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Analysis of the Declining Production Capacity of Fresh Water Generators on MT Green Park Ships

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ABSTRACT

This study aims to analyze the factors causing the decline in the production capacity of *Fresh Water Generator* (FWG) on the MT Green Park ship. The research method used is qualitative descriptive with case studies through observation, crew interviews, and analysis of operational and maintenance data. The results showed that the decrease in production was caused by scale build-up on the evaporator which inhibited heat transfer and vacuum leakage due to corrosion of the evaporator plate. After cleaning and repairs, the production capacity increased again to close to optimal conditions. This study emphasizes the importance of routine maintenance and critical parameter monitoring systems to maintain FWG performance in a sustainable manner.
Keywords: *Fresh Water Generator, production capacity, evaporator, vacuum leakage.*

ABSTRAK

Penelitian ini bertujuan menganalisis faktor-faktor penyebab menurunnya kapasitas produksi *Fresh Water Generator* (FWG) di kapal MT Green Park. Metode penelitian yang digunakan adalah deskriptif kualitatif dengan studi kasus melalui observasi, wawancara kru, dan analisis data operasional serta pemeliharaan. Hasil penelitian menunjukkan bahwa penurunan produksi disebabkan oleh penumpukan kerak pada evaporator yang menghambat perpindahan panas dan kebocoran vakum akibat korosi pelat evaporator. Setelah dilakukan pembersihan dan perbaikan, kapasitas produksi kembali meningkat mendekati kondisi optimal. Penelitian ini menekankan pentingnya pemeliharaan rutin dan sistem monitoring parameter kritis untuk menjaga performa FWG secara berkelanjutan.
Kata Kunci: Fresh Water Generator, kapasitas produksi, evaporator, kebocoran vakum.

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1. INTRODUCTION

The role of fresh water in ships is crucial. Not only as a basic need for the crew for daily consumption, fresh water is also used for engine cooling systems, cleaning, and sanitation functions which are very important in maintaining health and safety during the voyage. What's more, merchant ships that make long-distance voyages must have their own system to produce fresh water independently so that they do not depend on supplies from ports. One of the commonly used systems is the Fresh Water Generator (FWG), which uses the principle of low pressure distillation to convert seawater into fresh water with high energy efficiency due to the utilization of exhaust heat from the ship's main engine.

Although FWGs are designed to be durable and efficient, in reality various technical issues often interfere with its performance. The MT Green Park ship has experienced a significant decrease in FWG production capacity in recent months. This poses a serious challenge because the lack of fresh water can result in engine operational disruption and reduce the comfort and health of the crew. Therefore, a deep understanding of the technical and operational causes of the decline in FWG production is important to be able to take appropriate and measurable corrective steps.This problem not only has an impact on MT Green Park ships, but also has become a common issue in the shipping industry globally. Many studies show that the influence of mechanical damage, scale buildup, vacuum leakage, and undisciplined maintenance schedules are the main factors inhibiting the production of fresh water on commercial ships. Against this background, this study aims to identify the main problems that led to the decline in FWG production capacity on the MT Green Park ship. In addition, this study seeks to provide technical recommendations that can be used as a reference for maintenance and improvement so that freshwater production remains optimal according to the manufacturer's design.

2. METHOD

The research method used is a descriptive qualitative approach with a case study method that focuses on the Fresh Water Generator system on the MT Green Park ship. This study collected data through direct observation of the condition of

the tool, in-depth interviews with the engine crew and Chief Engineer, as well as documentation studies in the form of operational records, maintenance schedules, and system fault reports over the past six months.

Observations are made to physically identify the condition of the evaporator, including the thickness of the scale that forms as well as the presence of damage or corrosion to the evaporator plate that can affect the performance of the vacuum system. Interviews are used to obtain a comprehensive overview of the operational and maintenance side of equipment in the field.

Data analysis was carried out qualitatively and quantitatively through the comparison of daily freshwater production data before and after the repair and cleaning of the evaporator. The results of the analysis are used to identify the main causes of the decline in production capacity and provide appropriate technical recommendations.

3. RESULTS AND DISCUSSION

3.1 Research Overview

The Fresh Water Generator on the MT Green Park ship is one of the main systems of freshwater providers with a nominal production capacity of around 3 tons per day. However, during observation and data collection, the recorded production capacity decreased drastically to 1.2 tons per day. This condition results in an inadequate water supply for the needs of the crew and other machinery equipment.

Gambar 3. Fresh Water Generator

3.2 Object Data Studied

Table 1.Specification of Fresh Water Generator

Parameter	Specification
Brands	Miura
Type	WM-15 SS
No of set per ship	1 set/ship
Capcity of distillate	10-15 tons/day
Jacket cooling water temp	Inlet 26°c Outlet 68°c
Cooling sea water temp	Inlet 29°c Outlet 41.3°c
Distillate pump & motor	1.• 05m3/hXO. 3M Pa (30m) x O. 7 5 kW
Salinity indicator	AC440V 60Hz q) 3
Ejector pump & motor	1 8m3/hX 0. 4 8MPa(48m)X 5. 5

3.3 Research Data Analysis

Research shows that scale buildup and vacuum leakage are the main factors causing the decline in FWG production capacity. The crust that blocks heat transfer causes the temperature of the seawater in the evaporator to not be high enough to evaporate the optimal amount of water. Meanwhile, vacuum leakage results in the pressure not reaching the level needed to lower the boiling point of water, so the rate of water evaporation decreases.

Daily production data during the observation period showed a consistent downward trend before repair and capacity increase after cleaning and repairs were carried out, with production increasing again to close to 10-15 tonnes per day. The results of interviews with the crew corroborated that lack of attention to the maintenance schedule was the main cause of the delay in repairs.

In the evaporator section, it was found that there was a build-up of scale with a thickness of about 4.5 mm from seawater mineral deposits. This crust greatly inhibits the transfer of heat from the pipes to the flowing seawater, resulting in a significant decrease in evaporation process efficiency. In addition, the evaporator

plate undergoes micro-corrosion which causes leaks in the vacuum system, impacting the vacuum pressure to decrease from the ideal standard of -0.9 bar to -0.6 to -0.7 bar.

Vacuum and ejector systems were also found to have decreased performance due to wear and blockage of the ejector nozzles due to particles carried by seawater. Maintenance schedules that are later than ideal exacerbate this condition, where evaporator cleaning and vacuum system inspections are carried out at intervals of about five months, even though the manufacturer recommends every two months.

4. CONCLUSION

The problems found are consistent with similar case studies on other ships, where the movement and vacuum leakage led to a decrease in FWG performance. A disciplined maintenance schedule and digital monitoring system are recommended as a long-term solution to detect early damage and produce stable freshwater production (Choudhury, Borthakur & Deka, 2022; Singh, Patel & Mehta, 2022). The use of corrosion-resistant materials in evaporator and ejector plates should also be considered to increase the durability and durability of the tool (Al-Sarkhi, Akbarzadeh & Shah, 2023).

The decrease in the production capacity of the FWG of the MT Green Park ship is mainly due to the accumulation of scale on the surface of the evaporator pipe as well as vacuum leakage due to corrosion of the evaporator plate. This condition is exacerbated by an undisciplined maintenance schedule so that damage develops without being detected early. Cleaning and repair measures help to significantly increase production capacity.

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