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Performance of Oily Water Separator at KMP. Merak in Efforts to Prevent Pollution

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Abstract: The sea is a vital ecosystem that supports human life and marine biodiversity. However, marine pollution caused by the discharge of oily waste from ships remains a significant environmental issue, despite the existence of national and international regulations. This study aims to examine the performance of the Oily Water Separator (OWS) on the vessel KMP Merak in preventing marine pollution. A qualitative research approach was employed through observation, interviews, and literature review. The findings indicate that several factors influence OWS performance, including clogged coalescer filters, sludge accumulation in the engine bilge, lack of spare parts, and the absence of a structured maintenance system. A decline in OWS performance can lead to marine pollution, ecosystem damage, and disruption of the marine food chain. Solutions include regular maintenance, proper machine monitoring, well-organized spare part management, and maintaining sufficient air pressure in the three-way valve system. This research highlights the importance of consistent and disciplined OWS maintenance as a commitment to preserving the marine environment. The study is expected to serve as a reference for increasing awareness among ship crews and related institutions in the proper operation and maintenance of OWS equipment.

Keywords: Oily Water Separator, marine pollution, ship maintenance, spare parts, air pressure.

INTRODUCTION

The sea is a large or wide collection of salt water where various sea creatures such as fish, seals, plankton, and sea plants live. Life in the sea is very important for life on land. The sea contains more than 90% of the water on Earth, and the sea is full of resources such as protein, natural resources, and as a thermostat that absorbs solar heat and also functions as a very important means of transportation to connect one land to another (Rahmayanti, 2006).

According to Regulation (Minister of Transportation) No. 29 of 2014 concerning Prevention of Maritime Environmental Pollution, Article 1 states that pollution from ships is damage to waters with all its impacts caused by the spill or release of materials intentionally or unintentionally in the form of oil, toxic liquids, hazardous cargo in packaging, dirt, garbage and

air from ships. It is also clarified by Sudrajad, A. (2006) that the main sources of marine pollution are oil discharge from the process of use on ships, offshore drilling and due to ship accidents.

Marine pollution continues to occur even though regulations have been enacted in national and international laws governing marine pollution. Oil contained in ship gutter water or bilge, which is sometimes discharged directly into the sea or without going through an oil water separator (OWS), ship gutter water is one of the main sources of marine environmental pollution. In the provisions of Marpol 73/78 Annex I it is stated that gutter water pumped into the sea must first go through an oil water separator (OWS) and the oil content required to be discharged into the sea does not exceed 15 ppm. However, in fact, many ships do not comply with the regulations and directly discharge gutter water into the sea without complying with the requirements of Marpol 73/78 Annex 1 (Sudrajad, A. 2006).

The incident on the KM

Oily water separator (OWS) is a tool installed on a ship that functions to separate fluids that do not dissolve in each other due to differences in density, in this case the fluids in question are water and oil, where in theory the specific gravity of water is greater than the specific gravity of oil so that when the separation process occurs the water will be at the bottom and oil will accumulate on the surface of the water. The working principle of the oil water separator is by changing the speed and direction of the fluid from the well, so that the mixed fluids can be separated (Trinata et al., 2021).

From the problems that have been explained previously, it is very important to conduct research related to good and proper maintenance of the oily water separator (OWS) in order to reduce the risk of marine environmental pollution by oil due to the suboptimal performance of the tool, therefore the author raised the title "Oily Water Separator Performance at KMP.Merak in Efforts to Prevent Pollution".

So that the implementation of the regulations in Marpol 73/78 Annex I and (Minister of Transportation, 2022) No. 46 of 1986 which regulates the procedures for handling sewage water before being discharged into the sea is important to examine as a commitment to preventing marine environmental pollution and compliance with the regulations that have been implemented.

METHOD

This type of research is qualitative research. According to (Nurlatu et al., 2020) qualitative research is research as a research method that uses descriptive data in the form of written or spoken language from people and actors that can be observed. A qualitative approach is used to explain and analyze individual or group phenomena, events, event dynamics, beliefs and perceptions. Meanwhile (Sugiyono, 2021) states that the qualitative research method is a method that is based on the philosophy of postpositivism, qualitative research methods are used for research that focuses on the natural conditions of objects. In addition, using data collection techniques with triangulation (combination), inductive or qualitative analysis. The results obtained from using qualitative research itself emphasize the meaning of generalization. Descriptive research does not provide treatment, manipulation or changes to the variables studied, but rather describes a condition as it is. The only treatment given is the research itself, which is carried out through observation and literature studies.

In the initial observation conducted by the researcher, that the research on the KMP. Merak ship is in a position at the ferry port. The focus of the research at that location is based on the following considerations: The KMP. Merak ship is a place for loading and unloading vehicles and passengers. The KMP. Merak ship is easily accessible when conducting research.

This data is data obtained directly from ships or research sites and obtained through surveys, namely by observing, measuring and recording directly at the research location, as well

as the results of document studies on regulations and rules that apply in the process of issuing sailing permits.

Secondary data is complementary data from primary data obtained from library sources such as literature, lecture materials and data from companies and other things related to this research. Secondary data can come from relevant documents such as regulations, rules, and books related to the formulation of this research problem.

The analysis method in this study uses the Miles and Huberman theory with a qualitative descriptive method, namely the data obtained is reduced and classified, data presentation, then conclusions are drawn. This method is used to describe in detail the data obtained with the aim of providing information on planning for problems that arise in relation to this study. By using existing analysis techniques, researchers hope to produce good problem solving in the preparation of this study.

RESULTS AND DISCUSSION

What factors influence the performance of the Oily Water Separator on the KMP.Merak ship in efforts to prevent pollution?

In accordance with the purpose and function of OWS, namely a device that is useful for separating water from oil, it is necessary to have maintenance in the operation of the Oily Water Separator. This aims to ensure that the waste disposal has the maximum possible oil content where the wastewater discharge without dilution does not exceed 15 ppm. In general, these efforts are intended so that the water discharge is free from oil content and oil emulsions in the waters because oil can mix with natural processes such as in the absorption of food essence (photosynthesis) which can destroy plankton and algae which are fish food. This is the benchmark and reason why the oil and water separator (OWS) must be used on all ships owned by PT. ASDP (Persero) Indonesia, especially on the KMP ship. Merak is very concerned about supervising the discharge of sewage on the ship so that it remains within the specified limits, which always carries out supervision. So the engineer on the ship here is the second engineer who is responsible for maintaining the OWS so that it remains smooth and continuous in its operation.

In operating OWS, problems often arise, such as those the author states below:

When the OWS starts to run, that is, after the manhole pump starts pumping water from the engine room manhole, the pressure in the tank gradually increases and continues to rise beyond the normal limit which is estimated in the dirty tank, then the manhole pump is stopped, the separator suction valve is closed and the drain valve at the bottom of the tank is opened with the intention that the mud that has settled at the bottom of the tank can come out so that the pressure returns to normal.

After the water in both tanks is empty; then run the pump again by first opening the seawater priming valve and leaving the spout valve open, after it is clean the spout valve is closed, then the pressure gradually increases and stops at normal pressure. Then the suction valve from the separator tank is opened, pumping is continued and runs normally. However, for a few moments the PPM meter showed an increase, but still did not exceed 15 PPM.

Approximately 30 minutes later the pressure started to rise again for the second time the pump was stopped and the OWS suction valve was closed again, for the second time the tank was cleaned.

The next step is the same as the description above after it is considered clean, pumping is continued. However, the pressure in the tank continues to rise so that this high pressure is due to the large amount of mud in the separator tank.

From the description above, problems arise according to the facts, the causes of these problems are:

High separator tank pressure due to dirty filter in coaliscer tank.

Even though a filter has been installed in the engine room gutter, dirt can still pass through and be sucked up by the pump. According to regulations, gutter water that is discharged into the sea, other than oil content of less than 15 PPM, is attempted to prevent dirt from being discharged into the sea. In the oil water separator (OWS) gutter water after leaving tube one (1) and entering tubes no. 2 & 3, the gutter water is filtered again through wire and silica gel filters (blue marine) because gutter water that has not been filtered perfectly will enter the filter in tank no. 4. The purpose of making many filters is to avoid if one filter is damaged, the others still function to filter it.

Dirty and unfiltered inside the aircraft can be seen with a manometer where this tool shows whether the pressure before and after is the same. If before and after are the same then the indication will show a green mark and if not the same will point to red. The red color will shift the green mark which will tell us that the filter in the tube is dirty. The consequences caused by the pressure in the separator tube are high. If this incident is not quickly resolved and is allowed to continue, it will cause the bottom filter to enter the filter housing and will change shape.

In the maintenance of the oil and water separator (OWS) so that it can be operated at all times, attention is needed to maintain the filter which requires the most time, besides its location in the tube, it is also very difficult to open it, so it takes quite a long time. In cleaning it, first we drain the water in vessel No. 2 until it runs out, then open the top cover of the vessel after it is open, remove the top filter and its housing by first removing the bolts on the flange which number four. After the top filter is out, then remove the bottom filter not with the house, just the filter. After all the filters are outside the vessel, we clean them using pressurized water and also replace them if there are any filters. After all these filters are wrapped on the outside with a kind of soft and transparent cloth so that the dirt that comes with the gutter water will stick to the cloth and not be thrown into the sea. We clean the inside of the vessel house using pressurized water as well as the pressure difference control pipe so that what is shown is faster.

Things that can cause the above incident are:

1. The manhole hole in the engine room is too large.
The hole will cause all the dirt to enter the Coalescer tank and the hole is due to corrosion by sea water which causes the filter to tear easily and the tear becomes large.
2. A lot of mud was sucked up.
Because of the large amount of dirt in the form of mud under the plate, every time the gutter is pumped, the mud is always sucked in and goes inside.

Lack of availability of OWS spare parts on board.

An OWS aircraft can work smoothly continuously cannot be separated from the role of OWS spare parts. OWS spare parts that are maintained and organized and placed in a place that is easy for people to see and find are one of the important ways to carry out maintenance on an aircraft. Irregularity in the placement, storage of OWS spare parts in a good warehouse will slow down the implementation of planned maintenance. OWS spare parts on a ship besides supporting the smooth running of the ship but also as an obligation that must be fulfilled in accordance with applicable regulations.

As sophisticated as the maintenance theory is and supported by trained personnel in their fields, it means nothing if it is not supported by the availability of complete OWS spare parts. Good OWS spare parts are OWS spare parts that are stored in boxes and on the outside are marked and the name of the aircraft in question.

On commercial ships, OWS spare parts are divided into three parts, namely:

1. Standard OWS spare parts are OWS spare parts whose price is included in the price of the ship, or it can be said that OWS spare parts are brought when buying a new ship, whether they are in the engine room or outside the engine room.

2. Two-year OWS spare parts are provided with the remaining budget to purchase OWS spare parts which are often referred to as two years and it is expected that these OWS spare parts will be used up during the first two years of operation of the new ship.
3. OWS spare parts from the central procurement agency are provided by the head office to the ship. So in making the OWS spare parts inventory list by the merchant ship, there are three notes, namely standard OWS spare parts, two-year OWS spare parts, namely spare parts from the central procurement agency. In the type of standard and two-year OWS spare parts, there is no addition of OWS spare parts, but over time the number decreases. And in the end the standard OWS spare parts and two-year OWS spare parts will run out.

This happens due to the following reasons:

- a. Delay in delivery of OWS spare parts to the ship.

The delay in delivery is partly due to the request from the ship to the head office being too far away and taking time and the head office is still waiting for more time because it must follow the regulations and procedures that have been implemented by the company. Not to mention the delivery of spare parts to the ship is unclear, because the whereabouts of the ship are uncertain, in which waters and heading to which port.

- b. Lack of checking of OWS spare parts on board ship

Every time there is a change of ship crew, the handover of positions and responsibilities is incomplete, sometimes the place/box of spare parts used is not shown and the serial number of the part is not explained, as well as the number of spare parts used and how many are left and the condition of the spare parts.

- c. Planned maintenance system on OWS Not running

If we do not have planned and continuous maintenance for example by continuing operations until they fail or we have to over prepare machines and equipment or be prepared for a level of "downtime" that is appropriately reduced. The length of uptime will depend on the availability of OWS spare parts and support services. With the development of planned maintenance we expect reduced downtime unless very major maintenance is performed where the maintenance itself will result in reduced operations.

- d. Lack of compressed air pressure to the three way valve on the OWS

Air and pressurized air vessels to and from the third-way valve of the OWS through several equipment including air filters. In this air filter, pressurized air is cleaned. Air that is clean from dirt is passed through a Reducer valve. In the Reducer valve, the air pressure will be reduced from 30 bar to 5-7 bar, pressurized air of 5-7 bar will flow to the Solinoid valve, and then the three-way valve.

The Reducer Valve is also equipped with a safety valve, its function is to release more pressure so as not to damage other parts. Lack of air pressure reaching the three-way valve is caused by many things, including:

1. A ruptured membrane on the reducer valve will result in air coming out that is not as desired.
2. Loose connecting bolts cause air to escape and pressurized air does not reach the three-way valve.
3. Leaking air pipe holes will result in a lack of air pressure reaching the three-way valve.

Lack of air pressure will disrupt the operation of the three-way valve, overall it will disrupt the working system of the oil and water separator (Oily Water Separator). To find out whether the pressure we want is in accordance with what is expected, it can be seen on the manometer installed on the plane. If the needle on the manometer does not show the number 6, the oil and water separator cannot be operated because the three-way valve will be disrupted. Furthermore, the leak is looked for and resolved so that the working air pressure reaches the solenoid valve.

Based on the data description explained above, there are alternative solutions to the problem as follows:

The drain hole in the engine room is too big, the solution is:

1. The filter material must be good.

The manhole screen is usually easily torn because it is brittle and corroded by seawater. Here, a filter material that is resistant to seawater corrosion and rust-resistant can be used. In the ship's warehouse, it can be stored in the form of a rust-proof wire filter sheet, if the filter is damaged we can make it and install it. It would be more optimal if the OWS spare part is in the form of a finished filter (original) and has a part number.

2. Clean the filter properly and carefully.

Opening the filter should not be forced or hit which can cause the cover or the filter housing to crack or break. The inside of the filter with small holes is brushed using a wire brush and then sprayed with fresh water, the small holes in the filter that are blocked are drilled again using a harder wire by piercing it until the holes are correct. After the filter is clean, continue with the installation of the zinc anode.

The amount of mud that is sucked up during the breakdown is:

1. Keep the engine room manholes clean

The engine room manholes should be free from mud as much as possible, if after cleaning the coolers such as sea water coolers, fresh water coolers, auxiliary motor coolers or compressors, the dirt should be collected and disposed of in the trash bins that have been provided. Every Saturday, spraying is also carried out under the plate, it must always be clean. So that mud does not fill the engine room manholes if the engine room manholes still have mud, it must be immediately cleaned or lifted and collected in the place that has been provided.

2. The bottom floor of the engine room plate must be clean and free of oil.

In the engine room, try not to have any drips or leaks of lubricating oil or fuel and the like. If there are still leaks, they must be fixed immediately, as well as the pipes under the plate, so that none of them leak. After fixing the leak, the floor that is still oily should be given oil dispersand immediately and then sprayed with fresh water and the gutter water pumped until the gutter water runs out. So the floor of the engine room and the floor under the plate are always clean and not oily.

Delay in delivery of OWS spare parts to the ship.

1. Ordering OWS spare parts directly from overseas manufacturers needs to be accelerated

The importance of the role of OWS spare parts on board the ship as a smooth operation of the ship, then the OWS spare parts on board the ship need to be monitored so that they do not run out. If we have a plan to replace OWS spare parts, then before we replace the new OWS spare parts, we first ask for spare parts to ensure that there are no empty OWS spare parts on board. In order to speed up the delivery of goods, the request must be complete, for example, which country the manufacturer is from, the type, or model of the aircraft complete with data and spare part numbers. The head office receives an order request from the ship must pay attention to these things. Where the company must know where the maker is, whether or not there is an agent for the goods in Indonesia and monitor where the ship is so that the supply of goods can be easy and fast.

2. OWS spare parts sent to the ship must be original.

Spare parts are rarely ordered directly from the maker or factory, the person in charge re-checks the purchase and approves or rejects the order. After approval, the purchase is sent to the seller. (NSOS, page 67). Sometimes OWS spare parts that have arrived on the ship after being checked and matched with the part number do not match so the ship is forced to return them. This can happen because:

- a. The order was made by a third party where the OWS spare part name was written incorrectly.
- b. OWS spare parts are purchased on the black market, if seen with the naked eye at first glance they look the same. However, if seen closely, they look different from the original.
- c. Deliberately put on board by irresponsible parties.

To prevent the above, as a machinist and with the approval of the KKM (Head of the Engine Room) asked the supplier for a statement letter to replace non-original spare parts with original ones according to their part numbers. And the OWS spare parts are checked more carefully so that the OWS spare parts received from the office are in accordance with the request and can be used on the ship.

Importance of Proper Storage and Checking of OWS Spare Parts on Board Ships

1. Lack of Inspection and Organization

The lack of regular checking and poor storage of OWS (Oily Water Separator) spare parts on board ships can significantly hinder maintenance operations. Spare parts should be stored in an organized manner within the ship's warehouse to ensure availability and ease of access.

Just like an aircraft cannot operate reliably without proper maintenance, the OWS equipment onboard also requires periodic attention. Spare parts will inevitably wear out over time and need to be replaced. Therefore, the reliability of OWS systems is directly tied to the condition and availability of their spare parts. Organized storage ensures that spare parts are readily accessible when needed.

2. Consequences of Irregular Storage

Improper or disorganized storage of OWS spare parts may lead to the following issues:

- a. Difficulty in identifying which parts are depleted and which are still in stock.
- b. Increased risk of environmental violations, such as unintentional discharge of waste into the sea due to unavailable replacement parts.
- c. Delays in reporting the inventory of OWS spare parts—both for the biannual reports to the head office and the end-of-year inventory review.

3. Proper Storage Practices

To ensure efficient OWS spare part management, the following steps should be taken:

- a. Store spare parts in individual labeled boxes, with one box per aircraft or unit—avoid mixing parts from different systems.
- b. Maintain a receipt and usage log consistently to track spare part flow.
- c. Treat the recording of receipt and usage of OWS parts as part of regular maintenance protocols.

4. Objectives of Proper Spare Part Management

- a. To conduct maintenance work in a systematic and economical manner.
- b. To provide accurate inventory data and feedback to the head office for better service planning.
- c. To support archiving and historical maintenance record-keeping.
- d. To enhance labeling and identification of components.
- e. To aid in maintenance and repair planning for OWS systems.

Receipt and usage of goods at the end of each month must be reported to the head office along with a report on remaining goods. Every six months, all remaining goods and OWS spare parts in the engine room must be reported. A machinist in taking OWS spare parts must check the receipt and usage book. With regular bookkeeping, a machinist will find it easier to check

for shortages of OWS spare parts and does not need to look directly at the OWS spare parts boxes.

Poor bookkeeping, where the receipt and use of OWS spare parts each month is not regular in its bookkeeping. So it will be difficult for the machinist to know which OWS spare parts have run out and which OWS spare parts are still in abundance. It could be that in the book it is written that OWS spare parts are still left, but in reality they have run out in the warehouse. If this happens, it can disrupt the smooth running of OWS. With irregular bookkeeping, there will be a difference between the remaining OWS spare parts in the book and the actual remaining OWS spare parts.

Planned maintenance is carried out as follows

In every maintenance of one aircraft must be able to schedule which is daily maintenance, weekly maintenance, or monthly maintenance. Without good checking and maintenance problems will arise and result in what we expect will not be realized, so there needs to be a schedule for maintenance on OWS In carrying out planned maintenance to achieve good results, operators must read a lot of manuals so that in fixing or analyzing a problem they can be right on target. Wrong analysis will slow down the aircraft smoothly

The planned maintenance system cards are arranged well so that everyone who operates can clearly read what will and has been done. Today or this week. Every job that has been done is written on the back of the card. Success in maintenance is because it is supported by everyone. So if only a handful of people carry out maintenance, the aircraft will not be ready to operate at any time. Good cooperation will result in the problems we will face being smaller.

Understanding and regular training will make the aircraft ready for use at any time. Neatness in storing OWS spare parts will facilitate maintenance. Without cooperation with each other, the atmosphere in the engine room will not be conducive. A harmonious atmosphere and openness between Olkapal's crew about maintenance, monitoring, and aircraft equipment will be more thorough. Thoroughness is a capital in solving a problem.

So it can be concluded that for perfect maintenance to run on OWS, the following things are needed:

1. Maintenance scheduling on OWS aircraft.

According to the manual book instructions, there is a maintenance period for OWS aircraft where each part has a different time, here it is necessary to have equipment such as cleaning the coalescer filter, testing the PPM sensor and cleaning it. Make, the machinists must carry it out in a disciplined and timely manner, because if the maintenance is delayed, if there is damage especially to the OWS, then the machinist is considered not to have carried out the maintenance properly.

2. Discipline in OWS maintenance.

Discipline here is intended so that all machinists carry out the maintenance schedule, because there are still machinists who only sign the maintenance evidence but do not carry out maintenance. This kind of thing can cause new problems in OWS. For example, in cleaning the coalescer filter that is not on time, the filter will rust and then tear and can cause dirt to come out with the water.

There fore it is necessary to hold:

1. Supervision

The supervision is carried out by an internal party, in this case as the head of the engine room, who always checks the maintenance on the OWS so that it is carried out in accordance with the maintenance system, namely the predetermined maintenance schedule. Then the KKM must ensure that the maintenance activities are carried out by the machinists and record them in the monthly work report (monthly maintenance report).

2. Reports and records

Reports and records are very important in knowing the evidence of maintenance in the form of scheduling and others. The reports and records are submitted to KKM and contain things that have been done which will then be reported to the company office. This is very closely related to OWS spare parts for smooth operation.

The compressed air is of appropriate pressure so that the three-way valve works perfectly

In order to ensure that the air pressure going to the three-way valve is achieved so that after the electrical box supplies electricity to the solenoid valve and opens the piston which then supplies air, the air can push and operate the three-way valve perfectly, the following actions are required:

1. Manometer check

Manometer check in this case is a manometer that is connected to the three-way valve on the OWS aircraft. This is carried out routinely in the operation of the OWS aircraft, because it is to ensure that the waste disposal remains smooth where sufficient pressure is able to push the three-way valve to work. This check is always carried out before the operation of the OWS and after it is certain that the air pressure is at the normal limit, namely between 5 - 7 kg / cm², then we run the OWS. If it turns out that before operating the OWS, the air pressure is found to be lacking, then further actions need to be taken, namely:

- a. Checking the air pipes leading to the three-way valve, try to make sure there are no leaks and take action immediately if a leak occurs by replacing it with a new pipe if the pipe is brittle or welding the pipe properly. It should be noted that in replacing the pipe, it must be adjusted according to its function, namely that different air pressures have different pipe strengths.
- b. Checking the reducer valve, which if broken will cause excessive pressure so that the pipe will burst due to excessive air pressure, this is because the pipe has a certain pressure strength that is designed according to its function.
- c. Checking the bolts connecting the pipes leading to the three-way valve. In this check, it is attempted that there are no leaks from each of these connections. Usually leaks occur because the bolts are corroded, if the pipe is still good, only the bolts need to be replaced and before replacing the air leading to the three-way valve, it is closed first.

2. Air pressure regulation going to the three way valve in the OWS

Air pressure can be adjusted according to the work of the three-way valve, which is between 5-7 bars. Things that must be done are to adjust the adjust bolt and see it on the manometer that has been shown, this is done to ensure the good work of the three-way valve.

3. Cleanliness of the air pipes, especially the air pipe leading to the three-way valve in the OWS

The cleanliness in question is keeping the pipes clean and free from corrosion, because corrosion can cause pressurized air pipes to leak, so measures are needed to keep the pipes free from corrosion.

Painting is done to avoid direct contact between metal pipes that are easily corroded and outside air containing salt. Painting is done if there are corrosion bubbles. The corrosion bubbles are removed using a brush until clean and then painted with anti-corrosion paint. It is expected not to use a hammer and chisel in cleaning corrosion because it can change the shape of the pipe and damage the pipe.

Cleaning the air filter is intended to ensure that the air going to the Sudan three-way valve is clean in order to achieve the desired air pressure.

4. The impact of the declining performance of the Oily Water Separator on the KMP.Merak Ship in efforts to prevent pollution

The use of Oily Water Separator (OWS) is very important in reducing the impact of marine environmental pollution from oil waste. Here are the performance and impact of its use:

Working Principle of Oily Water Separator, OWS are designed to separate oil from wastewater generated by ships and maritime industrial facilities. Typically, these systems use separation methods such as gravity, coalescence, and filtration to reduce the oil content in the water before it is discharged into the ocean.

OWS Performance

1. **Separation Efficiency:** OWS can reduce the concentration of oil in wastewater to levels that comply with environmental regulations, often below 15 ppm (parts per million).
2. **Pollution Reduction:** By removing most of the oil from wastewater, OWS helps reduce oil pollution in the ocean, which can damage marine ecosystems and biota.
3. **Monitoring and Control:** OWS is equipped with a monitoring system that ensures that oil levels do not exceed permitted limits before the water is discharged.
4. Positive Impact on the Environment
5. **Marine Ecosystem Protection:** By reducing oil contamination, OWS helps protect marine habitats and the species that depend on a clean marine environment.
6. **Marine Biota Health:** Reducing oil levels avoids damage to plankton, fish and other marine species that can be affected by oil pollution.
7. **Sea Water Quality:** By limiting the amount of oil discharged into the ocean, OWS contributes to improving overall seawater quality.
8. Negative impact on the environment
9. **Marine Ecosystem Damage:** Oil spills in the sea can damage marine ecosystems by changing the chemical composition of water and affecting habitat quality. This can result in the death of marine flora and fauna, including plankton, fish, seabirds, and marine mammals.
10. **Influence on the Food Chain:** Oil can enter the marine food chain. Organisms exposed to oil can become contaminated, and concentrations of these toxins can increase as marine creatures are eaten by larger predators, including humans.
11. **Habitat Destruction:** Oil can damage important habitats such as coral reefs, seagrasses, and mangroves. This not only affects the species that live there, but also reduces the ability of the ecosystem to provide important ecosystem services such as coastal protection and carbon sequestration.
12. **Impact on Human Health:** While most of the direct impacts are felt on the environment and marine animals, oil pollution can also impact human health, especially for communities that depend on seafood for their food and livelihoods. Oil contamination can get into seafood and impact human health if consumed.
13. **Economic Loss:** Oil pollution can cause significant economic losses, both in terms of fisheries, tourism, and recovery and cleanup costs. The impacts can be felt in the long term, affecting the livelihoods of communities that depend on the sea.
14. **Water Quality Deterioration:** Oil spills can reduce the quality of seawater, making it dirtier and potentially dangerous for marine organisms. It can also affect recreational activities such as swimming and diving.

Challenges and Considerations

1. **Maintenance and Care:** OWS requires regular maintenance to ensure optimal performance. Without proper maintenance, its efficiency can decrease.
2. **Compliance and Regulation:** OWS operations must comply with international and local regulations regarding waste oil disposal to avoid sanctions or penalties.

3. **Waste Management:** Oily sludge produced from the separation process must be managed properly to ensure it does not cause other pollution problems.

Overall, the use of efficient Oily Water Separator greatly contributes to the protection of the marine environment and the reduction of oil pollution impacts. However, it is important to ensure that the system is properly maintained and operated in accordance with regulatory standards to maximize environmental benefits.

CONCLUSION

Based on the explanations in the chapters, namely in accordance with the background of the operation of OWS at KMP.Merak in order to maintain smooth operations (OWS) so that it can indirectly realize environmental sustainability. These efforts are in accordance with the objectives of the study, namely to find the best solution to prevent pollution. In order to support the smooth operation and sustainability of nature and the environment, it is necessary to have proper and planned OWS maintenance according to the manufacturer's manual.

The problems that arise are as follows:

1. High coalescer tank pressure

Due to the filters in the coalescer tank being dirty where:

- a. The suction filter hole of the pump from the gutter is too large. A lot of mud and dirt are sucked up.

2. Lack of availability of OWS spare parts on board.

The reason for the less than smooth OWS maintenance is:

- a. Lack of maintenance and checking of spare parts on the ship means that they can no longer be used because they are rusty and damaged.

- b. Due to delay in delivery of spare parts to the ship

The planned maintenance system for OWS is only running at approximately fifty percent.

3. Lack of maintenance of OWS parts on board:

- a. The arrangement/arrangement of OWS spare parts storage on board the ship must be orderly and neat.

- b. Filling out the list of receipts and use of spare parts is carried out consistently. Where filling out the list of receipts and use of spare parts for Oily Water Separator is included as one of the aircraft maintenance.

Treatment goals:

- 1) To carry out work systematically and economically.

- 2) To obtain accurate feedback information for the head office in improving services.

- 3) For archiving facilities.

- 4) For OWS spare parts labeling facilities and so on.

- 5) For OWS maintenance and repair planning facilities.

4. The planned maintenance system is carried out as follows:

So it can be concluded that in order for OWS maintenance to run perfectly, the following things are needed:

- a. Maintenance scheduling on OWS.

- b. Discipline in OWS maintenance.

- 1) Supervision.

- 2) Reporting and recording.

5. Compressed air according to the pressure required so that

- a. Manometer check

- b. Air pressure regulation going to the three-way valve in the OWS.

- c. Cleanliness of the air pipes, especially the air pipe that enters the three-way valve, is always maintained and cared for;

From the description of the alternative problem solving, the evaluation of the chosen problem solving is explained as follows:

1. Clean the filter properly and carefully.
2. The bottom floor of the engine room plate is clean and free of oil.
3. OWS spare parts delivered to the ship must be genuine.
4. The storage arrangement of OWS spare parts in the ship's warehouse must be orderly.

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