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Oil Spill Clean Up Using Disc Skimmer Method

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Abstract

This paper deals with the separation of oil and water to find out the better solution for oil recovery from the water surface mixture Empress oil spill to produce oil free water. Also a deal with the fabrication of mechanical equipment to separate oil from the water. Oil and water separator is mechanical equipment, which is used in the environment pollution control from oil spillage. Oil separator helps in removing the oily from the mixing surface leaked water. By removing the oil from industry mixture water, it becomes free of oil pollution. This oil separator can be used in the effluent treatment plant. This paper consists of construction, fabrication details, assembly, working and applications of oil and water separator. There is the different method to remove the oil form the water but disc type oil skimmer is mostly used and efficient.

KEYWORDS: **Skimming, Disc skimmer, oil spill**

Introduction

Today world required speed in each field. Hence rapidness and quick working is most important. Now days for achieving rapidness, various machines and the equipment are being manufactured. In such a modern era of liberalization, small-scale industries are contributing in a big way to the growth of our country. Solar based; disc type oil spill recovery system is derived from the same mechanism. The concept of using this disc type oil recovery system to tackle the crisis of oil spill is a very efficient and effective possibility. It has numerous advantages over

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chemical or sponge suction techniques which are used now days for cleaning the oil from water surface. Using solar energy to drive the system makes it very effective, economical and environment friendly. This practically allows us to cross the boundaries of limited-service area and to reach the long distances for cleaning and recovery. Also, the system can be fully automated which can guide itself or can be guided by remote control. Means, a single person can operate and control 100s of such system at a time. This saves lots of human efforts and hence reducing the cost of operation. The simple disc skimmer mechanism is hence could be converted in to such an effective weapon against the global crisis of the oil spill. The following paper explains the need, brief background knowledge needed for the understanding of the concept, and the modifications in the concept.

What is oil skimmer ?

The oil skimming is the operation of removing or separating the oil from the oil polluted coolant. The oil and the coolant in the mixed form is collected in the containers. And one of the following classified methods are adopted to separate the oil from the coolant. By separating the oil from the coolant by violently pouring the upper layer of mixture in another container

- By soaking the oil layer using oil-soaking element.
- By skimming oil using flat belt arrangement.

The first two methods are not accurate also these are time consuming and it requires sort of skill for its execution. The later one is simple and the oil can be separated without any fatigue and the process is accurate. Oil being the lighter element as compared to coolant mixed with the water. It floats over the coolant. The endless belt running over the roller is adjusted such that the belt will violently smash the layer of the mixture coolant. The oil being the lighter and sticky will have stuck to the belt. The belt then is rubbed against the resting scoop or the container where the oil is collected after separation.

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Types of Oil Spills

CLASS A :

Class A oil is the most toxic oil. It is light and spreads quite easily. It has a very strong smell. This type of oil soaks into the soil and easily mixes with water. Crude oil, jet fuel and gasoline come under class A oil. This adversely affects the marine life and humans.

CLASS B :

Class B oil are less toxic than compare to class A oil. These are non-sticky oils which can cause long term contamination and are highly inflammable. Kerosene, heating oil and low-quality crude oil come under this category. CLASS C :

Class C oil are thick and heavy oil that do not penetrate or dilute into water and soil quickly. They produce a sticky film on the surface and cause severe contamination. Variants of crude oil, bunker B and bunker C oil come under this category.

CLASS D :

Class D oil is considered solid oils. These are the least toxic oils that harden when heated. The cleaning up of this oil is impossible

Non Petroleum Oil :

Non petroleum oil is thin type of oil that penetrates into the soil and water easily and cause severe damage. Synthetic oils derived from animal and plant fat comes under this category.

Causes For Oil Spills

1. Natural causes: some of the oil spills occur due to natural causes. Sometimes oil may seep out from the bottom of oceans when sedimentary rocks degradate due natural process at the bottom of the ocean floor.

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2. Human causes: oil spills due to various man-made reasons like

- negligence and lack of awareness
- lack of proper technology
- leakage during transportation and storage
- lack of proper maintenance of oil vessels
- due to accidents

Literature Survey

A number of publications were found in the literature survey it is express for the improvement in the industry. Therefore, some information was found on the cost and benefit to the companies.

Mr. Dhondeet. Al SEA OIL SEPARATOR WITH DISC AND BELT SKIMMERAs (2016)

we have studied in the past oil spill has occurred several times. These oil spills have caused a great collision on ecological life around the region of spillage. The spilled oil is waste oil as well as destroys the coastal life around it. While assembling for this project we have concluded that the oil spillage is not only harmful but also results in loss of lives and money. So, the recovery of spilled oil is very necessary. Our project is oil skimmer which is one of the methods of regaining the oil which is spilled. After designing our project and testing it we have concluded that we can regain about more than 90% by using oil skimmer. INDIA and other country where demand of oil is increasing rapidly, we think it will be very useful. So, after regaining spilled oil we can use it for other purpose. [1]

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SURAJ NAIR et. Al DESIGN& FABRICATION OF DISC TYPE OIL SKIMMER, (2017)

In the paper the disc of the material is used as a Mild Steel. The mild steel is hardened and it is easily weldable with the help of arc welding. The ultimate tensile strength as well as the compressive strength is increase with increasing the carbon content. [2]

SUMON KHANDAKAR et.al CONSTRUCTION OF AN ECONOMIC BLANKET BELT OIL SKIMMER (2017) The conventional spilled oil removal process is manual. So, these are harmful to the human health as well as time consuming. After being concerned with the related problem with the spilled oil and the costly belt oil skimmer, a single Blanket belt economic oil skimmer construction project has performed. The replacement of the conventional belt with blanket belt radically lowers the maintenance cost and easy availability. The design and construction of the project is simple thus easy to moderate it for the several conditions as required. According to the volume of the spilled oil, the width and the number of the belt can be redesigned easily to get more absorption. So, blanket-belt oil skimmer is economic and feasible for implication.[3]

MOHAMED AHMED MAHMOUD HYDRODYNAMIC SEPERATOR UNIT FOR REMOVAL AND RECOVERY OIL FROM WASTEWATER (2016) The amount of oil recovered increases with decreasing the percent of water in feed flow rate. The amount of oil recovered increases with increasing the percent of oil in feed flow rate. The presence of the air circulation within the oil spill (hydrodynamic forces) enhances significantly the separation rate of oil. The amount of separated oil increases in seawater than fresh water. [4] Zhang Yindonget.

Al. THE IMPROVEMENT OF OILWATER SEPARATION TECHNOLOGY IN OIL SPILL MECHANICAL RECOVERY 2014

The new methods of negative pressure suction and curved surface diversion are presented to improve oil-water separation in oil spill mechanical recovery. With the negative pressure suction, the oil-water mixture recovered by skimmer is inhaled into separator smoothly and bigger oil droplet is obtained. With curved surface diversion, the oil droplets in the separator obtain a base upward velocity in the flow field and rapid separation is achieved. The kinetic analysis of oil-water separation process is carried out, and according to the simulation analysis of separation process with the new methods, it can be found that the separation effect of smaller oil droplet is improved significantly and the density and viscosity of oil droplet have small influence on the separation speed. [5]

Methodology

Working Of Disc Skimmer

Oil and grease always on the water surface. They do not mix with water. Separation of it is based on the surface tension, specific gravity and viscosity of them. The “oil and grease skimmer unit has special purpose Disc, which is rotated by mechanical means such that it just touches the surface of water the oil and grease particle stick to the Disc material ana travels with the Disc up to scrapping arrangement where scrapping of oil and grease occurs and oil grease are collected. This unit mainly consists of rectangular frame. In first stage of unit at the top surface of frame motor and gearbox of fitted. The ¼ H.P. induction motor is used having 40r.p.m. At the bottom of frame driven shaft is placed in the tightening arrangement. This arrangement is provided for the movement of the shaft as per the requirement. One drum each is fitted on the two shafts with help of boss. On these drums main oil removing Disc is placed. With the help of tightening arrangement, the Disc is sufficiently tightened so that it will not slip. And also, it

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gives an advantage for the adjustment of unit as per the level of water flow. In same sense 2nd stage of unit is form and its upper shaft was with drum is driven by intermediate chain drive.

On one side of frame a scrapping arrangement is attached which removes the oil and grease from the surface of Disc. The removed oil and grease is carried through the collector pipe to the barrel. When the unit is switched on, motor starts, which is coupled to the gearbox. The motion of motor shaft is given to gearbox, which reduce the speed. This reduced speed is given to the driver shaft through sprocket. The upper shaft is rotated, because of these drums revolves at about at a because of these drums revolves and Disc is revolving at about 15 to 16 rpm. The Disc is immersed on water oil and grease is stacked to the Disc material. Which so carried with Disc up to scrapping arrangement. Here scrapping of oil and grease occurs and oil and grease is collected in barrel through collector pipe. The Disc after scrapping arrangement, here scrapping of oil and grease occurs and oil and grease is collected in barrel through collector pipe. The Disc after scrapping again goes to the downward in water channel. This cycle is repeated continuously.

Specification

1.PVC pipe

2. 12v DC Motor

3. 12v DC Gear Motor

4. 12v Battery

5. Oil tank

6. Scraper

7. Ply Wood

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8. Disc

9. Propeller

Prototype Of Disc Skimmer

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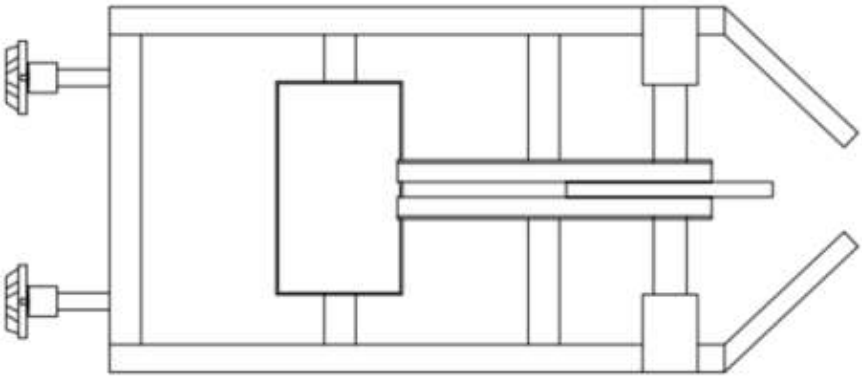
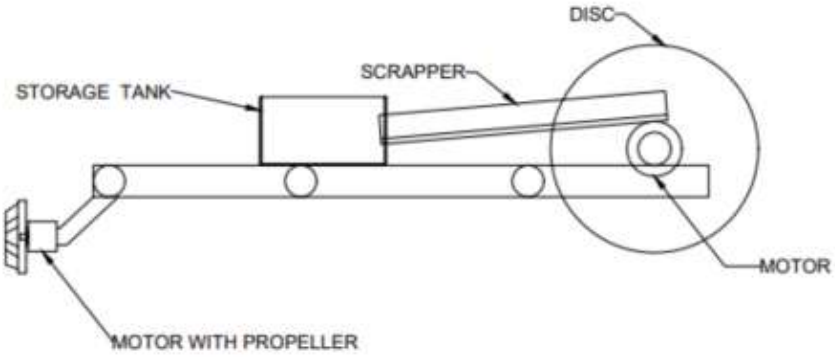
Construction Diagram





Selection Of Material

The main objective in the fabrication of machine is the proper selection of material for the different part of a machine. Design engineer must have to be familiar with the effect of the manufacturing process and heat treatment have on the properties of material.

The choice of material for engineering purposes depends upon the following factors:

- Availability of the material.
- Suitability of materials for the working condition in service.
- The cost of materials.
- Mechanical property of material.

The mechanical properties of the metals are associated with the ability of material to oppose mechanical forces and load.

1) Strength: It may be defined as the capacity of material to withstand load.

2) Stress: The internal resistance set up per unit cross-sectional area is called as stress.

3) Stiffness: The ability of a material to resist elastic deformation is called stiffness.

4) Elasticity: It is the property of a material by virtue of which it regains its original size shape after deformation the load causing deformation are removed.

5) Plasticity: Lack of elasticity is called plasticity.

6) Ductility: It is the property of material to undergo a considerable deformation under tension before rupture.

Material Used

Disc:

- We use wood for the rotating disc because of the weight of the material is less respect to our dimension. And also, it is easily available in the market.

Frame:

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- The material used for the frame is PVC pipe because of weight of the material is less respect to our dimension, easily float on water surface. And also, it is easily available in the market.

Future Scope

As the design of the disc type oil separator the multiple discs are attached at the shaft. It is used over the large area of oil recovery like the tunnels, small river, etc.

Conclusion

As we have studied in the past oil spill has occurred several times. These oil spills have caused a great collision on ecological life around the region of spillage. The main causes of oil spills are because of the carelessness of transporting authority and sometimes due to unpleasant weather causing storm which results in spilling of large tons of oil in water. The spilled oil is waste oil as well as destroys the coastal life around it. While assembling for this project we have concluded that the oil spillage is not only harmful but also results in loss of lives and money. So, the recovery of spilled oil is very necessary. Our project is oil skimmer which is one of the methods of regaining the oil which is spilled. After designing our project and testing it we have concluded that we can regain about more than 90% by using oil skimmer. INDIA and other country where demand of oil is increasing rapidly, we think it will be very useful. So, after regaining spilled oil we can use it for other purpose.

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