

A Review Paper on Oil Spill Recovery System

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Abstract - Nowadays, oil pollution is the most serious issue that have an adverse effect not only on marine life but also on ecosystem. Environmentalist come across big challenges while treating oil spills and finding an alternate procedure having low cost. There are different procedure for this, of which disk type oil skimmer is one of the majorly used. This is because of its easy operation and extremely high efficiency of around 90-95%. 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 Chemical or Sponge suction techniques which are used now days for cleaning the oil from water surface. Also by 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 the purpose of cleaning and recovery. Also, the system can be fully automated which can guide itself or can be guided by remote control. This saves lots of man power and hence decreases the price of operation. The simple disc skimmer mechanism is hence could be converted into 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.

Key Words: Oil Skimmer, Disk Skimmer, Belt skimmer, Oil Spill, Sea Oil Pollution.

1. INTRODUCTION

Oil pollution occurs in sea water when leaks from water fronts for the supply of diesel fuel to fishing vessels pass along into the harbour water, when vessels pump out oily bilge water in port, when used engine oil is dumped overboard and when an accident results in leakage of fuel oil; waste disposal and accidents. A fishery harbour which is neighboring with the main dock also faces the risk of major oil splatter if the main port is a transfer point for crude oil or refined products from oil tankers. Human activities are directly linked to these sources. More than 5 million tons of crude oil are transported annually around the world by the sea, putting the ecosystem in danger[1]. Eventually, it puts the environmental and marine lives in danger.

The marine oil spill is classified into thick oil with a thickness of more than 10mm and the thin oil with a thickness of less than 10mm in the field of oil spill disposal[2]. Further the thin oil having thickness less than 1mm are defined as oil film and can be classified into multiple level according to their appearance on the surface of sea water. Disposal of this

thin oil film is major problem as it is difficult to separate thin oil form water as compared to thick oil. The thin oil film on the sea would block the exchange of air and water and have adverse impact on the environment[3].

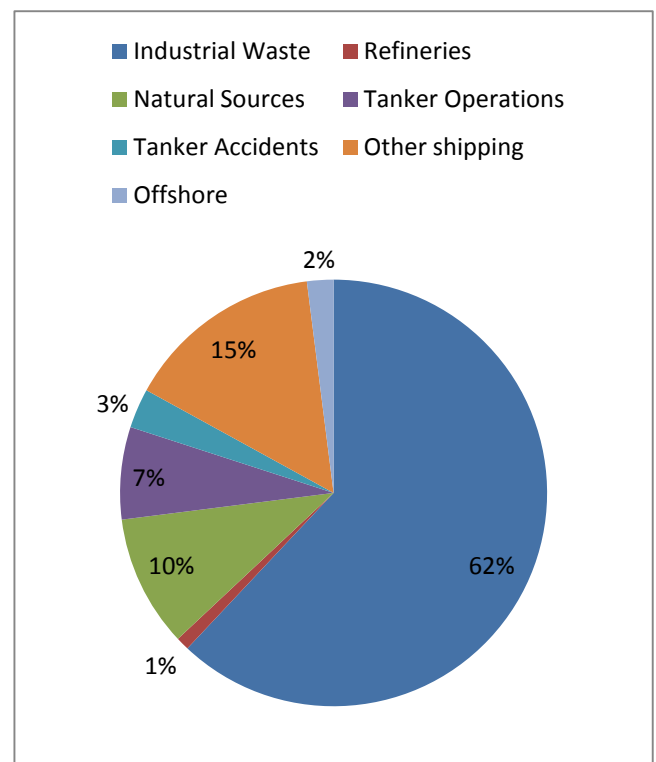


Chart- 1: Sources of Oil Spill into the Sea

Modernized world desire rapidness every single field. Hence pace and quick working is most important. Nowadays for achieving rapidness, various machines and the equipments are being manufactured. In such a modern era of globalization, scaled down industries are helping in a various manner to the growth of our country.

To combat oil spill some efforts have been taken, some of them are mechanical recovery by skimmer, absorption using sorbents, chemical dispersion, burning oil at sea, etc. However, among all this methods mechanical recovery is considered as the most efficient and environment friendly method. Hence it is the first preferred method for oil spill recovery system. So there is necessary to access the mechanical recovery capacity by skimmer as an integral part of overall oil spill response and preparedness capability[5].

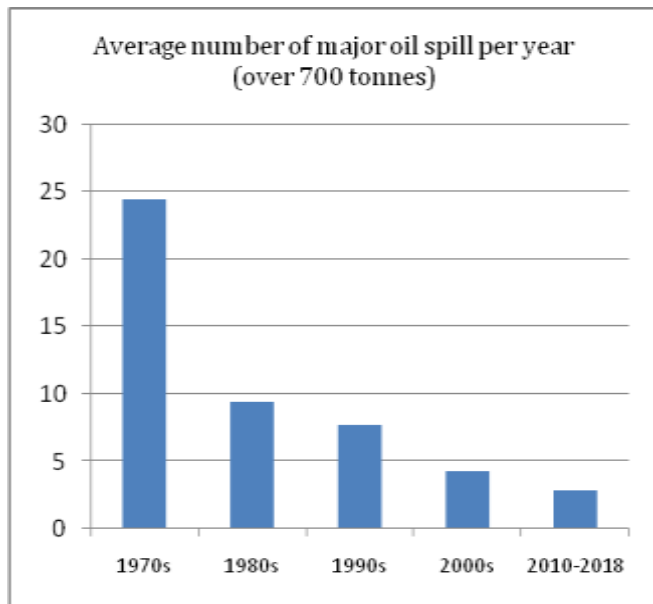


Chart-2: Reduction in Major Oil Spill

The inventor is regularly facing new challenges of importing new concepts and composition into reality. New gadgets and approach are being developed constantly to construct various products at economical rates and great quality. Considering the above inputs we have tried to design a device, which is the adornment of machine tool to have the cure to the cutting fluid after having used as a coolant. Because the coolant after having repeated use, gets mixed up with the lubricating oil and its property gets changed. Hence it becomes necessary to separate the oil from the mixture of the oil and the coolant.

1.1 What is oil skimmer?

Oil skimmer is a device which is used to separate oil from water.

Skimmer may be:

Self-propelled - Moved with thrusters for forward and backward movement operated by joysticks or levers. During an operation it is possible to position the skimmer in the place of greatest oil concentration[4].

Stationary- They are moved and retained by ropes placing in the location with the greatest concentration of oil. For many years the response industry has been making efforts with the development of methods and equipments for the recovery of oil[4].

Oil skimmer further can be classified into two types as Disc Skimmer and Belt Skimmer.

1.2 Disk Skimmer:

Disk skimmer have recovery capacity from 40-100m³/h and can be used for open sea operations. And it is dependent on number and size of discs. Tests are shown grooved discs can be highly effective. Disk Skimmers work best with lighter types of oil and cannot handle emulsified oil. The weight and volume of these disks is quite large to the size and number of rotating disks[4].

1.3 Belt Skimmer:

Belt oil skimmer uses a belt of stainless steel. This belt is immersed into the sea water in which oil is mixed. The belt then passes through special wiper blades, which separates the oil which is slicked on the surface.

1.4 List of Components:

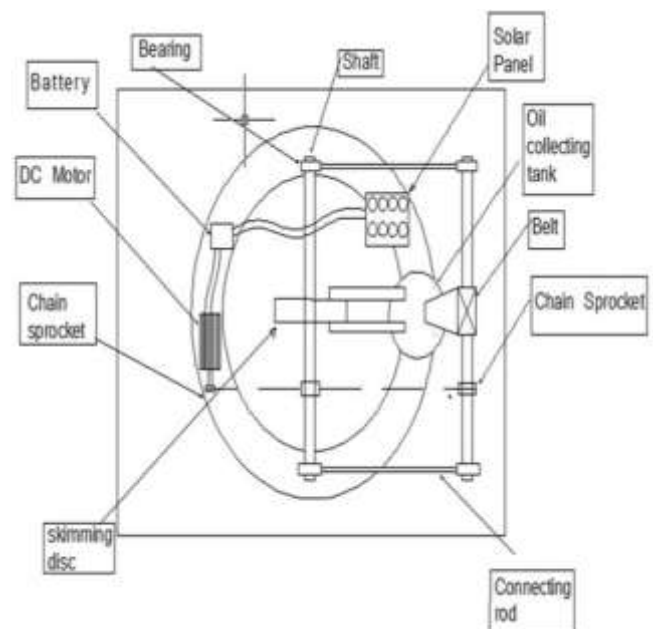


Fig-1: Disc and Belt type Oil Skimmer.

1. DC Motor: A DC motor is an electrical machine which is used to convert electrical energy into mechanical energy. Speed of DC motor can be controlled over wide range by either changing the strength of the current or by using varying supply.

2. Chain drive for power transmission: Chain drive is used to transmit mechanical energy which is been produced by DC motor to the shaft.

3. Shaft: The disc and belt which are used for skimming purpose are mounted on this shaft. With the help of chain drive it rotates and eventually the disc and the belt mounted on the shaft starts rotating.

4. Battery: An electric battery is a device which consist of a one or more electrochemical cells with external connections

to power electric device. In this mechanism battery is used to provide power to the DC motor.

5. Solar Panel: Solar panel are used for alternate battery purpose. Installation of solar panel helps to convert the mechanism to be portable i.e. it can help to eradicate the problem of oil spill deep into the middle of the sea.

6. Skimming Disc and Belt: This disc and belt which are mounted on the rotating shaft gets immersed into the oil which is floating on the surface of water and passes through a tray which helps to remove the oil which is slicked on the surface.

7. Oil Collecting tank: The oil which is separated from the disc and belt with the help of tray is then passed and is stored in this tank.

8. Bearings: Bearings are the devices which are used to constrain relative motion to desired motion and to reduce the friction between the moving parts. In this mechanism bearings are used to reduce the friction between the rotating shaft and hence to reduce the vibration and make the mechanism stable.

9. Floating Tube: The whole mechanism is placed on the floating tube so that the tube floats on the water and the disc and belt which are used for skimming purpose can easily get immersed in the oil on surface of water.

2. Literature Survey:

Large number of research paper were found during the literature survey of this project all of which lead to a great improvement. While doing this survey, it was assured that the result of this research will be helpful in contributing on this project.

G.Alaa El-Din et al., [1] studied separation of oil from water using banana peel as a medium. It was found that different characteristics of oil like oil type, oil film density, absorption time, temperature, as well as brininess, all affect oil absorption capacity. It can be seen that absorption capacity of banana peel gives a good result as a new and low cost agriculture waste for oil spill cleanup. Subsequently, banana peel not only helps in lowering of environmental contamination, but also helps in reduction of agriculture waste.

Dhonde Dipak Panditrao et al., [4] studied the use of both disk and belt for oil separation method. After designing and testing of this project they reached to a conclusion that their device can separate oil from water with almost 90% efficiency.

Chunchang Zhang et al., [5] temperature of water and time of spill are two major factors which affect the thickness of oil on the surface of water. The deploy of skimmer should be as soon as possible before the thickness of oil decreases so that

recovery of oil will be at faster a rate and the efficiency will be high. Skimmer should be demobilized when the thickness of oil spill start getting thin which is not suitable for mechanical recovery by skimmer. On site monitoring and observation is important for the mechanical recovery by the skimmer. Apart from the thickness of oil, the speed and sweeping width of the skimmer are important factors for recovery capacity of skimmer. The speed of the skimmer and sweeping width should be adjusted approximately to maximize the effectiveness of the skimmer.

Zhang Yindong et al., [6] mechanical recovery is the most commonly used oil spill response technology which can separate oil floating on water with the help of mechanical equipment known as skimmer. Density of oil and water is different so here we used the working principle which is based on gravity type oil water separation. In which there is a buoyancy force is produced due to density difference where able to achieve oil water separation. For the improvement of oil water separation, new procedure of negative pressure suction and curved surface diversion is used. By the method, the oil water mixture retrieved by skimmer can be sucked into separator smoothly and obtain an upward base velocity in the flow field, so the oil droplets could obtain larger diameter and float upward with higher speed[6].

3. METHODOLOGY

Oil and grease do not mix with water and hence they remain on the surface of water. Oil and water separation is done on the principle of specific gravity, viscosity and surface tension.

Rotating discs are used to attract oil. The collected oil is removed and the oil is pumped to a collection tank. These mechanism generally rest on the surface of the water but larger installations may use fixed mechanism. The disc rotates and collects oil from water because of its skimming characteristics. The solar panel is used to charge battery and eventually to run the motor and make system portable and wire free.

The rubber scraper is attached to the disc and oil is collected in a storage container.

Oil skimming is basically sticking of oil to some material which is inserted in it. This action can be effectively used as oil can stick to the material but not the other impurities in it. Hence by this principle, Oil can be separated from its containments as well as it can be separated when it is containment.

Floating or sinking oil and grease adhere to skimming media more readily than water, and water has little compatibility for the media. This allows skimming media in the shape of a belt, disk, drum, etc. to pass through a fluid surface to collect oil and grease with very little water. This oily material is

eventually removed from the media with wiper blades or pinch rollers.

4. CONCLUSION

Solar based disc type oil spill recovery system is easy, effective, economical and environ friendly system to tackle the global crisis of the oil spill. It has many advantages over present day technologies to clean spilled water. It can effectively clean the water surface recovering most of the oil back in usable form. The system can be automated and run on solar system making it greatly capable to survive on its own. Hence lots of human efforts are eliminated and hence oil spill recovery can get faster and efficient response can be obtained. The hazardous effects of oil spill are thus effectively reduced. Hence, solar based disc type oil spill recovery system promises to be an important tool against global crisis of oil spill.

5. ACKNOWLEDGEMENT

It is a great pleasure in submitting this project work. We take this opportunity to express our sincere gratitude to "**Prof. Priyanka Verma** " for her valuable advice in this undertaking, without which the project report would not have been completed .We are very much grateful to her for her untiring assistance in this research and she has been encouraging us in eliminating the errors .This research has been developed as a result of valuable advice .

6. REFERENCES

- [1] G. Alaa El-Din et al., (2017) Study on the use of banana peels form oil spill removal. Alexandria Engineering Journal, 05.020.
- [2] Yin, Peihai, 2000. Prevention technology of ship pollution. Dailan: Dailan Maritime University Press.
- [3] Lingzhi Zhao et al., (2015) Research development and key scientific and technical problems on EMHD marine oil film recovery technology. International Oil Spill Response Technical Seminar, 02.223.
- [4] Dhonde Dipak Panditrao et al., (2016) Sea oil separator with disc and belt skimmer. International Journal for Scientific Research & Development, Vol. 4, Issue 01.
- [5] Chunchang Zhang et al., (2015) Modified assessment methodology for mechanical recovery capacity for oil spill response at sea. International Oil Spill Response Technical Seminar, 02.224.
- [6] Zhang Yindong et al., (2014) The improvement of oil-water separation technology in oil spill mechanical recovery. International Conference on Logistics Engineering, Management and Computer Science.