DEVELOPMENT AND PERFORMANCE TEST OF BELT PULLEY MECHANISM OIL SKIMMER

A Thesis

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In partial fulfillment of the requirement for award of the degree

Of

Bachelor of Science in Mechanical Engineering

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APPROVAL

This is to certify that the Project and Thesis Work Submitted by Md Abdul Bari ME2102024556, Khandokar Abiduzzaman ME2102024566, Mahafuz Rahman ME2102024585, Md.Hasibur Rahman Babul ME2102024595,Md. Emran Hossen ME2102024596,entitled "DEVELOPMENT AND PERFORMANCE OPTIMIZATION OF BELT PULLEY MECHANISM OIL SKIMMER" has bem approved by the examiners for the partial fulfillinent of the requirements for the degree of Bachelor of Science in Mechanical Engineering, Sonargaon University, Green Road, Dhaka

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DECLARATION

We do hereby solemnly declare that, the work presented here in this project report has been carried out by us and has not been previously submitted to any University/ Organization for award of any degree or certificate

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ABSTARCT

Nowadays there are lots of oil accidents happening in the ocean and it makes huge impact on environment. Due to Sea accidents can further cause oil pollution. So the oil separator systems are necessary in such cases. Various oil separator systems are available currently all over. In oil separator systems belt is one of the most important components. Different types of belts are been in use in these systems. Performance and efficiency of these systems mainly depends on the type of belt & belt material use in the system. This belt speed will be able to control its speed. So, it is necessary to study and analyze the performance of various types of belts in order to select proper belt for better performance. In this paper we are taking a review of various types of belt materials used, research work done on oil skimmers and their belt materials. In this project we use a transformer, gear motor, Pulley, bearing, conveyor belt, and many things. The main purpose if this system is separate oil from water with a conveyor belt.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

The basic objective of this project work is to develop oil skimmer. Oil is one of the most important energy draw material sources for synthetic polymer and chemicals worldwide. As long as oil is explored, transported, stored and used their will ether risk of spillage. Oil pollution, particularly of sea and navigable water, has exited more public concerned than other water or spilt materials. Oil pollution of the sea has steadily increased with the increase in oil consumption. The bulk this in flux is due to transportation related activities spill from tanker loading and unloading operations, pipeline rupture which may be due to industrial waste as leakage from engines, incorrect operations of valves and discharge of oily wastages. Oil pollution of the shore in addition to the reduction of amenity, also affects marine, shore life and vegetation. Crude oil consists of different hydrocarbon that range from light gas to heavy solids. When oil is spilled on water, the physical and chemical properties of oil change progressively. Spilled oil has an undesirable taste and odour and causes severe environment damage on water fall, material life and affects tourism economy. The pollution increasing various sectors of the world.

Oil is one of the precious crude and being used in many routine application of human life. Since most of the oils are toxic so quite dangerous for alive when it comes to direct contact with them. During the years of recent decades, world has witnessed many oil spillage tragedies and subsequent damage to alive and environments. Many countries has made stringent safety norms for waste water disposal contained with oils mainly typically from petrochemical and process industries so that such industries are equipped with such kind of oil skimmers to separate the oils from disposal water.

1.2 Objectives

We have some specific objectives for this project and they are pointed below:

- Design and Construct of a **Belt Type Oil Skimmer.**
- To implement and study of **Belt Type Oil Skimmer**.

- To take necessary notes from the project for future improvements.

1.3 Scopes of use

- In reduce oil wastage.
- Just set the system and the system will different oil from water accurately.

1.4 Structure of the Project

This Project is organized as follows:

Chapter 1 Introduction**:**The first chapter contains the statement of the introduction, our background study for the project, problem statement, objectives of the study and the project outline.

Chapter 2 Literature Review**:** The chapter two contains our introduction, literature review part.

Chapter 3 Hardware and Software Analysis**:**Chapter three describes the theoretical model. Here we mainly discuss about proposed system Hardware and software development of our project etc.

Chapter 3 Methodology**:**Chapter three describes the theoretical model. Here we mainly discuss about proposed system architecture in details with having block diagram, circuit diagram, structural diagram, project working principle, complete project image etc.

Chapter 4 Result and Discussion**:**Chapter four deals with the result and discussion and discuss about our project advantages and application.

Chapter 5 Conclusion**:**Chapter five all about our project conclusion and future scope.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter is arranged on Literature Review. Here's a look at some of last year's literature, like our project. By reading them, we can overcome the mistakes of the previous project and make a more effective project.

2.2 Related Research/ Works

A M Najar and et al [1]; It is now common practice to use disc skimming systems to recover oil floating on the surface of water. However, the performance of these devices is dependent on a large number of parameters and is certainly not understood completely. This paper describes a fundamental study in which experimental techniques have been developed to enable the performance of model skimmers to be measured.[1] This has enabled the importance of the various parameters to be examined in a more systematic and detailed way than ever before. Based upon an improved understanding of the flow behavior inherent in the oil collection process, a number of enhanced disc skimming systems are discussed. Results are presented for these systems to show the capabilities of the new forms of disc skimmer when operated as oil recovery devices [2].

A H Hammoud et al [2]; Oil spill recovery by means of a rotating drum skimmer was investigated experimentally for a wide range of design and operating conditions. The effect of drum diameter, drum length, rotating speed, oil lm thickness, oil properties, and drum center height above the oil/water interface surface were analyzed with respect to oil recovery rate of the drum skimmer. Crude, diesel, SAE 10W and SAE 140W oils were used during this investigation. It was found that oil recovery rate increases with increasing drum diameter, drum length, and drum center height above the oil/water interface, and oil slick thickness oil viscosity, and increases as oil density and surface tension decreases. The results revealed that the drum skimmer is an effective device for recovering spills of low viscosity oil, such as light crude oil, which is the type of oil involved in most serious spills and pollutions of the sea. Furthermore, an empirical

equation is proposed for predicting the oil recovery rate of the device. The equation can be applied to different oils, and gives good agreement with observed data [3].

Suraj Nair et al; [3] Recently in Mumbai, there occurred 2 cases of sever oil spill near sea shore affecting most of the aquatic life of the area. Also fishing and tourism were affected by this spillage. The environmental effects of such oil spills are not negligible as this is a global problem now days. Every year, there is 100 million US gallons of oil spill. This is equal to 100 large size gymnasium halls. The numbers though could not tell the actual harm caused to the environment by such oil spill as it is in numerous. So there is need of an effective way to clean this oil from the surface without actually wasting it. Now, in industries, to separate oil from other things like coolant and water, we use oil skimmers. There are various methods for this, of which disk type oil skimmer is one of the majorly used [3].

TusharPathare et al [4]; Aim of this project is to remove the oily effluent from the waste water. Pollution has created lot of problems in industries. By removing the oil from waste water, it becomes free of oil pollutions. Oil skimmers are commonly found in three types: weir, oleophilic and non-oleophilic. Oleophilic skimmers are distinguished not by their operation but by the component used to collect the oil (rope, disk, belt or drum). It can remove even a thin floating film of oil from the water. This is mainly due to the "oleophilic material" used in the belt. A free floating endless belt oil skimmer was developed as means of recovering spilled oil from surface water. The skimmer utilizes a unique high efficiency belt which is driven by motor. By removing oil we can preprocess water for other use. This can avoid water wastage and control pollution due to oil spillage. In current world scenario most of the oil from the industries goes wasted into ponds, rivers and sea. So, national and international environmental norms are getting strict day by day. It is economical to manufacture a low-cost machine to meet these norms [4].

SurajBurungale et al [5]; Aim of this project is to remove the oily effluent from waste water of sugar factory. A free-floating endless belt oil skimmer was developed as means of recovering spilled oil from surface water. The skimmer utilizes a unique high efficiency belt which is driven by motor. By removing oil, we can preprocess water for other use. A free-floating endless belt oil skimmer was developed as means of recovering spilled oil from surface water. The skimmer utilizes a unique high efficiency belt which is driven by motor. By removing oil, we can preprocess water for other use. [5]

Philip C. Lewan et al [1992] [6] had studied apparatus for removing oil from the surface of a liquid using an endless belt partially submerged in the liquid, the belt passes over a primary roller having a vertical axis and pressure rollers squeeze the belt on the primary roller removing oil from the belt which allows by gravity to a collection receptacle mounted upon a frame supporting the primary roller and its drive structure. The belt twists whereby its lower portion submerged in the liquid denes a reversing loop whose configurations maintained by a weight roller having a horizontal axis of rotation.

Mamta Patel [2015] [7] had studied the function of oil skimmer, its various design aspects and performance. All the results of experimental studies indicate that slight design improvement of typical oil skimmers towards to include additional belt shaft and use of belt with steel material instead of rope; significantly improve the oil recovery efficiency and also its structure became simpler. As practical overview of different oil spillage cleanup method, this paper has illustrated several limitations of these methods and current oil spill technology. Further extensive research & testing can improve the existing techniques and equipment to have better control for oil recovery exercise.

Prof. P.A. Patil et al [2017] [8] had concluded that the separation of oil is based on surface tension, specific gravity and viscosity. He studied the operation of oil skimmer on various positions of the belt like inclined, vertical, horizontal.Spills may occur from refined petroleum products. Off and on from there by products, and heavier fuels used by large water vessels such as bunker fuel, or the spill of any oily refuse or waste oil. Cleaning and full recovery of spilled oil is challenging and May takes weeks or months. Sometimes even years required to clean up.

2.3 Summary

The above has been discussed in detail in the past few literature's which has given us a lot of motivation to do this project.

CHAPTER 3
HARDWARE AND SOFTWARE ANALYSIS

3.1 Introduction

In this section, we will discuss elaborately about our hardware design of "**Oil Skimmer**" and the component description, features, working procedure and description of our all equipment.

3.2 EQUIPMENT

3.2.1 Software

I. Easy EDA

3.2.2 Easy EDA

Easy EDA is a web-based EDA tool suite that enables hardware engineers to design, simulate, share - publicly and privately - and discuss schematics, simulations and printed circuit boards. Other features include the creation of a bill of materials, Gerber files and pick and place files and documentary outputs in PDF, PNG and SVG formats. Easy EDA allows the creation and editing of schematic diagrams, SPICE simulation of mixed analogue and digital circuits and the creation and editing of printed circuit board layouts and, optionally, the manufacture of printed circuit boards.

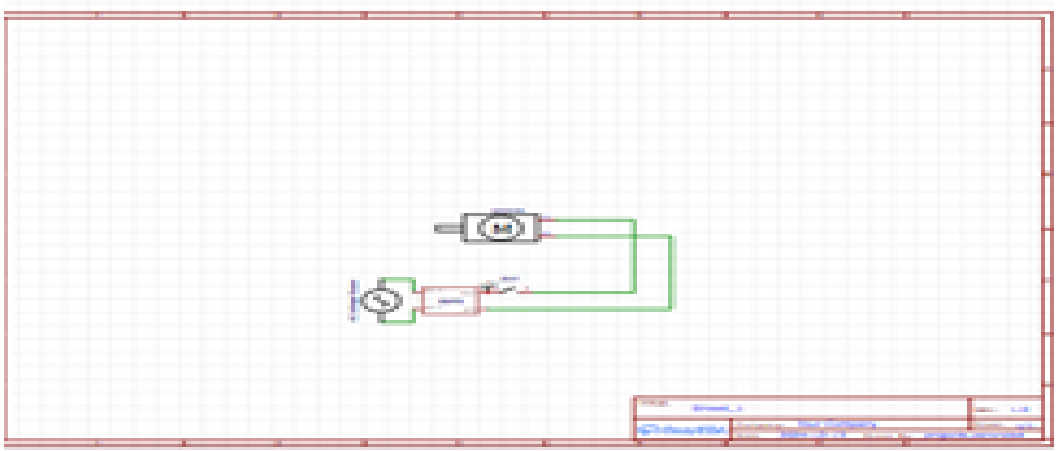


Figure 3.1: Easy EDA Software Interface

Subscription-free membership is offered for public plus a limited number of private projects. The number of private projects can be increased by contributing high quality public projects, schematic symbols, and PCB footprints and/or by paying a monthly subscription.Registered users can download Gerber files from the tool free of charge; but for a fee, Easy EDA offers a PCB fabrication service. This service is also able to accept Gerber file inputs from third party tools.

3. 3 Hardware

I. SMPS
II. Gear Motor
III. Conveyor Belt
IV. Pully
V. Bearing
VI. Switch
VII. Supporting Frame
VIII. Motor Shaft Supporter
IX. Shaft
X. Mixture Tank
XI. Wiper

3.3.1 Switch Mode Power Supply (SMPS)

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power) to DC loads, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. A hypothetical ideal switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time (also known as duty cycles). In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This

higher power conversion efficiency is an important advantage of a switched-mode power supply. Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight.



Figure 3.2: SWITCH MODE POWER SUPPLY (SMPS)

Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight are required. They are, however, more complicated; their switching currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor. Switched-mode power supplies are classified according to the type of input and output voltages. The four major categories are:

- AC to DC
- DC to DC
- DC to AC
- AC to AC

A basic isolated AC to DC switched-mode power supply consists of:

- Input rectifier and filter
- Inverter consisting of switching devices such as MOSFETs
- Transformer
- Output rectifier and filter
- Feedback and control circuit

The input DC supply from a rectifier or battery is fed to the inverter where it is turned on and off at high frequencies of between 20 KHz and 200 KHz by the switching MOSFET or power transistors. The high-frequency voltage pulses from the inverter are fed to the transformer primary winding, and the secondary AC output is rectified and smoothed to produce the required DC voltages. A feedback circuit monitors the output voltage and instructs the control circuit to adjust the duty cycle to maintain the output at the desired level.

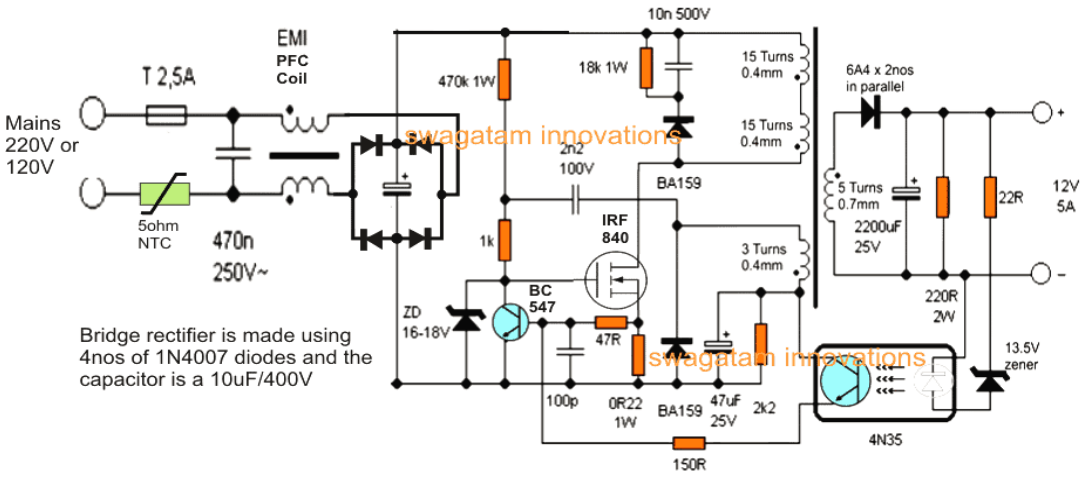


Figure 3.3: SWITCH MODE POWER SUPPLY (SMPS) Circuit

3.3.1 Basic working concept of an SMPS

A switching regulator does the regulation in the SMPS. A series switching element turns the current supply to a smoothing capacitor on and off. The voltage on the capacitor controls the time the series element is turned. The continuous switching of the capacitor maintains the voltage at the required level.

3.3.1 Design basics

AC power first passes through fuses and a line filter. Then it is rectified by a full-wave bridge rectifier. The rectified voltage is next applied to the power factor correction (PFC) pre-regulator followed by the downstream DC-DC converter(s). Most computers and small appliances use the International Electrotechnical Commission (IEC) style input connector. As for output connectors and pin outs, except for some industries, such as PC and compact PCI, in general, they are not standardized and are left up to the manufacturer.

There are different circuit configurations known as topologies, each having unique characteristics, advantages and modes of operation, which determines how the input power is transferred to the output. Most of the commonly used topologies such as flyback, push-pull, half bridge and full bridge, consist of a transformer to provide isolation, voltage scaling, and multiple output voltages. The non-isolated configurations do not have a transformer and the power conversion is provided by the inductive energy transfer.

Advantages of switched-mode power supplies:

- Higher efficiency of 68% to 90%
- Regulated and reliable outputs regardless of variations in input supply voltage
- Small size and lighter
- Flexible technology
- High power density
- Disadvantages:
- Generates electromagnetic interference
- Complex circuit design
- Expensive compared to linear supplies

Switched-mode power supplies are used to power a wide variety of equipment such as computers, sensitive electronics, battery-operated devices and other equipment requiring high efficiency. Linear voltage IC regulators have been the basis of power supply designs for many years as they are very good at supplying a continuous fixed voltage output. Linear voltage regulators are generally much more efficient and easier to use than equivalent voltage regulator circuits made from discrete components such a zener diode and a resistor, or transistors and even op-amps.The most popular linear and fixed output voltage regulator types are by far the 78… positive output voltage series, and the 79… negative output voltage series.

These two types of complementary voltage regulators produce a precise and stable voltage output ranging from about 5 volts up to about 24 volts for use in many electronic circuits.There is a wide range of these three-terminal fixed voltage regulators available each with its own built-in voltage regulation and current limiting circuits. This allows us to create

a whole host of different power supply rails and outputs, either single or dual supply, suitable for most electronic circuits and applications. There are even variable voltage linear regulators available as well providing an output voltage which is continually variable from just above zero to a few volts below its maximum voltage output.

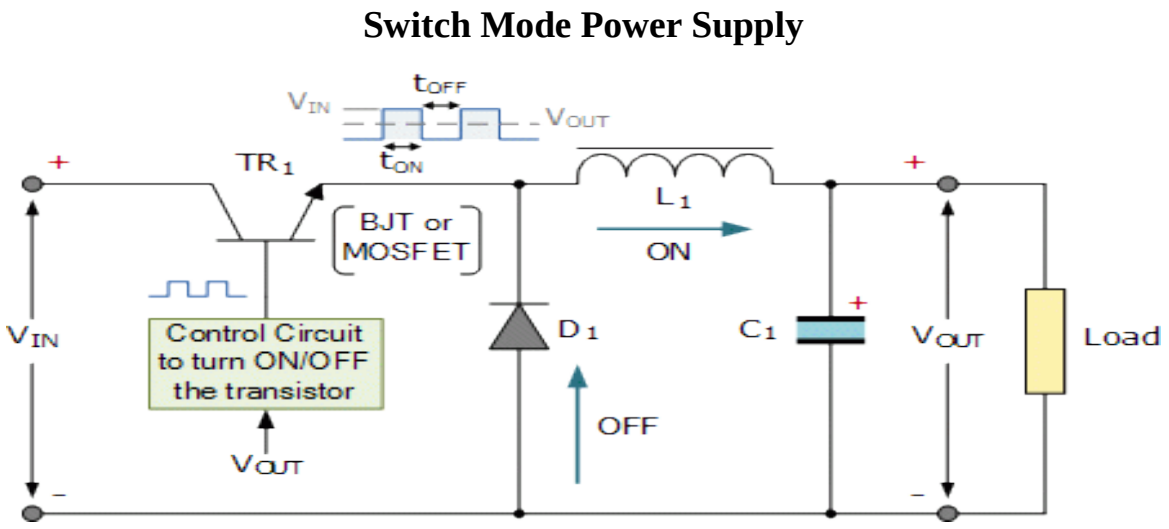


Figure 3.4: SWITCH MODE POWER SUPPLY (SMPS) Circuit Connection

Most d.c. power supplies comprise of a large and heavy step-down mains transformer, diode rectification, either full-wave or half-wave, a filter circuit to remove any ripple content from the rectified d.c. producing a suitably smooth d.c. voltage, and some form of voltage regulator or stabiliser circuit, either linear or switching to ensure the correct regulation of the power supplies output voltage under varying load conditions. Then a typical d.c. power supply would look something like this:

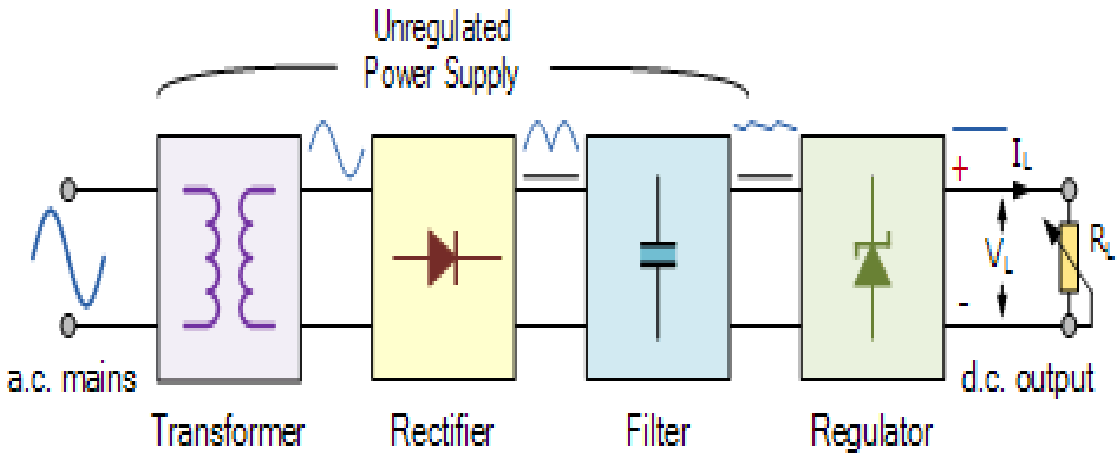


Figure 3.5: DC Power supply way

These typical power supply designs contain a large mains transformer (which also provides isolation between the input and output) and a dissipative series regulator circuit. The regulator circuit could consist of a single zener diode or a three-terminal linear series regulator to produce the required output voltage. The advantage of a linear regulator is that the power supply circuit only needs an input capacitor, output capacitor and some feedback resistors to set the output voltage.

3.3.2 DC Gear Motor

3.3.2.1 Description

A **DC gear motor** combines a DC motor with a gearbox to deliver controlled speed and torque, making it ideal for applications requiring precise movement and power. The motor converts electrical energy into mechanical motion, while the gearbox reduces speed and increases torque. This configuration enhances performance in robotics, automation, and industrial machinery. DC gear motors are available in a variety of sizes, voltages, and torque ratings to suit diverse needs. Their efficient and reliable operation, compact design, and ability to handle varying load conditions make them a popular choice for tasks demanding accuracy and durability in motion control systems.

3.3.2.2 Specification:

- Voltage:12V DC
- Gear ratio: 1/31
- No-load speed: 200RPM
- Rated Speed: 140RPM
- Rated torque: 10kg.cm
- Rated current: 2.5Amp
- Length of Motor(including spindle): 106mm/4.17″
- Diameter: 37mm/1.45″
- Shaft length: 21mm/0.82″
- Shaft diameter: 6mm/0.24″



Figure 3.6: DC Gear Motor

3.3.3 Conveyor Belt

A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with a closed loop of carrying medium—the conveyor belt—that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley.

3.3.3.1 Overview

Conveyors are durable and reliable components used in automated distribution and warehousing, as well as manufacturing and production facilities. In combination with computer-controlled pallet handling equipment this allows for more efficient retail, wholesale, and manufacturing distribution. It is considered a labor-saving system that allows large volumes to move rapidly through a process, allowing companies to ship or receive higher volumes with smaller storage space and with less labor expense.

Belt conveyors are the most commonly used powered conveyors because they are the most versatile and the least expensive.[1] Products are conveyed directly on the belt so both regular and irregular shaped objects, large or small, light and heavy, can be transported successfully. Belt conveyors are also manufactured with curved sections that use tapered rollers and curved belting to convey products around a corner. These conveyor systems are commonly used in postal sorting offices and airport baggage handling systems.

3.3.3.2 Application

Today there are different types of conveyor belts that have been created for conveying different kinds of material available in PVC and rubber materials. Material flowing over the belt may be weighed in transit using a belt weigher. Belts with regularly spaced partitions, known as elevator belts, are used for transporting loose materials up steep inclines. Belt Conveyors are used in self-unloading bulk freighters and in live bottom trucks. Belt conveyor technology is also used in conveyor transport such as moving sidewalks or escalators, as well as on many manufacturing assembly lines. Stores often have conveyor belts at the check-out counter to move shopping items, and may use checkout dividers in this process. Ski areas also use conveyor belts to transport skiers up the hill. Industrial and manufacturing applications for belt conveyors include package handling, trough belt conveyors, trash handling, bag handling, coding conveyors, and more. Integration of Human-Machine Interface (HMI) to operate the conveyor system is in the developing stages and will prove to be an efficient innovation.

3.3.3.3 Types of Conveyor Belt

"There are different types of conveyor belts: **Basic belt, snake sandwich belt and long belt, Flat Belts, PVC Belts, Rubber Belts, Artificial Leather Belt**. A basic belt conveyor consists of two or more pulleys that hold one continuous length of material. These types of belts can be motorized or require manual effort. Conveyor belts come in various types designed to handle different materials, products, and operational conditions. Below are some common types of conveyor belts and their specifications:

1. Basic Conveyor Belt

Specification:

- **Shape**: Typically flat, continuous, and flexible.
- **Material**: Commonly made from rubber, PVC, leather, or fabric with a rubber or polyurethane coating.
- **Application**: General-purpose use in various industries, including conveyor systems, automotive, and light-duty industrial machinery.
- **Width**: Varies depending on the application, usually from 50 mm to 2000 mm.
- **Thickness**: Ranges from 1 mm to 10 mm, depending on the load capacity required.
- **Advantages**: Simple, cost-effective, and versatile; used for light to medium-duty applications.
- **Types**: Single layer (flat) belts, V-belts, and flat rubber belts.

2. Flat Conveyor Belt

Specification:

- **Shape**: Flat and smooth surface.
- **Material**: Usually made of rubber, PVC, or fabric (e.g., polyester, nylon).
- **Application**: Used for light to medium-duty applications, such as transporting packages, parcels, and in industries like food processing, packaging, and electronics.
- **Width**: Typically range from 150 mm to 2000 mm.
- **Advantages**: Flexible, cost-effective, and suitable for a variety of industries.
- **Types**: General-purpose, food-grade (FDA approved), and heat-resistant belts.

3. Rubber Conveyor Belts

Specification:

- **Shape**: Flat or slightly textured surface.
- **Material**: Rubber with fabric reinforcement.
- **Application**: Typically used for heavy-duty applications such as in mining, quarrying, and recycling industries to move bulk materials like coal, ore, and gravel.
- **Width**: Available from 300 mm to 2400 mm or more depending on the load capacity.
- **Advantages**: High wear resistance, strong load-bearing capacity, and suitable for abrasive and heavy materials.
- **Types**: Conveyor rubber belts (steel-reinforced), fabric-reinforced rubber belts.



Figure 3.7: Conveyor Belt

3.3.4 Pulley

A **pulley** is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave.

Pulley systems are used for lifting, moving, and transferring mechanical power across different industries. The type of pulley used depends on the application, load requirements, and the specific mechanical setup. Below are the **various types of pulleys** and their specifications:

1.V-Belt Pulley

Specification:

- **Shape**: Pulleys with a groove that fits a V-shaped belt.
- **Function**: Designed to transmit rotational motion from one rotating shaft to another.
- **Load Application**: Transmit power between shafts, ensuring efficient power transfer without slipping.
- **Mechanical Advantage**: Offers significant power transfer capability, as the V-shape helps grip the belt tightly.

Applications:

- Used in automotive engines, industrial machines, and HVAC systems for power transmission.

2. Timing Pulley

Specification:

- **Shape**: A pulley with teeth around its circumference that mesh with corresponding teeth on a timing belt.
- **Function**: Ensures precise synchronization of motion between two shafts.

- **Load Application**: Used in applications where accurate timing and movement are critical, such as in camshafts, conveyor systems, or robotics.
- **Mechanical Advantage**: Provides high torque transmission with zero slip between the pulley and the belt.

Applications:

- Engines, conveyor systems, and robotics where precise synchronization of parts is essential.

Table 3.3.4: Pulley Product Specification

Product Type	Motor Pulley
Size	5mm,
Height	25mm
Outer diameter	12.2mm/0.48
Pitch Diameter	12.7mm & 13.0mm



Figure 3.8: Pulley

3.3.5 Bearing

3.6.1 Description

A bearing is a mechanical component designed to reduce friction and support the smooth movement of rotating or sliding parts in machinery. By minimizing resistance between surfaces, bearings enhance efficiency and extend the lifespan of equipment. They come in various types, including ball bearings, roller bearings, and plain bearings, each tailored to specific load and motion requirements. Bearings are essential in applications ranging from automotive and industrial machinery to household appliances and aerospace systems. Made from durable materials like steel or ceramics, they ensure reliability, precision, and stability in dynamic environments, enabling machines to operate efficiently under various conditions. Ball bearings are essential components in many machines and mechanical systems. They reduce friction between moving parts and allow smooth rotation or linear motion. There are various types of ball bearings, each designed for specific applications based on load requirements, speed, and environmental conditions.

Below is a list of various types of ball bearings along with their specifications:

1. Deep Groove Ball Bearing

Specification:

- **Structure**: A ball bearing with deep raceway grooves, which help carry both radial and axial loads.
- **Function**: Designed to handle both radial and axial loads in a wide variety of applications. It has high speed capability and low friction.
- **Load Capacity**: Suitable for moderate to high loads.
- **Speed**: High-speed applications.
- **Material**: Typically made from carbon steel, stainless steel, or ceramic.
- **Seals/Cages**: Available in sealed or shielded versions to protect against dust, dirt, and moisture.

Applications:

- Automotive (wheel hubs, electric motors).
- Household appliances (fans, washing machines).
- Industrial machinery and conveyors.

2. Miniature Ball Bearing

Specification:

- **Structure**: A smaller version of a deep groove ball bearing, made for applications requiring smaller and more compact designs.
- **Function**: Designed to handle small radial and axial loads in tight spaces.
- **Load Capacity**: Can carry light to moderate loads.
- **Speed**: High-speed performance due to the smaller design.
- **Material**: Stainless steel, ceramic, or chrome steel.
- **Seals/Cages**: Can be open, shielded, or sealed.

Applications:

- Electronics (motors, fans).
- Small equipment (medical devices, toys).
- Computer hardware (hard drives, fans).



Figure 3.9: Bearing

3.3.5.1 Specification

- **Type**: Ball, Roller, Needle, or Plain Bearing.
- **Material**: Steel (Chrome/Stainless), Ceramic, or Composite.
- **Load Capacity**: Dynamic (C) and Static (C_0) ratings.
- **Dimensions**: Bore Diameter (ID), Outer Diameter (OD), and Width.
- **Speed**: Maximum RPM limit.
- **Lubrication**: Greased, oil-lubricated, or sealed.
- **Sealing**: Open, shielded, or sealed design.
- **Temperature Range**: Typically -40°C to 150°C

3.3.6 Single Pole Double Throw (SPDT) Switch:

A switch that has a single input and two dissimilar outputs is known as SPDT. The term SPDT stands for Single Pole Double Throw Switch which is used to control two dissimilar circuits through a similar single input. The operating of this switch can be done manually or included through the electromagnetic coil.



Figure 3.10: SPDT Switch

3.3.6.1 SPDT Switch Applications:

- This switch is used in a three-way circuit for controlling a load from two locations like from the top and bottom of a staircase.
- This switch is used to control two different circuits through a similar single input.
- Control Circuit.
- ABB/Siemens VFDs.

3.3.7 Supporting Frame:

The supporting frame is a function of both the weight of the supported and the frame's material of construction. Many machine-based suppliers, supports, and frames indicate whether the support frame is rated for light, medium, or heavy-duty. It's made up of stainless steel. It supported the pulley and belt assemblies. And also, the motor is fixed on the frame. The frame is lightweight, so it's easy to transfer. It's the main component of the oil skimmer.

3.3.8 Motor Shaft Supporter:

The shaft supporter is used for the end, or intermittent support where loads are light and slight shaft deflection is not a concern. Using a shaft supporter decreases, the vibration, and noise which results in smooth operating of the timing belt

3.3.9 Shaft:

In this project, three shafts have been used. One shat is a driver which is mainly a motor shaft were coupled with one pulley. Its length is 122mm. Another shat is fixed with the supporting frame were coupled with a rotating pulley. Its length is 60mm. Another shaft is a couple with propeller and bevel gear which length is 294mm. Each of the shafts is made of stainless steel.

3.3.10 Mixture Tank:

The mixture tank contains a mixture of oil and water. For demonstration purposes, the oil skimmer will separate the oil present in the oil-water mixture in the oil tank. The mixture tank can contain up to 15-litre water.

3.3.11 Wiper:

Its function is to remove the oil that sticks or clings to the surface of the belt. The contact between belt and Wiper enables the removal of oil. It is made up of stainless steel. An angle of 45 degrees is provided for inclination.

CHAPTER 4
METHODOLOGY

4.1 Methodologies for the project

Methodologies for the project:

- Creating an idea for design and construction of **Oil Skimmer**. And designing a block diagram & circuit diagram to know which components we need to construct it.
- Setting up all the components in a PCB board & then soldering. Lastly, assembling all the blocks in a board and to run the system & for checking purposes.

4.2 Block Diagram

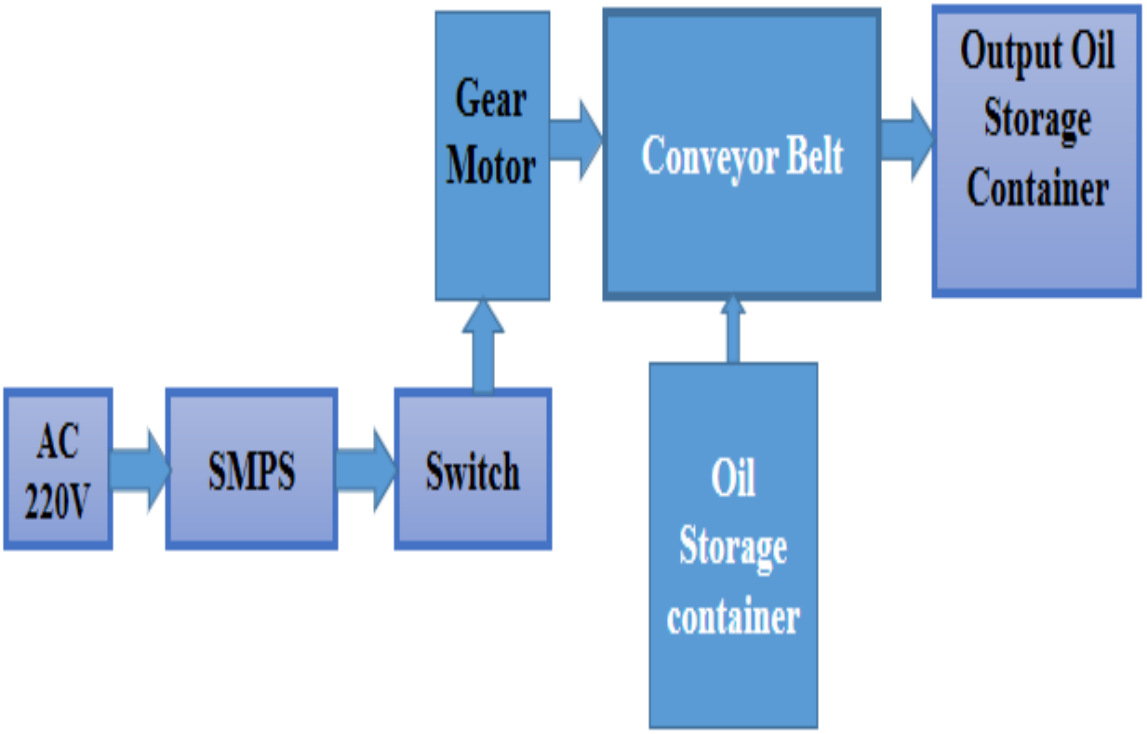


Figure 4.1: Block Diagram of Oil Skimmer System.

4.3 Circuit Diagram of proposed Model:

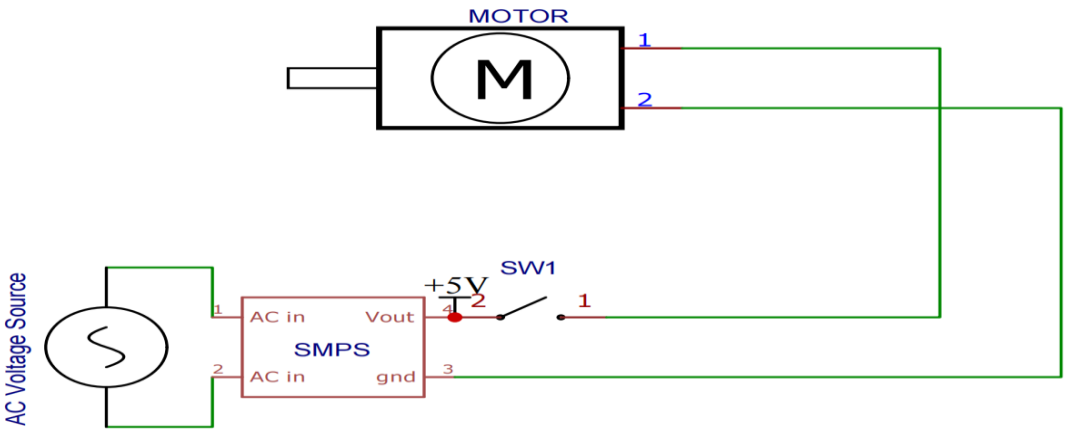


Figure 4.2: Circuit Design of Belt Type Oil Skimmer System.

4.4 Working Principle

When the power up of this system then the system able to work. Then if we start the system then transformer rectifier the AC current and rotate the gear motor. This gear motor is able to control its speed. When we need to oil skimming then just place the system on this water and start out project. Our System will be separate oil fron the water easily. This is the mail procedure of our system.

4.5 Cost Analysis:

Table 4.5: Component's Name and Price

Sl. No	Components Name	Specification	Quantity	Unit Price	Total Price
1	SMPS	5V, 7Amp	1	600	600
2	Gear Motor	12V, 100 RPM	1	880	880
3	Pulley		2	300	600
4	Bearing		2	150	300
5	Frame			2200	2200
6	Others				1550
Total					6130/=

4.6 Basic Drawing of System

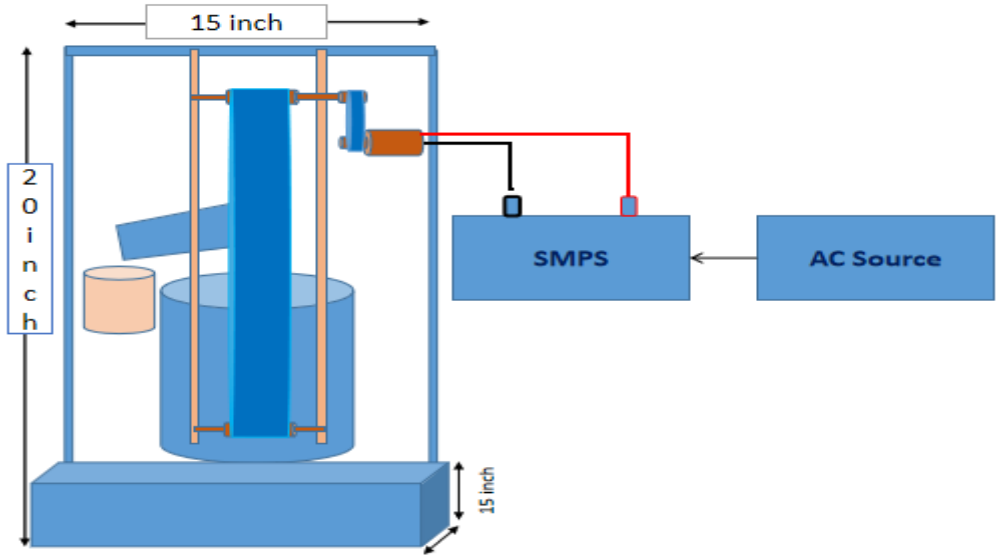
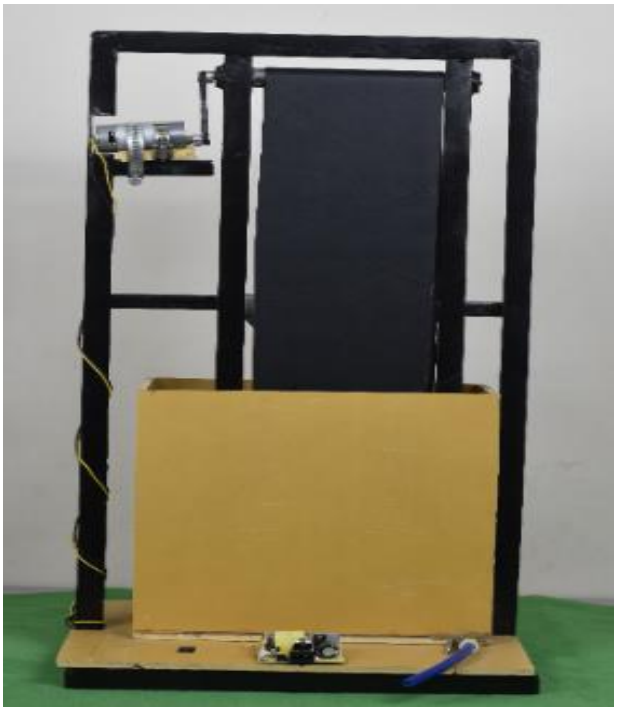


Figure 4.3: Basic Drawing of this System

4.7 Real View of project



FRONT VIEW



REAR VIEW

Figure 4.4: Project Prototype

CHAPTER 5

RESULT AND CALCULATIONS

5.0 EXPERIMENTAL DATA CALCULATION AND OBSERVATION

Belt velocity = πd*N/60

=π*0.0127*140/60 =0.093 m/s

Pulley velocity: N1d1=N2d2

= 140*0.0127=N2*0.0130

N2 = 137 RPM

Here: d= Diameter of motor pulley(m)
N= RPM of motor pulley
N1= RPM of motor pulley (Driver)
N2= RPM of Driven pulley
d1= Diameter of motor pulley (Driver) m.
d2= Diameter of Driven pulley (m)

5.1. Extraction of Diesel Oil by Oil Skimmer

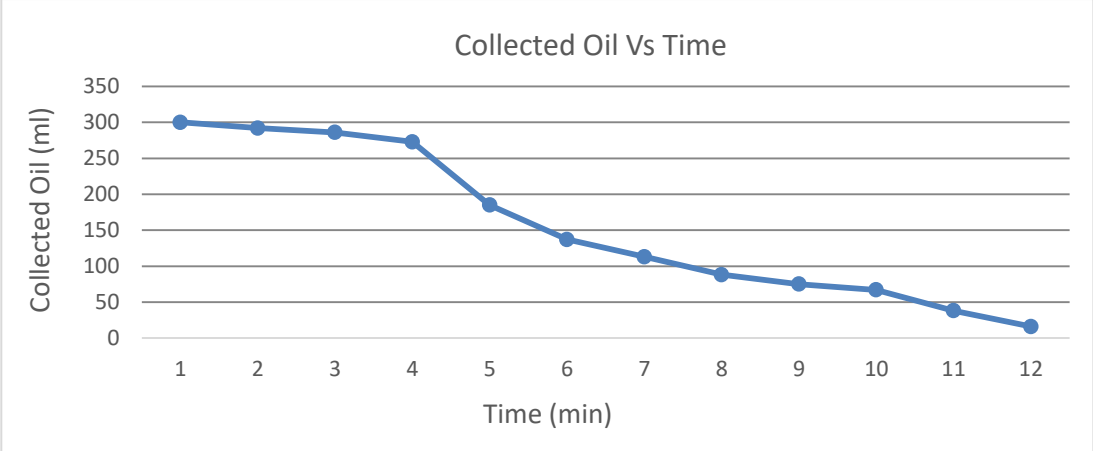
Initial amount before extraction: 2200 ml

5.1.2 Data calculation

After extraction:

Table No. 5.1: Extraction of Diesel Oil by Oil Skimmer

Time (min)	Extracted Oil (ml)	Water (ml)
1	300	100
2	285	93
3	260	85
4	230	78
5	205	71
6	185	61
7	160	53
8	130	44
9	100	33
10	62	20
11	45	15
12	16	7
Total	1978	660



Graph No. 5.1: Extraction of Diesel Oil by Oil Skimmer

5.1.3 Calculation:

Loss of the Diesel oil after extraction = (2000-1870) ml= 130 ml

Efficiency = (1870/2000)*100= 93.5 %

5.2Extraction Of Petrol Oil by Oil Skimmer

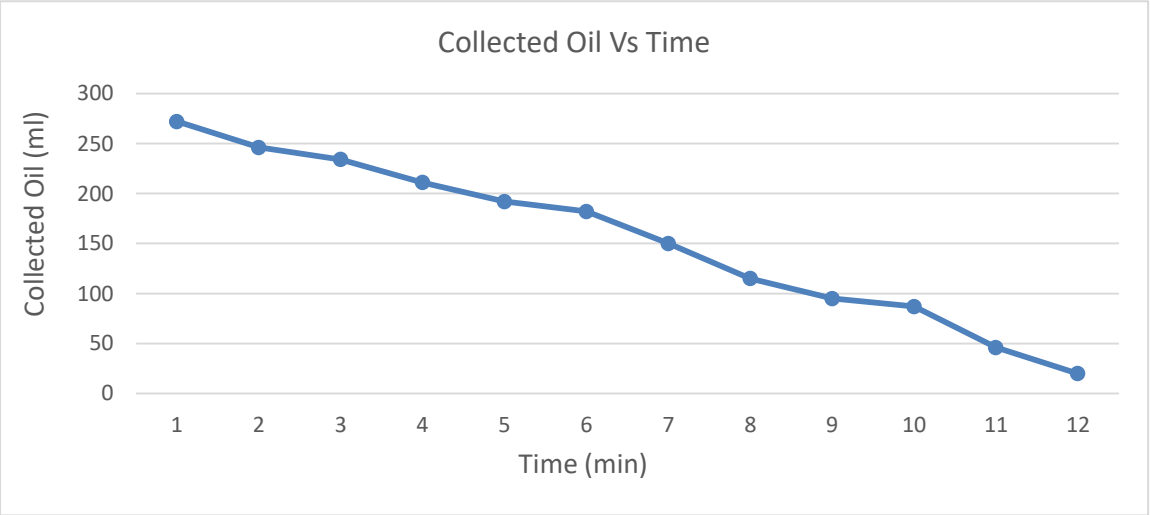
Initial amount before extraction: 2000 ml

5.2.1 Data calculation

After extraction:

Table No. 5.2: Extraction of Petrol Oil by Oil Skimmer

Time (min)	Extracted Oil (ml)	Water (ml)
1	272	60
2	246	57
3	234	50
4	211	47
5	192	42
6	182	40
7	150	35
8	115	28
9	95	21
10	87	15
11	46	7
12	20	5
Total	1850	407



Graph No. 5.2: **Extraction of Petrol Oil by Oil Skimmer**

5.2.2 Calculation:

Loss of the Petrol oil after extraction = (2000-1850) ml= 150 ml

Efficiency = (1850/2000)*100= 92.5 %

5.3Result:

After making this project and observe it very careful. It works as we desire. Our project give output perfectly and all equipment are work perfectly. We check how much it works and we get perfect output from this project.

- Finally, we have completed our project successfully & check our project its run accurately according to our objective.
- AT FIRST, WE MIXED WATER AND OIL. THE RATIO OF WATER AND OIL IS 8:1
- Connect the AC 220 to system on.
- Then when we start the switch then motor will be rotate.
- Then belt will separate the oil from water.
- This motor rotation speed control option is available here.
- Then oil will be store in a Container
- SUCCESSFULLY SEPARATED OIL FROM THE WATER 1.14 GM/S

CHAPTER 6
CONCLUSION

6.1 Conclusion

In this project, our enforced to highlight the function of oil skimmer, its various design aspects and performance. All the results of experimental studies indicate that slight design improvement of typical oil skimmers towards to include additional belt shaft and use of belt with steel material instead of rope; significantly improve the oil recovery efficiency and also its structure became simpler. Further extensive research & testing can improve the existing techniques and equipment to have better control for oil recovery exercise.

6.2 Environmental Effects:

Belt-type oil skimmers can have both positive and negative environmental effects:

6.2.1 Positive Environmental Effects:

1. Reduction of Oil Pollution: Belt-type skimmers effectively remove oil from water surfaces, reducing the amount of oil pollution in aquatic ecosystems. This helps protect marine life, reduces water contamination, and improves the overall quality of the water.

2. Ecosystem Protection: By removing surface oil, they prevent harmful substances from sinking or spreading, protecting fish, plants, and other aquatic organisms from the toxic effects of oil exposure.

3. Sustainability: When properly managed, these skimmers can contribute to the sustainability of aquatic environments by reducing the long-term damage caused by oil spills, especially in sensitive areas like wetlands, estuaries, and coastal regions.

6.2.2 Negative Environmental Effect:

1. Energy Consumption: Belt-type oil skimmers typically require mechanical power to operate, which can lead to increased energy consumption. If the energy source is not from renewable resources, this can indirectly contribute to environmental degradation and carbon emissions.

2. Waste Disposal: The oil collected by belt skimmers may still contain water and other impurities, requiring additional treatment before disposal or recycling. If not handled properly, this residual waste could lead to environmental contamination.

3. Maintenance and Chemical Use: The maintenance of belt systems may require lubricants, solvents, or other chemicals that could potentially leak or spill into the environment if mishandled, posing an additional risk of contamination.

6.3 Advantages

There are many advantages of our project because of its accuracy. Some of the advantages are pointed out below:

- An oil skimmer helps reduce that threat by removing the oil.
- It’s an automated process.
- The cost of an outside contractor to haul away oil is greatly reduced with the installation of an oil skimmer.
- Time saving machine for industrial work.
- Very effectively work for oil skimming.
- Reduce energy waste.
- Less skill technicians is sufficient to operate.
- Less time and more profit.
- Ease of operation

6.4 Disadvantages

Belt-type oil skimmers, while effective in removing oil from water surfaces, have several disadvantages:

1. Limited Oil Removal Capacity: Belt skimmers may not be as efficient in environments with high oil loads or thick oil layers, as they can become overwhelmed or require frequent maintenance.

2. Maintenance Requirements: The belt system and components can wear over time, leading to higher maintenance costs. Regular cleaning and replacing of belts are necessary to maintain efficiency.

3. Energy Consumption: Belt-type skimmers can consume more energy due to the moving parts and mechanical systems involved in the skimming process.

4. Oil Discharge Contamination: In some cases, the oil recovered by belt-type skimmers can still contain water, which might require further treatment to separate the oil from the water before disposal or reuse.

6.5 Applications

The application areas for this project in this modern and practical world are huge and some of these are given below:

- It can be implemented in sea.
- Industry
- On Ship
- Factory

6.6 Future Work

We are thinking about adding many features to our project in the future to get more desirable out comes. Some of the steps that we are thinking about taking are given below:

- In future we will add some sensor to measure oil quantity in container.
- In future we will add IoT System to operate in fully automatically.
- In future we will add protection equipment to protect this system from any kind of hazard.

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