

## A Review on Analysis of Belt Type Oil Skimmer

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**Abstract**— 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 component. 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. 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.

**Key words:** Oil Skimmer, Polyurethane Belt, Pollution, Crude Oil

### I. INTRODUCTION

Oil is one of the most precious crude and being used in many everyday application of human life. Since most of the oils are poisonous so quite dangerous for alive when it comes to physical contact with them. Many countries have made strict 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 skimmer to separate oil from disposal water.

The continous removal of oil from process fluids, increases the life of fluid; resulting of:

- 1) Reduce the machine fluid refilling cost
- 2) Improves the disposal water quality.

#### A. What is Oil Skimmer?

It is the process of removing or separating the oil from the oil polluted coolant or oil from oil & water mixture. 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.

- 1) By separating the oil from the coolant by aggressively pouring the upper layer of mixture in the another container
- 2) By soaking the oil layer using oil soaking element.
- 3) 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 it's execution. The later one is simple and the oil can be separated without any fatigue and the process is accurate.

#### B. Types of Oil Skimmers

- 1) Disc skimmers
- 2) Drum skimmers
- 3) Rope skimmers
- 4) Brush skimmers
- 5) Belt skimmers

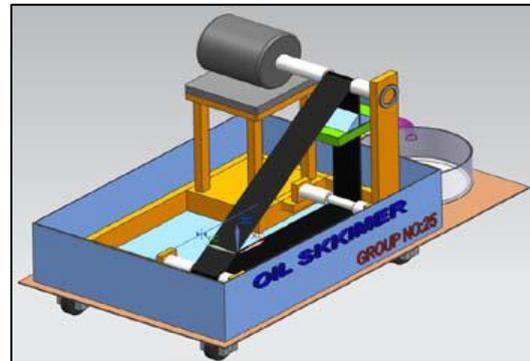


Fig. 1: 3D CAD Model of Oil Skimmer Conceptual Model  
<sup>^</sup>[3]

### II. LITERATURE REVIEW

- 1) Gregory and Alfred Cohen [1978] had studied that Oil skimming is an underdeveloped market cluttered with companies and technologies. In accordance with the present invention, a system is provided for removing accumulated oil from a basin. The system comprises an endless belt for carrying oil with the endless belt being adapted for partial submergence in the basin. A rotary drum is provided for supporting and driving the endless belt. The rotary drum has an irregular surface for frictional cooperation with the belt. Means are provided for urging the belt against the irregular surface. Means are provided for scraping oil from the belt and means are provided for directing the scraped oil away from the belt and basin.
- 2) Philip C. Lewan et al [1992] 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.
- 3) Mamta Patel [2015] 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. A set of

experiments had been conducted by using various oils and different materials of belt to understand the oil recovery performance and viscosity deviation of oils before and after separation.

- 4) Suraj Nair et al [2017] had studied oil spills had occurred several times. These oil spills have caused a great collision on ecological life around the spillage. He had conclude that the oil spillage is not only harmful but also result in loss of lives and money. So the recovery of spilled oil is very necessary. He studied various oil skimmer belts and their properties.
- 5) Prof. P.A. Patil et al [2017] 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.

#### A. Material Selection for Belt

- 1) According to polar and non-polar properties of oil and water, water consist of  $H^+$  and  $OH^-$  having polar nature while oil is act as a non-polar. Therefore they do not mixed they form layer. Also oil has a lesser density than water so oil always float on water. Belt material has been selected as non-polar element due to this oil attract towards belt and get stick on it which permit us to easily lift oil through belt. Example materials like cotton, rubber, steel, oleophilic, polyurethane.
- 2) Oil having higher adhesive property than water. So we select material for belt having adhesive property greater than water and closer to oil. Due to these belt absorb oil easily.
- 3) Oleophilic material offers less wearing property than polyurethane but oil carrying capacity of polyurethane is greater than oleophilic material. So we can choose polyurethane material for belt.

#### III. COMPARATIVE STUDY OF VARIOUS BELTS:

Belt Capabilities	Steel	Elastomer	Polyurethane
Temp Range	<220°F (104°C)	<120°F (49°C)	160°F (71°C)
pH Range 2-13*	Yes	Yes	Yes
Operates in the presence of grit fines and other suspended particles	No	Yes	Yes
Removes certain DNAPL's and some emulsified oils	No	No	Yes
Effective for every light oils	No	No	No

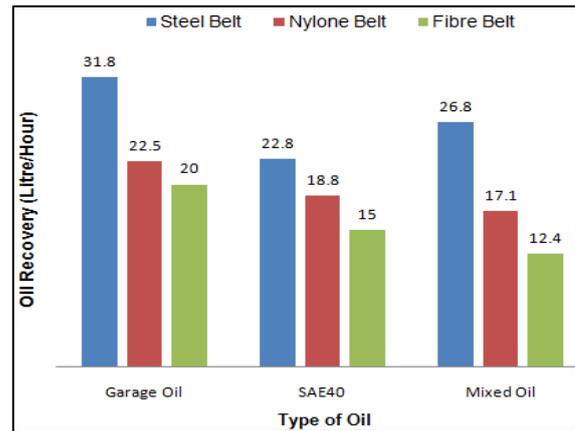


Fig. 3: Performance Graph of Oil Skimmer by using Various Types of Belts & Oils [3]

#### IV. APPLICATIONS

- 1) Separating oil from water
- 2) Swimming pool sanitation
- 3) Cylindrical Grinding machine.
- 4) Surface Grinders.
- 5) Automats
- 6) Milling Machine & where coolant separation is necessary.
- 7) Centre less grinding machine.
- 8) Lathe machine

#### V. CONCLUSION

From above information we studied different types of belts for oil skimmer. We compared the different type belts rope disc, their oil absorption capacity, wear and tear factor, cost, life and noise. We have studied different properties of steel, rope, cotton and polyurethane materials. Out of these we conclude polyurethane shows better performance considering all above factors.

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