International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 08 | Aug - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Designing and Manufacturing of Oil Skimmer Bot

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Abstract: The oil skimmer serves to remove the floating oil from the fluid. The oil sits on the water since it has less density than water. Water molecules are more attracted to each other than that of oil since they don't mix with each other. In this case, the skimming medium is a belt and a metal disc. The skimming medium passes over the surface of the water, bringing out oil with a small bit of water. The main purpose of this fabricated skimmer is to purify the water from various dirt oils. In comparison to more expensive treatments such as membrane filters and chemical treatments, the skimmer is more cost effective efficient as well and straightforward in construction. The oil is removed from the metal disc and belt through wiping blades. Over the last 40 years, there have been hundreds of big oil spills all over the world, most of them were caused by ship collisions. There are numerous strategies for dealing with an oil leak accident, the most successful of which is to use a mechanical oil skimmer with a disc plate. The efficacy of the oil skimmer in dealing with oil spills is determined by a number of elements, including the depth of the disk submerged or the disk surface area dipped into the oil spill, the area of the wiper sweep, the thickness of the oil on the disk surface, and the disk rotation speed. The findings of a small size experiment with a mechanical oil skimmer are presented in this article. Diesel engine oil was utilized in the oil samples.

I. Introduction

Processes for the separation of oil and water are very well known to the oil industry. There are no principles differences in the technology required when separating oil and water mixtures which have been recovered during an oil spill clean-up operation. The main difference between separation of oil and water connected to production and handling of oil, as compared to an oil spill recovery operation is that the influence may, and generally does, vary significantly. Spillages of all types of oil occur under all types of sea conditions. This study clarifies the applicability of this exemption to oil-water separators including equipment, vessels and containers that are not specifically called oil-water separators but performs oil water separation. It is impossible to stop all oil spills. This leads to the need for cleaning up oil spill. This system will minimize spillage of oil in sea corrective action against oil spillage in shortest time as possible. The design of the separator is based on the oil will rise to top of the separator, and the wastewater will be the middle layer between the oil on top and the solids on the bottom. By using in almost all possible ships and other applications where oil spillage has occurred we can make it possible to

minimize oil pollution and make safe environment.

The efficiency of an oil skimmer is affected by a number of factors, including the speed of the rotary disc, the size of the collection chamber, and the type of oil being skimmed. In general, the faster the rotary disc rotates, the more oil it will collect. The size of the collection chamber also matters, as a larger chamber can hold more oil. Finally, the type of oil being skimmed also affects the efficiency of the skimmer. Some oils are more viscous than others and are therefore more difficult to collect. The rotary disc method is a relatively simple and effective way to remove oil from water. It is a common choice for oil spill clean- ups and other applications where oil needs to be removed from a water surface.

II. Literature Review

1.] M.F. Khalil a , Ibrahim El-Boghdady b , E.R. Lotfy. Oil-recovery performance of a sponge-covered drum skimmer The present study examined the effect of sponge porous cover on the drum skimmer performance. The sponge layer implemented proved a positive effect on the oil recovery performance. From the results of the experimental study carried out, the following conclusions were drawn: An increase in the oil recovery rate of about 24% was recorded when using the sponge porous covered surface compared with the plain steel surface at a rotating speed of 30 rpm

2.] Md. Ansar Khan, SK. Md. Golam Mostafa, Anisur Rahman, Md. Mizanul Hoque, Mohammad Tawsiful Islam, Mehataj Kalam Implementing and Improving The IoT Based Weather Monitoring and Controlling Double Discs Type Oil Skimmer. The proposed IoT- based weather monitoring and controlling the double disk type oil skimmer is a complete system designed to monitor the environmental parameters such as humidity, moisture, and temperature to know weather is good or not and can control this system from any geographical location in the world. Moreover, for implementing and improving this system, we divided the whole process into three parts, for instance- mechanical, controlling, and data monitoring part. This proposed skimmer offered 89.87% efficiency which provides good performance for high viscosity oil like it can collect 40.22L Mobil oil from the water surface per hour. The traditional system for collecting oil from the water surface is labour-intensive and time-consuming, but the proposed system saves time, money, human effort and can easily control and monitor.

3.] delnasser Abidli1,2, Yifeng Huang1,2, Pavani Cherukupally1,2,3, Amy M. Bilton2,3 5 and Chul B. Park Novel Separator Skimmer for Oil Spill Cleanup and Oily Wastewater 2 Treatment: From Conceptual System Design to the First Pilot Scale Prototype 3 Development. The vacuum system was designed to produce optimum oil flow rate and residence time towards enhanced dual separation-recovery process, thus fulfilling the operating requirements. The overall system is equipped with multiple specific sensors and connected data loggers. These accessories and auxiliary systems have been incorporated in order to allow adequate monitoring of the operating conditions. The system has been carefully designed to allow flexibility for further Journal Pre-proof Journal Pre-proof 23changes and/or replacements of the main system parts and high precision mechanical components without significantly altering the design of the OWSS prototype, while avoiding full disassembly of the system. The system also works with different oil- water mixtures and different porous sorbent materials.

4.] Marko Đordevi´c ¯ , Đani Šabalja, Đani Mohovi´c and David Brˇci´c * Optimisation Methodology for Skimmer Device Selection for Removal of the Marine Oil Pollution. Rapid response to accidental marine pollution as well as the selection of appropriate specialised equipment can lead to improvements in environmental protection and prevention of pollution aftermaths that can significantly impact flora and fauna. In accidental J. Mar. Sci. Eng. 2022, 10, 925 14 of 16 oil pollution, various pieces of specialised equipment are available to remove pollution from the sea surface. The authors analysed a mechanical method for removing oil using a skimmer device. The efficiency of oleophilic and weir skimmers and auxiliary equipment such as centrifugal and spate pumps were analysed. Research results showed that different skimmer devices had different efficiencies when collecting oil from the sea surface. The efficiency of an individual skimmer device depends on weather conditions and oceanographic parameters, such as tides and wave heights.

5.] D.R. TOPHAM An Analysis of the Performance of Weir Type Oil Skimmers. The comparison of a range of test results from weir type skimmers with the idealized twolayer weir model of Wood and Lai (1972) suggests that the simple Froude number scaling of the model can be used to present the results in a universal form. The results themselves,however,exhibit a wide scatter,of the order of 30%,which is characteristic of all the tests. This scatter appears to be random,with no correlation with any of the recorded variables,although it appears to be greater for flows with thin slick thicknesses.

6.] Vignesh. T1 , Bhuvaneswari M2 , S.Manojkumar3 , S.Kishore4 , N.Bommuraj Development of Automatic Tube Oil Skimmer. Oil skimmer system prototype is tested and evaluated in the industry circumference. The recovery test has done in the industry. The system gives the good performance result. The system works well in harsh surface. This method is more cost efficient and less material requirement. This system is designed and tested and it shows that it can regain most of the oil from water

7.] M. Maruthirao1 , V. Pavan Kumar2 ,
N.V. Surya narayana3 Design and Fabrication of Multi-Disc Oil Skimmer . In this project we have found numerous point which need to be booked into while designing the oil skimmer. The changes in the design of skimmer results in huge difference in the oil recovery. Aluminum disc gives better edge in oil recovery all design aspects lead to improvement of oil skimmer. The oil from coolant was easily separated with this machine. This machine overcame many designs hurdle to reach the final stage. The objective of project multi disc oil skimmer is: 1) Successfully fabricated oil skimmer. 2) Better oil removal rate and less cost.

III. Problem Statement

In recent times there have been many methods developed to remove the spilled oil from the affected waters, but the main problem arises in the efficiency and/or its other consequences on the immediate environment. The selection of the topic for this report is aimed at finding a universally accepted method for oil removal that has maximum oil removal rates and no consequences on the environment. The efficiency of the disctype oil skimmer depends upon many factors such as the disc RPMs, environmental conditions, and type of materials There is an extreme need to study all these factors and how they affect each other. Most oil skimmers are not available in small sizes, hence the study of all these factors on those machines is cumbersome. The small size of this oil skimmer helps to study all these parameters effectively with an affordable cost, which is also one of the most important variables in this study

IV. Methodology

A. Simulation (3D)

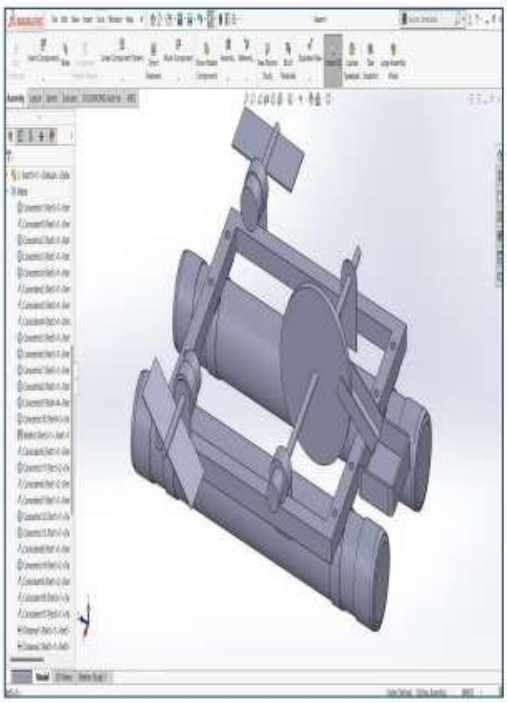

Fig . 3D design of oil skimmer bot

B. Calculation

Moving frame calculation The total weight of the frame without oil is 4kg and the total weight of the frame with oil is 5 kg we can used two motor for moving frame So each frame contain 2 kg without oil and 2.5 kg with oil Force required for lifting 2 kg is

Moving Frame Calculation with oil and without oil

Dimensions of frame are as follows: Length of frame =600 mm

Diameter of frame=80 mm

So the each Motor Contain oil 2 kg load without 2.5 kg load with oil

Force required to lift 2 kg load is : F_1=m x a

F_1=2 x 9.81 F_1=19.62 N

Force required to lift 2.5 kg load is: F_2= m x a

F_2= 2.5x981 F_2= 24.52 N

Torque required to moving Frame T_1 = F_1 x d

= 19.62×150

= 2943 N-mm

=2.943 N.m

Torque T_2 is required to moving Frame T_2 = F_2 x d

T_2 =24.52×150

= 3678 N.mm

= 3.678 N.m

We are selected the 10 rpm - DC motor Rpm= 10 Rpm

Voltage = 12 V Power = 4.8 W Torque For DC motor

T=4.58 N.m T1, T2 <Tp =2πNT

60

$T = \frac{60 \times p}{2 \times \pi \times N}$

$T = \frac{60 \times 4.8}{2 \times 3.141 \times 10}$

Md. Ansar Khan, SK. Md. Golam Mostafa, Anisur Rahman, Md. Mizanul Hoque, Mohammad Tawsiful Islam, Mehataj Kalam Implementing and Improving The IoT Based Weather Monitoring and Controlling Double Discs Type Oil Skimmer (ICREST) | 978-0- 73813042- 2/20/$31.00 ©2021 IEEE |

DOI: 10.1109/ICREST51555.2021.9331192

So Selected motor is safe

V. Conclusion

In this first semester project we have successfully designed the oil skimmer bot with the help of Solid Work software, the calculations will be done accordingly then materials for model is selected.

Future Scopes

The said model of Oil Skimmer, despite of being made with lesser cost, has efficiency of more than 80%. With increase in resources and accuracy, the device can have the efficiency of about 93-97%. One way to increase the efficiency is to use commercially made metal discs instead of sheets glued to the wood, which will increase the scraper's reach on the surface and will accumulate more volume of the oil-water mixture.

Further the model can be made to adjust with variable thickness of discs by using adjustable scrapers. The most intricate part while constructing this model was making sure that all the scrapers touch the disc surfaces without applying undesired pressure which would have made discs hard to rotate.

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Impact Factor: 7.177 Volume 7 Issue X, Oct 2019- Available at www.ijraset.com