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Causes of the High Acid PH Numbers of EGCS Exhaust Gas on The Mt. Succes Altair XLII Ship

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ABSTRACT

EGCS is a device, machine, new technology in the maritime world where the main function pf this technology is to overcome air pollution in this era due to emissions from exhaust gases produced by industrial machines and motorized vehicles that can pollute the air and interfere with the respiratory health of living things. The researcher used the SWOT and SHELL methods to find out what factors caused the high acid pH number detected in the gas analyzer, by conducting interviews during the study and distributing questionnaires to the influencing factors of service engineers and machinists MT Succes Altair XLII. The results obtained from this study indicate that the high acid pH number detected comes from poor fuel quality, of course there are other factors but by using the SWOT and SHELL methods, the results obtained from the highest matrix, namely the fuel quality factor.

1. Introduction.

The shipping industry plays a vital role in the economic development of every country bordered by sea. Furthermore, it is key to international development, with over 90% of world trade conducted by sea. According to the Journal of Maritime Science: Research & Development, "Sea vessels contribute over 100 Gigatons of energy to a total of over 104,000 vessels today." Annually, the shipping industry boasts a significant reputation in maritime activity, but its operations also contribute significant amounts of exhaust emissions to the environment, and environmental pollution is a significant problem today.

To overcome this problem, IMO issued regulations governing exhaust emissions, namely those stated in ANNEX VI, MARPOL 73/78 Regulations Concerning the Prevention of Air Pollution from Ships, Regulation 14 Concerning Sulphur Oxides (Sox) and Certain Substances, therefore to save expenses, shipping companies use EGCS to save expenses in terms of fuel that has low sulfur which is basically expensive.

EGCS (Exhaust Gas Cleaning System) or scrubber is an additional machinery on a ship that functions to reduce the levels of acid/sPualgfeu3r of(6S-OAIXW)ritiinng Susbhmipissieon-ngine exhaust gases, especially on the Main Engine and Generator Engine by spraying seawater or fresh water mixed with caustic chemicals into the exhaust gas flow so that the exhaust gas which pollutants (especially carbon dioxide) will react with the sprayed water and form sulfuric acid. There are 2 types of Scrubbers, namely Open Loop and Closed Loop, Open Loop system is a system where seawater/washing water sprayed on the exhaust gas will return to the sea, on the contrary in Close Loop where the sprayed water or washing water will be rinsed back in the room/tank that has been given H2SO4 which will neutralize the waste water from the washing water and will be reused for exhaust gas spraying. Therefore, several countries prohibit the use of open loop system scrubbers, including Singapore, Fujairah, China, Belgium, Germany, Latvia, Lithuania, Ireland, Norwegian fjords, and India.

For the MT. SUCCES ALTAIR XLII ship itself, an Open Loop System scrubber is used because there is no longer space for installing a rinsing water tank containing H2SO4.

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2. Methodology.

This research uses a qualitative approach with a case study method in MT. Successs Altair XLII. The aim is to focus on the EGCS system and the acid/pH emission measurement system on the gas analyzer. The research lasted for ten months, from September to July 2020, with the research location in MT. Success Altair XLII.

To obtain accurate data with guaranteed validity, several data collection methods are required, based on data, facts, and information. The methods used are observation, interviews, documentation, and literature studies.

Meanwhile, the writing method guides researchers regarding the sequence of research conducted. This research uses the SWOT & SHELL method.

3. Results and Discussion.

3.1. SWOT Model Analysis.

Gas analysis it self has an important role in the final execution of the exhaust gas disposal process by reading whether the exhaust gas has met the maximum global emission standars or not, if the gas is detected to still have a high CO_2 or sulfur content, re- flushing will be carried out until the CO_2 or sulfur levels fall below the maximum sulfur standard, namely 10ppb.

Table 1: The specifications of the PureSOx analysis gas MT. SUCCES ALTAIR XLII.

SO2/CO2 measurement (QT 1-7035)		
	SO_2	CO_2
Application	EGCS ID: 182.30.1.5316	
Analyser manufacturer	Vimex AS	
Model reference	ShipCEMS	
On-board tag no.	QT 1-7032	QT 1-7034
Arrangement	Extractive	
Probe location	EGCS funnel just below the stack casing	
Probe description	Heated probe (60 °C), ceramic filter 3 µm, single hole quill, quill insertion length: 1000 mm, flange: DIN DN 65, SS316L	
Analyser location	Engine control room	
Max. measurement range	0..1000 ppm	0..15 %
Used measurement range	0..50 ppm	0..10 %
Zero gas specification	Ship instrument air quality: at least ISO 8573-1:2010 class 4.3.4 Analyser air quality requirement: ISO 8573-1:2010 class 1.3.1(air filter package prior to analyser cleans to this standard) Pressure: 6..8 bar g	
	Flow: 0.9 m_n^3/h (15 L/min.)	
Span gas specification	40 ppm	8 % volume
Manual span calibration interval	Every 30 days (type approved interval)	
Sampling	Sequence: every 70 s Purge time: 30 s Residence time: 30 s Measurement time: 10 s	
Sample conditioning cabinet location	TBD	
Sample conditioning system	Heated cabinet (60 °C), Teflon filter 2µm, pump, permeation dryer, recirculation pump	
Heated sample line	60 °C prior sample conditioning, no heating after (dried gas dew point temp. < -20 °C)	
Sample line details	Length: X m prior sample conditioning, X m after. Diameter ID/OD: 4/6 mm prior sample conditioning, 4/6 mm after	
Logging frequency	270 s (Guidelines requirement is 285 s)	

Source: Author.

Based on the results of the author?s observations of the gas analyser and EGCS was consistently high. These factors are:

Table 2: Internal factors and external factors.

FAKTOR INTERNAL			
STRENGHT (S)		*WEAKNESS* (S)	
1	Sample probe/filter gas detector	1	The sample probe/filter gas detector has high residual absorption capacity.
2	Routine Maintenance	2	Less Optimal Maintenance
3	Good fuel quality	3	Poor Fuel Quality
4	Adequate sea water quality	4	Alarm system failure
FAKTOR EKSTERNAL			
OPPORTUNITY (O)		*THREATH* (T)	
1	Maintenance is carried out in accordance with PMS	1	Water Location
2	Timely and genuine spare part arrival	2	Sea Water Conditions
3	Low Sulfur	3	Fuel quality
4	Time efficiency	4	Water in the daily fuel tank

Source: Author.

The table above is a table that the author used as a reference to identify problems and find the main cause of the high pH number in the EGCS the MT. Success Altair XLII ship.

Table 3: Comparison of Urgency of Internal and External Factors.

NO.	FAKTOR INTERNAL	A	B	C	D	E	F	G	NU	BF (%)
A	*Sample probe/filter gas detector*		B	C	D	H	I	I	7	20,00
B	Maintenance berkala	A		C	D	E	F	G	1	2,86
C	Kualitas bahan bakar yang bagus	A	C		C	C	F	G	4	11,43
D	Kualitas air laut yang memumpuni	A	D	C		D	F	G	2	5,71
E	Sample probe/filter gas detector memiliki daya serap residu yang tinggi	A	E	C	D		F	G	1	2,86
F	Kurang Optimalnya Maintenance	A	F	F	F	F		G	5	14,29
G	Kualitas Bahan Bakar Buruk	A	G	G	G	G	G		8	22,86
H	Kegagalan sistem alarm	A	H	H	H	H	H	G	7	20,00
	JUMLAH	7	1	4	2	1	5	7	35	100,00
NO.	FAKTOR EKSTERNAL	A	B	C	D	E	F	G	NU	BF (%)
A	Dilakukan maintenance sesuai dengan PMS		A	C	A	A	A	A	8	16,67
B	*Pendatangan spare part yang tepat waktu dan asli*	A		C	D	B	B	B	6	12,50
C	Rendah Sulfur	C	C		D	E	C	G	5	10,42
D	Efesiensi waktu	A	D	D		E	D	D	7	14,58
E	Lokasi Perairan	A	B	E	E		E	G	6	12,50
F	Kondisi Air Laut	A	B	C	D	E		G	1	2,08
G	Kualitas bahan bakar	A	B	G	D	G	G		6	12,50
H	Air dalam daily fuel tank	A	H	H	H	H	H	H	9	18,75
	JUMLAH	8	6	5	7	6	1	9	48	100,00

Source: Author.

Table 3 explains the assessment of internal and external factors contained in the SWOT method, including the urgency and weighing values of the factors. This table will then be processed as data to identify key factors related to the high pH of EGCS acid.

Table 4: Summary Matrix of Internal and External Factor analysis.

NO.	FAKTOR INTERNAL EKSTERNAL	BF%	ND	NBD	NRK	NBK	TNB	FKK	JML	TNB
	FAKTOR INTERNAL									
A	*Sample probe/filter gas detector*	20,00	5	1,00	8,67	0,173333333	1,17	1		
B	*Maintenance* berkala	2,86	4	0,11	2,32	0,006639456	0,12			
C	Kualitas bahan bakar yang bagus	11,43	4	0,46	5,30	0,060517007	0,52	2		
D	Kualitas air laut yang memumpuni	5,71	3	0,17	2,96	0,01692517	0,19		S	2,00
E	Sample probe/filter gas detector memiliki daya serap residu yang tinggi	2,86	4	0,11	2,32	0,006639456	0,12			
F	Kurang Optimalnya *Maintenance*	14,29	4	0,57	6,29	0,089795918	0,66			
G	Kualitas Bahan Bakar Buruk	22,86	5	1,14	9,67	0,220952381	1,36	1		
H	Kegagalan sistem alarm	20,00	3	0,60	7,87	0,157333333	0,76	2	W	2,90
	FAKTOR EKSTERNAL									
A	Dilakukan maintenance sesuai dengan PMS	16,67	4	0,67	7,11	0,118518519	0,79	1		
B	*Pendatangan spare part yang tepat waktu dan asli*	12,50	3	0,38	5,29	0,066145833	0,44			
C	Rendah Sulfur	10,42	4	0,42	4,94	0,05150463	0,47			
D	Efesiensi waktu	14,58	4	0,58	6,39	0,093171296	0,68	2	O	2,37
E	Lokasi Perairan	12,50	3	0,38	5,29	0,066145833	0,44			
F	Kondisi Air Laut	2,08	1	0,02	1,03	0,002155671	0,02			
G	Kualitas bahan bakar	12,50	4	0,50	5,67	0,070833333	0,57	1		
H	Air dalam *daily fuel tank*	18,75	5	0,94	8,23	0,154296875	1,09	2	T	2,13

Source: Author.

Explanation:

a. NU: Urgency Value, the factor's urgency towards the target, with a value ranging from 1-5.
b. BF: Factor Weight, is the percentage of internal and external NU.
c. ND: Support Value, the factor's support value towards the target.
d. NDB: Support Weight Value (NBD) = BF x ND.
e. NK: The value of the relationship between a factor and other factors.
f. NRK: Average Relationship Value NRK = TNK (total description value).
g. NF (number of factors assessed) 1.
h. NBK: Linkage Weight Value (NBK) = BF x NRK.
i. TNB: Total Weight Value (TNB) = NBD + NBK.
j. FKK: Key Success Factors.

Table 5: Key success factors.

NO	FAKTOR INTERNAL		
	STRENGHT (S)		WEAKNESS (W)
1	Sample probe/filter gas detector	1	Poor fuel quality
2	Good fuel quality	2	Alarm system failure
NO	FAKTOR EKSTERNAL		
	OPPURTUNITIES		THREATHS
1	Maintenance is carried out in accordance with PMS	1	Fuel quality
2	Time efficiency	2	Water in the daily fuel tank

Source: Author.

3.2. *SHELL Model Analisys.*

3.2.1. *Software.*

This study used analysis to evaluate the software on board the ship. The study found that some ship officers still had difficulty operating the software related to exhaust gas. This was evident in the difficulty experienced in operating exhaust gas technology. At the time the ship was sailing, the exact cause of the high acid content in the engine was unknown, so there were issues that needed to be optimally managed.

3.2.2. *Hardware.*

The research results showed that several indicators were still uncontrolled, requiring improvements for navigation. A persistent alarm was detected, requiring manual recording to ensure the ship was in good working order.

3.2.3. *Environment.*

The ability of the engine to operate in cold waters is also a concern for operators and crew, so everything related to the environment needs to be analyzed in depth. Furthermore, an analysis of water conditions is necessary because in cold locations the ship experiences difficulty in flushing.

Furthermore, there are several other external factors related to the weather that can affect the ship's systems, causing several abnormal aspects and resulting in problematic ship indicators.

3.2.4. *Liveware.*

Based on the results of this analysis, human resources still need to be developed, so that they are able to operate all types of technology and learn to operate new technologies that may emerge in the future. The learning process is an important part because efforts are needed to ensure that human resources are improvised.

Conclusions.

Based on the results of field research and the data processing described in the previous chapter regarding the high acid pH detected in the gas analyzer on the MT. SUCCES ALTAIR XLII, which can affect the operation of the EGCS, the author can draw several conclusions related to the problems discussed in this thesis, namely:

a. The main cause of the high pH detected is poor fuel quality. Other causes include dirty sample propellers/gas detectors, maintenance not carried out according to the PMS schedule (late maintenance), and water content in the daily fuel tank.
b. The impact of a gas analyzer failure in detecting exhaust emissions or CO_2/sulfur emissions exceeding 10 ppb is environmental pollution. If the ship enters an ECA, the ship, along with the company, will be fined, and the ship's journey to its destination will be hampered.
c. Efforts taken to control CO_2/sulfur emissions on the MT. The ALTAIR XLII's success in remaining below 10 ppb is achieved by monitoring the fuel supplied to the ship and conducting independent fuel quality checks while awaiting results from onshore laboratories. Furthermore, the primary preventive measures taken should poorly fuel quality be detected.

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