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Paper on Aqua Lift OWS (Oil Water Separator)

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Abstract: *Oil pollution in water bodies and industrial effluents has become one of the major environmental challenges faced today. Industrial processes such as machining, automobile servicing, transformer maintenance, and wastewater discharge often result in oil–water mixtures that are difficult to separate using conventional methods. The presence of oil in water not only contaminates natural resources but also affects aquatic life, clogs drainage systems, and leads to the wastage of valuable oil. To address these issues, a belt-type oil and water separator has been developed as a low-cost, energy-efficient, and eco-friendly solution.This system operates on the simple principle of adhesion of oil to a belt material. A specially selected belt, usually made of oil-attractive and water-repellent material, is continuously rotated through the oil–water mixture. When the belt comes in contact with the contaminated water, the oil molecules stick to its surface while the water molecules remain behind. As the belt rotates upward, the adhered oil is mechanically scraped off and collected in a separate container. The cleaned water is thus left behind, making the process effective for pollution reduction and oil recovery. The design of this system is simple, robust, and requires very little power for operation. Unlike traditional oil separation techniques such as chemical treatment, centrifugation, or complex filtration systems, this belt separator consumes minimal energy, involves no chemical usage, and can be maintained easily. Its modular design allows it to be installed in industries of different scales, from small workshops to large wastewater treatment plants*

Keywords: Aqua Lift, OWS

I. INTRODUCTION

The increasing use of oils, lubricants, and petroleum products in industries and daily activities has led to significant challenges in wastewater management and environmental protection. Oil spillages and leakages are common occurrences in sectors such as manufacturing, automobile maintenance, power generation, and marine transport. When oil mixes with water, it forms a persistent layer on the surface that not only contaminates the water but also obstructs oxygen transfer, severely affecting aquatic life. If discharged untreated, oily water contributes to pollution, foul odors, and health hazards. Therefore, the removal of oil from water before it is discharged into the environment has become an essential requirement for industries to comply with environmental regulations.

It is important to note that oil skimmers are not complete oil–water separators but are widely used as a first step in oily water treatment systems. By physically removing the oil layer, skimmers reduce the load on subsequent treatment units, making the overall separation process more effective. The use of skimmers minimizes water stagnation, unpleasant odors, and the formation of scum, thereby improving water quality and workplace hygiene.

There are several methods available for oil removal, including chemical dispersants and biological treatment. However, these methods have limitations. For instance, chemical treatment can be harmful to the ecosystem, while biological decomposition using bacteria such as Pseudomonas leads to the breakdown of oil but makes recovery and reuse impossible. In contrast, oil skimmers have a distinct advantage: the recovered oil remains reusable, turning waste into a valuable resource. This makes skimmers an economical and environmentally friendly option for industries dealing with frequent oil contamination.

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II. PROBLEM STATEMENT

Industrial processes such as machining, metal finishing, and wastewater treatment often generate effluents containing floating oil and grease. If not removed, these oils cause water pollution, reduce efficiency of treatment plants, create equipment fouling, and pose health and environmental hazards. Conventional oil removal methods are often costly, energy-intensive, or inefficient in separating thin oil layers. Therefore, there is a need to develop a simple, cost-effective, and energy-efficient belt type oil skimmer that can continuously remove floating oil from wastewater, recover usable oil, and improve water quality for safe discharge or reuse.

LITERATURE SURVEY

Rafi Jamal Algawi, Maha Adnan Dawood (2017),The experiment of separating oil from water by using the skimming belt best operating conditions here we study Oil recovery rate increases with increasing belt rotational speed, oil recovery rate increases with decreasing oil temperature and the belt material polyvinyl chloride was more effective than synthetic Rubber and polypropylene.

vignesh. T, Bhuvaneswari M, et.al. (2020), Removing oil from the water which is wasted from the machines. 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.

Lokhande M. M., Pawar R.R.et.al.(2017), Experiment of effective way to clean this oil from the surface without actually wasting it. Simplified the complex driving mechanisms used in earlier projects and giving it simple and high working capability. They achieved process at cheaper side and eco-friendly.

Sathiyamoorthy V Arumugam K. et.al.(2017), Experiment of the oil skimmer is used to separate oil, from mixtures of aqua and oil. Significantly improve the oil recovery efficiency and also it's becomes simpler.

III. PROJECT DESCRIPTION

This study uses a descriptive qualitative approach with data collection techniques by means of observation, interviews, and literature studies (Driscoll, 2011). Observations were made by periodic sounding on the bilge tank every 30 minutes during the operation of the oily water separator. Interviews were conducted with three sources, namely the chief engineer as the person in charge of all machinery on the ship, and the second engineer as the person in charge of the oily water separator at SS. Golden Isaia, and Oiler 1 as the second engineer's work assistant. Literature studies were obtained based on previous similar studies regarding problems surrounding oily water separators. The analysis technique used in this study used the fishbone analysis technique which includes four factors, namely man, machine, material, and method. The research framework is summarized in Figure 1.

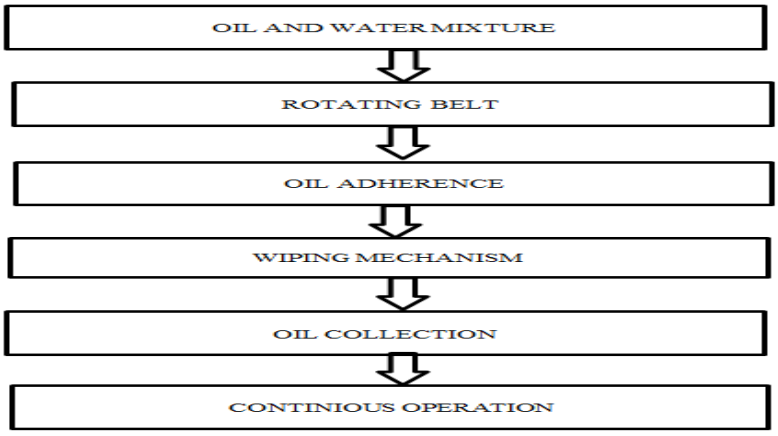

Fig.1. flow chart of aqua lift OWS

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1. Oil & Water Mixture
Wastewater containing floating oil is collected in a tank or pit.

2. Rotating Belt –
A continuous belt (made of oil-attracting material) is lowered into the tank.

3. Oil Adherence –
As the belt rotates, oil sticks to its surface while water remains behind.

4. Wiping Mechanism –
At the top, scrapers/wipers remove the collected oil from the belt.

5. Oil Collection –
The removed oil flows into a separate collection tray or container.

6. Continuous Operation –
The belt keeps rotating, ensuring continuous oil removal from water

IV. PARTS USED IN A SYSTEM

1. AC MOTOR
This 795 DC motor is used in an oil skimmer to drive the rotating belt or disc that collects oil from the water surface. Its high torque output allows continuous operation even when handling viscous oils. The built-in cooling fan helps prevent overheating during long running hours in industrial environments. With a 5 mm shaft, it easily connects to pulleys or rollers in the skimmer mechanism. It is commonly powered by 12V or 24V DC, making it suitable for portable and small industrial oil recovery systems.

Fig.1. Ac Motor

2. CONVEYOR BELT
An oil skimmer conveyor belt is a continuous moving belt designed to collect oil from the surface of water or coolant tanks. It works by attracting oil to the belt surface, lifting it out of the liquid, and scraping it off into a collection container. Belt rotates through contaminated liquid. Oil adheres to the belt surface. Belt passes through scraper blades. Oil is removed and collected. Clean belt re-enters liquid.

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Fig. 2. Conveyor Belt

3. WIRE

Wire used in industrial oil-water skimmers is typically durable, oleophilic (oil-attracting) metal, often stainless steel, used for conveyor belts, mesh, or cables to separate oil from water based on surface tension. These specialized belts, sometimes referred to as metal wire belts, remove oil regardless of water level changes, making them efficient for industrial applications

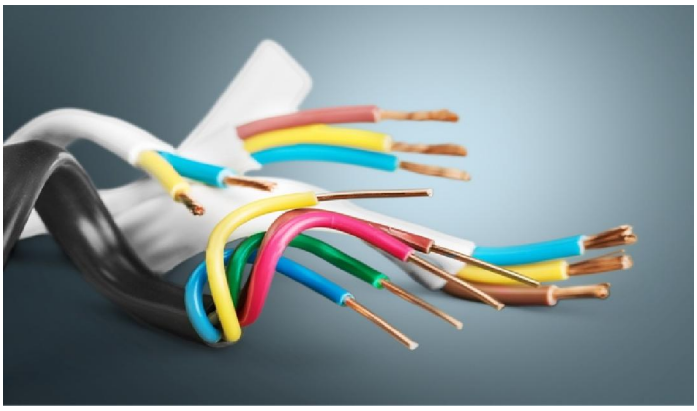

Fig. .2. WIRE

4. SWITCH

Oil water skimmers, particularly belt and disc types used in industrial, marine, and coolant cleaning, rely on electrical switches for operation, safety, and automation. The switch typically powers the motor that drives the oleophilic (oil-attracting) belt or disc.

Fig3. SWITCH

5. PVC Pipes

PVC Pipes are commonly used in oil-water skimmers for their affordability, durability, and buoyancy, serving as structural floating frames, suction lines, or specialized slotted collector pipes. Rigid PVC offers high tensile strength, while its lightweight nature allows the assembly to float, reducing manufacturing costs.

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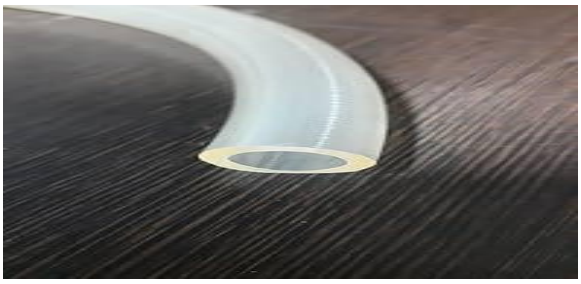

Fig. 4 PVC Pipes

6. BENT

In aqua lift oil skimmers that are fabricated using laser cutting and bending presses to ensure a rigid, precise structure for holding the belt pulleys and motor. These bent mounting frames ensure that the belt operates at the correct tension and alignment, preventing slipping and ensuring efficient oil removal.

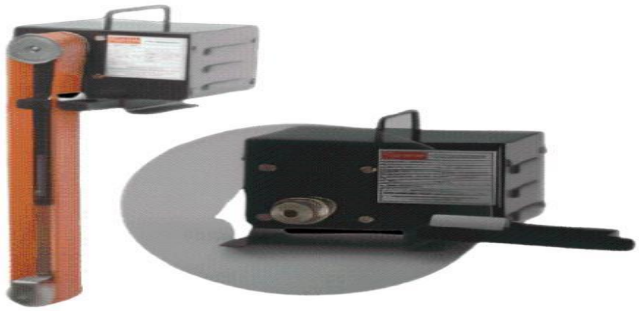

Fig 5. Bent

7. TEE

In an oil-water skimmer, a "tee" usually refers to a 3-way connector, such as a T-junction in piping, which is commonly used to split or combine flows of oil and water, or to provide a discharge point for the separated oil collected from a drum or belt. These fittings are essential for directing the skimmed,, concentrated oil into a separate disposal tank or container. In simple terms, the tee acts as a distribution and outlet connection point in the oil discharge line, ensuring controlled flow of recovered oil from the skimmer to the storage tank. Proper sealing and alignment of the tee are important to prevent leakage and maintain efficient oil recovery.

8. SKIMMER ROLLER

Skimmer roller in an oil skimmer works on the principle that oil floats on water and naturally adheres to certain materials. Since oil is lighter than water, it forms a layer on the liquid surface. The roller, or a belt running over rollers, is made from an oleophilic (oil-attracting) material such as rubber or a specially coated polymer. When the motor drives the roller to rotate, it passes through the oil layer and oil sticks to its surface while most of the water falls away. As the roller continues to rotate upward, the oil-coated surface reaches the top section of the unit where scraper or wiper blade presses against it. This scraper removes the collected oil and directs it into a collection tray or container. The cleaned roller then rotates back into the tank to repeat the cycle.

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Fig.6. Skimmer Roller

V. ADVANTAGES & APPLICATION

Advantages:

Efficient Oil Removal – Separates oil, grease, and suspended solids from wastewater effectively.
Environmental Protection – Prevents contaminated water from entering natural water bodies, helping to meet pollution control norms.
Reuse of Water – Treated water can be reused for gardening, vehicle washing, or other non- potable purposes.
Low Operating Cost – Requires less energy and maintenance compared to other water treatment systems.
Compact Design – Occupies less space and is easy to install in industries, workshops, or service stations.
Compliance with Regulations – Helps industries comply with CPCB/PCB norms for wastewater discharge.
Durability – Made with corrosion-resistant materials ensuring long service life.
Automatic Operation (in some models) – Reduces manual intervention and makes operation user-friendly.

Applications:

1. Automobile Industry – Vehicle service stations, garages, washing centers (to treat oily wastewater).
2. Petroleum Industry – Refineries, fuel stations, oil storage depots (to separate oil leaks/spills from water).
3. Marine Industry – Ships, ports, and dockyards (for bilge water treatment).
4. Manufacturing & Engineering Units – Metalworking, machining, and fabrication shops (oil and coolant recovery).
5. Food Processing Industry – Dairy, meat, and food processing plants (to separate fats, oils, and grease).
6. Textile & Leather Industry – Removes oily waste and chemical residues from processing water.
7. Power Plants – Turbine lubricating oil recovery and wastewater management.
8. Chemical & Pharmaceutical Industry – For separating oily and greasy effluents.
9. Railways & Airports – For treating wastewater from engine maintenance depots and hangars.
10. Municipal Wastewater Treatment – As a pre-treatment step before sewage treatment plants (STP/ETP).
11. Automobile Workshops & Wash Stations – Removes oil and grease from car/bus/truck washing wastewater.
12. Petroleum Refineries & Depots – Controls oil discharge from storage tanks, pipelines, and loading areas.
13. Marine & Shipping Industry – Treats bilge water, ballast water, and dockyard oily effluents.
14. Railway Yards & Depots – Handles oily wastewater from engine maintenance and washing.
15. Airports & Aircraft Maintenance Hubs – Separates hydraulic oil, fuel, and lubricants from wash water.
16. Steel & Metal Industries – Removes cutting oils, lubricants, and coolant residues.
17. Textile & Leather Processing Units – Treats greasy and oily effluents from processing operations.
18. Power Plants – Recovers turbine lubricants and hydraulic oils from wastewater streams.
19. Food & Dairy Industries – Separates fats, oils, and grease (FOG) before wastewater treatment.
20. Chemical & Pharmaceutical Plants – Removes oil-based effluents from process water.
21. Municipal Corporations – Used in sewage and effluent treatment plants (ETP/STP) as a pretreatment unit.
22. Mining Industry – Treats oily runoff water from heavy machinery and workshops.

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23. Cement Industry – For workshop oily wastewater treatment.
24. Plastic & Rubber Manufacturing – Removes lubricants and process oils from wash water.
25. Paint & Coating Industries – Treats solvent- and oil-contaminated wastewater.
26. Heavy Engineering & Fabrication Units – Separates oil from cooling tower blowdown water.
27. Hospitals & Large Institutions – For oily wastewater from kitchens and mechanical maintenance.
28. Cold Storage & Refrigeration Plants – Treats oily water from compressors and refrigeration units.

VI. CONCLUSION

The Aqua lift ows project successfully demonstrates a simple, economical, and effective method of separating oil from water. The rotating belt attracts oil particles due to its surface properties and transfers them to a scraper, where the oil is collected separately. This method reduces water pollution, promotes recycling of oil, and lowers environmental hazards. Since it uses a mechanical process with minimal energy and maintenance requirements, it can be applied in industries, workshops, and wastewater treatment plants. Overall, this project proves that a belt-based oil skimmer is a practical and eco-friendly solution for oil–water separation.

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