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ANALYSIS OF EXHAUST VOLUME REDUCTION IN *OILY WATER SEPARATOR* AT SS. GOLDEN ISAIA

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ABSTRACT

An oily water separator is an auxiliary engine on board that is used to prevent the mixing of oil and water with density differences. The oily water separator is very important on board for the separation of the ship's bilges from oil content which can pollute the marine ecosystem. This matter also fulfills the requirements of MARPOL 73/78 Annex 1 when the researcher carried out a sea project on SS. Golden Isaia, The researcher found the abnormality of the oily water separator. There was a decrease in its discharge volume, in which the normal flow was 5 m 3 / hour, which became 1 m 3 / hour. The purpose of this research was to determine the causal factor of oily water separator decreasing discharge volume on SS. Golden Isaia, evaluate the impacts, and the efforts to solve this oily water separator decreasing discharge volume on SS. Golden Isaiah. This research uses a descriptive qualitative method by applying a fishbone diagram analysis model. Data collection techniques include observation, interviews, and literature review. The interviews involved three informants, there chief engineer the one responsible for all machinery on board, the second engineer whose responsible for the oily water separator, and oiler 1 as the second engineer's assistant. The research results conclude that the causal factors of oily water separator decreasing discharge volume such as the lack of pressure of the oily water separator feed pump, dirty process filter due to accumulated dirt, and unavailability of oily water separator maintenance history. The efforts to solve this oily water separator decrease discharge volume on SS. Golden Isaia such as the change of a feed pump set with the new one, cleaning the strainer and replacing the filter bag, and the documentation of repair and maintenance.

Keywords*: Analysis, Oily water separator, Discharge volume*

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INTRODUCTION

Transportation plays an important role in accelerating the mobility of goods. Air, land, and sea transportation are some of the methods that can be used to transport goods. Sea transportation is the most common way to transport cargo from one island to another, between countries, or between continents. Merchant ships can vary according to the goods they carry. The level of marine pollution due to ship waste, especially oil waste, will increase along with the progress of the maritime world and the increasing number of ships (Santiko et al. 2020) . In the engine room of a ship, various types of machinery can be found. With the operation of a ship, it is not uncommon for leaks to occur in the engine room, the system that is prone to leaks is the lubrication system (Mustain & Hidayat, 2019). Leaks also often occur in tanks that hold operational engine oils such as fuel and lubricating oil, the leaked oils will be channeled to the bilge well. Bilge is a process waste that occurs in the engine room, in the cargo hold, and during the operation of the deck and deck engines under ship operating conditions (Abdurohman, 2022; Malakhov et al., 2023) .

Seawater pollution can occur if the disposal of sewage waste does not go through a separation process first as stated in MARPOL Annex I which contains regulations for the prevention of seawater pollution due to oil and oil-containing liquids originating from ships and establishes special areas in certain sea areas where ships passing by are not allowed to dump oil in the sea area. Due to the many

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causes of seawater pollution due to irregular ship operations, regulations have been issued to prevent seawater pollution due to oil to maintain the balance and sustainability of the sea and its ecosystem. Oil pollution from sewage is one of the most common ship pollutants (Widodo & Wahyuni, 2020). Therefore, regulations require oil-fueled or oil-laden ships to install oil and water separators known as Oily Water Separator (OWS). This regulation also establishes seawater zones where oil may not be discharged. Oily water separator is an auxiliary machine on a ship that is used to separate fluids that do not dissolve in each other due to differences in density, in this case water and oil (Trinata et al., 2021) .

Bilge water that will be separated by the oily water separator can contain not only oil but also solid impurities that require prior filtering so as not to hinder the performance of the oily water separators. This happened on the SS. Golden Isaia, which is the ship while research on board. On October 3, 2022, SS. Golden Isaia sailed from Darwin, Australia to Himeji, Japan. The operation of the oily water separator was carried out for 4 hours 30 minutes and periodic sounding was carried out during the operation. It was found that the discharge volume on the oily water separator was 1 m^3 / hour, while according to the manual book, the oily water separator can discharge 5 m3/hour of processed water. Therefore, considering the importance of the oily water separator in ship operations, further examination of the oily water separator components that can affect the decrease in its discharge volume is needed. This study aims to determine the cause of the decrease in discharge volume on the OWS in SS. Golden Isaia, knows the impact that reducing exhaust volume has on OWS in SS. Golden Isaia, as well as knowing the efforts made to overcome the decrease in exhaust volume at OWS at SS. Golden Isaia.

METHOD

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.

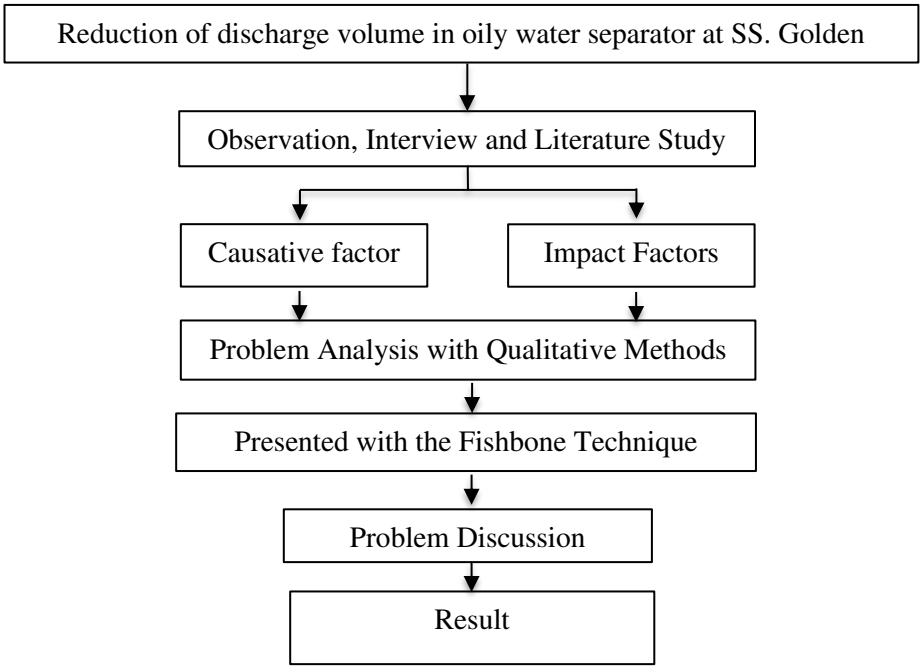

Figure 1Research Framework

RESULTS AND DISCUSSION

1. Results

Based on the results of observations, interviews, and interviews conducted by researchers, the data obtained were analyzed using the fishbone diagram analysis technique (Coccia, 2018; Widyahening, 2018). With this method, it is expected to be able to find a solution to the problem of reducing the volume of exhaust in the oily water separator at SS. Golden Isaia. The following are the results of the analysis of the reduction in the volume of exhaust from the oily water separator at SS. Golden Isaia using the fishbone diagram analysis method as in Figure 2.

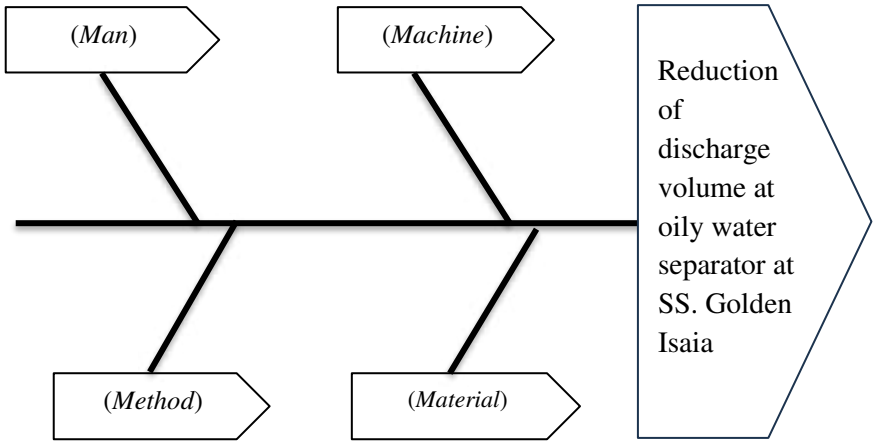

Figure 2Analysis Technique Using Fishbone Method

Based on observation data obtained from the results of periodic sounding on the bilge tank during the operation of the oily water separator. Measurements were taken from the bilge tank level because there was no measurement of water discharge at the OWS output. This measurement can be said to be accurate because there was no addition to the bilge tank during the operation of the OWS, all water from the engine room operations will be collected in the bilge well first, then the water in the bilge well will be transferred to the bilge tank. In addition, no transfer was made from the bilge well to the bilge tank during the operation of the OWS. The following are the results of the sounding carried out by Oiler 1 during the operation of the oily water separator. The results of the periodic sounding show that the bilge tank level has decreased by 1 m^3/hour in table 2.

Table 1Sounding data on the bilge tank when the oily water separator is operating.

Time	09.00	09.30	10.00	10.30	11.00	11.30	12.00	12.30
Sound Tape (cm)	240	238	235	233	231	228	225	223
Volume (^{m3})	126.0	125.2	124.0	123.2	122.4	121.2	120.0	119.2

a. Human Factor (Man)

From the results of observations, interviews, and documentation, no human factors were found in the reduction of waste volume at OWS. At SS. Golden Isaia

b. Machine Factors

Based on data from observation results, it has been found that the engine factor causes a decrease in exhaust volume in the oily water separator in SS. GOLDEN ISAIA is in the feed pump, the feed pump is a component of the oily water separator that sucks sewage water from the bilge tank through the HELI-SEP Separator tube and then presses it toward the filter. The pressure of this pump is one of the main causes of a decrease in exhaust volume in the oily water separator showed in Figure 3, when conducting observations during the operation of OWS it was found that the feed pump pressure was less than the normal working pressure according to the manual book.

Figure 3Condition of the feed pump oily water separator
Source: Research Documentation

After a visual check, it was found that the physical condition of the pump had been eaten away by corrosion, and when the pump was opened the impeller condition had also been eaten away by corrosion and was very difficult to remove from its shaft, as well as its bearing. This caused the feed pump pressure to be low and not operating at the working pressure according to the manual.

c. Material Factors

Material factors that cause a decrease in exhaust volume in OWS at SS. Golden Isaia are coarse particles in the bilge tank causing the OWS process filter to become increasingly clogged. Dirty process filters can also be one of the findings that cause a decrease in exhaust volume in the oily water separator. This can be indicated by the differential pressure gauge indicator which shows the difference in pressure before and after passing through the process filter. According to the manual book, the filter bag must be replaced when the pressure reaches 1 bar. When observed, the differential pressure had reached 1.2 bar showed in Figure 4.

Figure 4*Filter Bag* in the *oily water separator filter process*
Source: Research Documentation

d. *Method* Factor

After the researcher conducted an interview with the chief engineer, the researcher found a method factor that caused the decrease in exhaust volume at OWS at SS. Golden Isaia, namely the absence of a history of oily water separator maintenance from the previous management. So the crew from the current management does not know how long the oily water separator has not been maintained since the last maintenance was carried out.

2. Discussion

a. Factors causing the decrease in discharge volume in the oily water separator at SS. Golden Isaia

1) Damage to the OWS feed pump due to corrosion

Corrosion on the feed pump can be caused by high humidity in the air around the oily water separator. If this is left unchecked, corrosion will spread further to the oily water separator components.

2) Dirty process filter

Dirty process filters in oily water separators can also affect the flow of water that will be discharged into the sea by oily water separators. A dirty process filter is caused by the accumulation of coarse particles from the bilge tank.

3) Unavailability of OWS maintenance history

After the researcher conducted an interview with the chief engineer, the researcher found a factor that caused the decrease in exhaust volume at OWS at SS. Golden Isaia, namely the absence of a history of oily water separator maintenance from the previous management. So the crew from the current management does not know how long the oily water separator has not been maintained since the last maintenance was carried out.

b. The impact was caused by the decrease in the discharge volume on the oily water separator at SS. Golden Isaia

1) Slowing down the OWS separation process

The impact caused by the feed pump that has been corroded is a decrease in pump performance, so the flow of gutter water from the bilge tank to the separation process is getting smaller and the time needed to dispose of gutter water is getting longer. This is concluded based on table 1 which contains the results of periodic sounding during the operation of the OWS.

2) Sewer water separation efficiency decreases.
The impact caused by dirty filter bags on OWS, apart from causing a decrease in waste volume, can also cause the oil content in OWS wastewater to increase because it is carried by dirt in the filter bag.
3) Further damage to OWS.
The impact caused by the unavailability of oily water separator maintenance history from previous management caused delays in maintenance on the oily water separator , as well as the potential for further damage to the OWS components.

c. Efforts were made to address the reduction in exhaust volume at OWS at SS. Golden Isaia
1) Replacing a new set of OWS feed pumps showed in Figure 5

Figure 5*feed pump* components affected by corrosion.
Source: Research Document

To handle the feed pump that has been corroded, initially the crew wanted to replace several pump components that were no longer feasible. However, this was not possible, because the components were stuck due to corrosion, and the pump casing was also mostly corroded. After checking the spare part room, a set of feed pump oily water separator along with its electric motor was available (Sulaiman & Suharto, 2020), so the effort to overcome the decrease in exhaust volume in the oily water separator at SS. Golden Isaia was to replace a set of OWS feed pump along with its electric motor showed in in Figure 6.

Figure 6One set of OWS *feed pumps*
Source: Research Document

2) Cleaning the strainer and replacing the filter bag
Based on data collected from observations, interviews, and literature studies, efforts to overcome the cause of dirt accumulation in the bilge tank process filter are to clean the strainer and replace the filter bag. This is done based on the manual book instructions (Ardhi et al., 2018). Inside the strainer of the process filter there is a filter bag as a double filter. The instructions in the manual book state that the filter bag must be replaced if the pressure differential before and after the process filter reaches a pressure of 1 bar showed in Figure 7

Figure 7. Replacement of OWS filter bag
Source: Research Document

3) Performing treatment according to PMS and documenting treatment
Efforts made to overcome the unavailability of maintenance history for oily water separators and other machinery, namely the second engineer as the head of work held a meeting with all machine crews and instructed the crews in the machine department to document all maintenance and repairs that had been carried out and to carry out maintenance and repairs on the components. other machinery components in accordance with applicable PMS.

CONCLUSION

The factors causing the decrease in exhaust volume in the oily water separator at SS. Golden ISAIA are damage to the feed pump due to corrosion, dirty process filters, and the unavailability of OWS maintenance history. The impact caused by the decrease in exhaust volume in the oily water separator at SS. Golden Isaia is to slow down the sewage separation process, decrease the efficiency of OWS separation, and further damage to the OWS. Efforts made to overcome the decrease in exhaust volume in the oily water separator at SS. Golden Isaia include replacing the OWS feed pump, cleaning the strainer and replacing the filter bag, and carrying out maintenance on the OWS in accordance with the applicable PMS.

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