electrolyser technologies continue to advance and costs decline, the scalability and commercial viability of hydrogen production are steadily improving. applicable in transportation, industry, and energy storage. Its environmental benefits lie in its potential to decarbonize sectors traditionally reliant on fossil fuels. Advancements in electrolyser technology, coupled with the increasing availability of renewable energy sources, Embracing electrolytic hydrogen production not only reduces reliance on finite resources but also mitigates environmental impacts, contributing to efforts to combat climate change. By investing in and adopting electrolysis for hydrogen production, we can pave the way for a cleaner, greener future powered by renewable energy and sustainable practices.

EXPERIMENTATION OF SYN GAS PRODUCTION FROM WASTE BIO MATERIAL IN TWO STAGE GASIFIER BY AIR AND STEAM MEDIUM

A PROJECT REPORT

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Certified that this project report **"EXPERIMENTATION OF SYN GAS PRODUCTION FROM WASTE BIO MATERIAL IN TWO STAGE GASIFIER BY AIR AND STEAM MEDIUM"** is the bonafide work of **R.KISHORE HIRAN (812420114336), SHEIK ABDULLAH S (812420114383), HARI HARAN M (812420114502)** and **MOHAMED ARSATH M (812420114701)** who carried out the project work under my supervision.

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ABSTRACT

At present scenario agricultural waste bio material are not mostly used in the production of Syn gas. So we are using agricultural waste bio material to produce Syn gas. In downdraft gasifier with two stage gasification along with the steam medium is not widely used. In this present work steam and air working as a gasification medium to improve carbon conversion efficiency, tar reduction, gasifier working efficiency.

The experimentation of syn gas from waste bio-material using a two-stage gasifier employing both air and steam as mediums is a promising avenue for sustainable energy production. This study aims to investigate the feasibility and efficiency of this process, offering insights into its potential as an eco-friendly energy solution.

The two-stage gasification process involves the sequential utilization of air and steam as gasification agents. This approach aims to optimize gas yield while minimizing undesired by-products such as tar and char. The choice of waste bio-material as feedstock underscores the environmental benefits of utilizing renewable resources for energy generation.

CHAPTER 8

CONCLUSION

The experimentation of syn gas production from waste bio-material in a two-stage gasifier utilizing both air and steam as mediums holds significant promise in addressing environmental and energy challenges. Through our research, we have observed the feasibility of this approach in efficiently converting waste biomass into valuable synthesis gas, which can be utilized for various industrial applications, including electricity generation and chemical synthesis.

The two-stage gasification process offers several advantages, including improved gas quality, higher gas yield, and better control over the reaction parameters. By incorporating steam into the gasification process, we have demonstrated enhanced gasification efficiency and reduced tar content in the produced syn gas, thereby enhancing its suitability for downstream applications.

DESIGN AND FABRICATION OF CYCLONE SEPARATOR AND ASH COLLECTION BOX FOR CIRCULATING BED GASIFIER

A PROJECT REPORT

Submitted by

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APRIL 2024

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ABSTRACT

To design a cyclone separator abatement system for particulate control, it for circulating fluidized bed gasifier application. In this present work, new the methods for computing travel distance, numbers of turns and cyclone pressure drop are studied. The flow pattern and cyclone dimensions determine the travel is tancein a cyclone. The number of turns is calculated based on this travel distance. The new theoretical analysis of cyclone pressure drop is tested against measured data at different inlet velocities and gave excellent agreement. The results show that cyclone vary with cyclone diameter Cyclone cut-points for different dusts are traced measured cyclone overall collection efficiencies and the theoretical model for calculating cyclone overall efficiency. The cut-point correction models 2D cyclones are developed through regression fit from traced and theoretical cut points Diameter. Experimental results indicated optimal cyclone design velocities, which are for 2D cyclones, is determined based on standard air density. It is important to consider the air density effect on cyclone performance in the design of cyclone abatement systems. The tangential inlet generates the swirling motion of the gas stream, which forces particles toward the outer wall where they spiral in the downward direction. Eventually, the particles are collected in the dust bin locate the bottom of the conical section of the cyclone body. The cleaned gas leaves through the exit pipe at the top. The ash content are collected by an ash collection box, it's fitted in the bottom of cyclone separator.

CHAPTER 7

CONCLUSION

It is observed from the efficiency formula that an increase in the density. Number of turns increases the device's efficiency which is similar to the conclusion which can be made from centrifugal force equation (i.e., increase in particle weight increases centrifugal force which helps in better separation).

Cyclone separators are mechanical systems that control particulate emissions by use of centrifugal separation process. Static pressure drop is the most important factor in evaluating the performance of this pollutant control device. Other factors such as particulate size, Cyclone dimensions, inlet particulate speed and particulate concentration in air are very essential in evaluating the cyclone collection performance. The cyclone particulates collection efficiency increases with increasing particulate size. Thus large diameter cyclones are most effective removing large particulates from large particulates – laden gas steam. Cyclonic separation remains one of the most effective particulate pollutant control measures. If the size of sample is the collection efficiency is almost same for the sample. With an increase in density of the sample, collection efficiency increases linearly. For the same velocity (or for the same power consumption). Highly dense particles are removes with higher collection efficiency compare to low dense particles.

DESIGN AND DEVELOPMENT OF BLENDING MACHINE FOR A VIBRATING BALL MILL USED IN POWDER METALLURGY

A PROJECT REPORT

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ABSTRACT

This project presents the design and fabrication of a ball mill integrated with a vibrating step-up mechanism. Powder metallurgy (PM) is increasingly favored for its efficient output across various industries. The study delves into the application of vibrating ball mills within PM processing, emphasizing their pivotal role in enhancing powder mixing and grinding. The vibrating ball mill showcases notable advantages, including heightened mixing efficiency, reduced processing durations, and operability under controlled atmospheres. However, a significant challenge lies in the time-consuming nature of powder processing conditioning. Traditional ball mills for powder blending often prolong the process, hindering efficiency. To address this drawback, a vibrating source is introduced to facilitate easier blending. The project assesses the time required for powder blending and outlines procedures to optimize efficiency in powder metallurgy processing. By introducing innovative methodologies, this project seeks to streamline the powder blending process, thereby enhancing productivity and output quality in powder metallurgy applications.

CHAPTER 7

CONCLUSION

The integration of double-axis movement and vibration into our powder metallurgy blinding machine represents a significant advancement in powder processing technology. We have demonstrated the tangible benefits of these innovations, including enhanced mixing and blending efficiency, improved material homogeneity, and reduced processing time. By introducing movements in we achieved better dispersion of powder particles leading to a more uniform blend and eliminating the risk of uneven distribution. Additionally,the incorporation of vibration effectively broke up agglomerates, ensuring thorough inter-particle interactions and further enhancing the homogeneity of the final mixture. These enhancements not only improve the quality of powdered materials but also contribute to increased productivity and cost-effectiveness in powder metallurgy processes. Moving forward, the success of this project underscores the importance of continuous innovation in manufacturing technologies, driving advancements that elevate the performance and reliability of industrial processes. With further refinement and optimization, the principles demonstrated in this project hold the potential to revolutionize powder processing methodologies and pave the way for future developments in the field of metallurgy and beyond.

DESIGN AND FABRICATION OF SHELL AND TUBE HEAT EXCHANGER AND SCRUBBER FOR CIRCULATING FLUIDIZED BED GASIFIER

A PROJECT REPORT

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ABSTRACT

Biomass gasification is a promising technology that converts organic materials such as agricultural residues, forest residues, and energy crops into clean, renewable energy sources such as syngas and biochar. This process involves thermo chemical conversion in a controlled environment, resulting in the production of a combustible gas primarily composed of hydrogen, carbon monoxide, and methane. The syngas generated can be utilized for various applications including electricity generation, heat production, and biofuels synthesis. Biomass gasification offers several advantages including reduced greenhouse gas emissions, potential for waste valorization, and energy security. However, challenges such as feedstock availability, technological complexity, and economic viability need to be addressed for widespread adoption. This abstract provides an overview of biomass gasification technology, its applications, benefits, challenges, and future prospects in the transition towards a sustainable energy future.

Circulating Fluidized Bed (CFB) gasification has emerged as a versatile and efficient technology for converting various feedstock's into valuable syngas. This abstract delves into the fundamental principles and operational mechanisms of CFB gasifier, highlighting their unique capabilities in handling a wide range of biomass, coal, and waste materials. By suspending particles in a fluidized state, CFB gasifier offer enhanced heat and mass transfer, facilitating through conversion and minimizing tar formation. This abstract explores recent developments, challenges, and future prospects of CFB gasification, emphasizing its role in advancing towards a cleaner and more sustainable energy landscape.

CHAPTER 8

CONCLUSION

In conclusion, the design and fabrication of the shell-and-tube heat exchanger and wet scrubber have been successfully completed. Through careful consideration of factors such as heat transfer requirements, material selection, and operational efficiency, both systems have been tailored to meet the specific needs of the application. The shell-and-tube heat exchanger provides efficient heat transfer between two fluids, while the wet scrubber effectively removes pollutants from gas streams. The fabrication process adhered to industry standards, ensuring reliability and safety. Overall, these systems represent reliable and efficient solutions for heat transfer and pollution control in industrial processes.