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1. Kelengkapan dan keseusian Unsur

- Unsur penggunaan bahasa harus disesuaikan.

2. Ruang Lingkup dan Kedalaman

Cukup

3. Kecukupan dan kemutakhiran data serta metodologi

ada.

4. Kelengkapan unsur Kualitas Penerbit

- Unsur Bahasa yg digunakan harus konsisten berbahasa Indonesia atau Inggris.

- Asal teori tertulis pada tinjauan pustaka.

Reviewer

(Dr. Markus Y.)



CALCULATE THE ESTIMATED LOADING TIME OF CAUSTIC SODA ACCORDING ON THE AMOUNT OF CAUSTIC SODA LOADED ON MT AKRA 102.

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Untuk Keperluan **Blind Review**, Nama, Afiliasi dan alamat tidak perlu ditulis sampai artikel dinyatakan diterima

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ABSTRACT

Sodium Hydroxide is a chemical with the chemical formula NaOH. At room temperature Sodium Hydroxide is a white powder (ATSDR, 2014), known as Caustic Soda, because it gives a burning effect on the skin and causes yellow spots on fabrics and paper (PHE, 2019). Caustic soda is included in the category of hazardous materials categorized by the International Maritime Organization when transported by ship. In order to reduce costs, it is sought to streamline the loading time of Caustic soda into the ship without ignoring the established safety procedures. For this reason, it is necessary to calculate the loading time, to ensure that the time required during the implementation of loading activities is not too much different from the predetermined time. To estimate the loading time can be done by calculating the maximum transfer rate of caustic soda can also be calculated based on time reports from previous loading activities. It is expected that with an estimate of loading time that can be calculated accurately based on the amount of caustic soda loaded, the calculation of costs associated with loading activities can be estimated more accurately.

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Kata Kunci : Caustic Soda, Loading Time, hazardous materials

1. INTRODUCTION

Sodium Hydroxide is a chemical with the chemical formula NaOH. At room temperature Sodium Hydroxide is an odorless white powder and is able to absorb air moisture (ATSDR,

2014). Sodium Hydroxide is also known as Caustic Soda, because it gives a burning effect on the skin and causes yellow spots on fabrics and paper (PHE, 2019). Caustic Soda is used in Industry Caustic soda is generally in the form of white solids, or powders, and can also be in the

form of liquids which are mostly used in the chemical industry which are useful in various fields of industry in daily life including being used as petroleum refiners, textile and cotton bleaching agents, cleaning fluid materials and other industrial purposes. Caustic soda is categorized of hazardous materials by the International Maritime Organization when shipped by ship. For shipments of Caustic Soda using ships, the ships used must use stainless steel material with a maximum Caustic Soda concentration of 50% at a temperature of 65-75°C. The ship used must be cleaned by spraying hot water at 50°C for 20 minutes, flushing using fresh water, draining tanks, pumps and loading pipelines. Personnel in charge handling Caustic Soda are required to have the qualifications set out in STCW Chapter V Section A-V and safety procedures must be strictly implemented. (www.cargohandbook.com).

To reduce the cost of shipping Caustic soda from producers to consumers, one thing that can be done is to streamline the loading time of Caustic soda into the ship without ignoring the established safety procedures. It is expected that with the shorter time required for the loading process, the costs charged to the loading operator are less and the cost of berthing at the port is also cheaper. For this reason, it is necessary to calculate the loading time, to ensure that the time required during the implementation of loading activities is not too much different from the predetermined time. To estimate the loading time can be done by calculating the maximum transfer rate of caustic soda can also be calculated based on time reports from previous loading activities. It is expected that with an estimate of loading time that can be calculated accurately based on

the amount of caustic soda loaded, the calculation of costs associated with loading activities can be estimated more accurately. If there is a shift from the predetermined time, it is hoped that the time shift will not exceed the predetermined tolerance.

2. METHODE

Metode yang digunakan dalam penelitian ini adalah dengan mengambil data Sekunder terkait Waktu muat Kapal Tanker MT AKRA 1.02 pada PT Radyan jaya Samudera khususnya Kapal tanker yang melakukan proses Muat *Liquid Caustic Soda*. Periode data yang digunakan terhitung mulai tanggal 1 Agustus 2022 sampai dengan 30 September 2023. Untuk mendapatkan perkiraan waktu muat maka perlu dilakukan Uji statistik berupa, Statistik Deskriptif dari data Jumlah Muatan Caustic Soda serta Waktu muat Caustic Soda, menghitung Uji Korelasi Muatan Caustic Soda terhadap Waktu muat Caustic Soda, Uji Regresi Linier Muatan Caustic Soda terhadap Waktu muat Caustic Soda, Uji Normalitas Kolmogorov-Smirnov Unstandardized Residual. Pengolahan data dalam secara statistik menggunakan software IBM SPSS 23 serta menggunakan microsoft Excel

The method used in this research is to take secondary data related to the loading time of the MT AKRA 1.02 Tanker at PT Radyan Jaya Samudera, especially tankers that carry out the Liquid Caustic Soda. The data period used starts from August 1, 2022 to September 30, 2023. To get an estimate of loading time, it is necessary to conduct statistical tests in the form of Descriptive Statistics, calculate the Correlation Test of Cargo of Caustic Soda on Caustic Soda Loading Time, Linear Regression Test of Cargo of Caustic Soda

on Caustic Soda Loading Time, Kolmogorov-Smirnov Unstandardized Residual Normality Test. Data processing in statistically using IBM SPSS 23 software and using Microsoft Excel.

3. RESULT AND DISCUSSION

Knowledge of dangerous cargo plays a major role in the regulation of dangerous cargo for transportation safety (Zhang et al, 2019). Human factors are still the main cause of shipping accidents related to dangerous goods (Khan et al, 2022). A frequent violation is the presence of dangerous goods that are not informed in detail and transparently to the authorities (Maternova et al, 2022) International Maritime Organization (www.imo.org) classifies dangerous cargo into 9 (nine) categories. Caustic soda is classified into the 8th category because Caustic Soda is corrosive. If caustic soda swallowed can cause oesophageal necrosis, severe gastric injuries accompanied by gastrectomy and digiunostomy (Rodanelli et al, 2016), the level of injury due to ingestion of caustic soda depends on the concentration level of caustic soda and the duration of Caustic soda (Martínez-Caballero et al, 2020). Caustic soda when exposed to the skin can cause pain, burns, redness, irritation. Eye contact with caustic soda causes pain, eyelid twitching, watery eyes, inflammation, sensitivity to light, at high concentration levels can cause permanent damage to the eyes. Caustic soda is irritating to the nose and throat when inhaled in high concentrations (PHE, 2019).

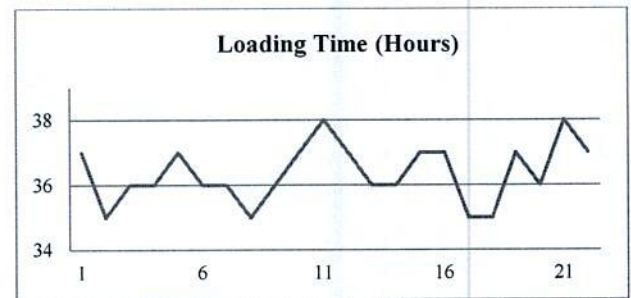
According on the loading activities of Caustic soda on MT AKRA 1, the period August 2022 to September 2023 obtained data on the amount of Caustic Soda cargo and the time required when

carrying out loading activities obtained the following data

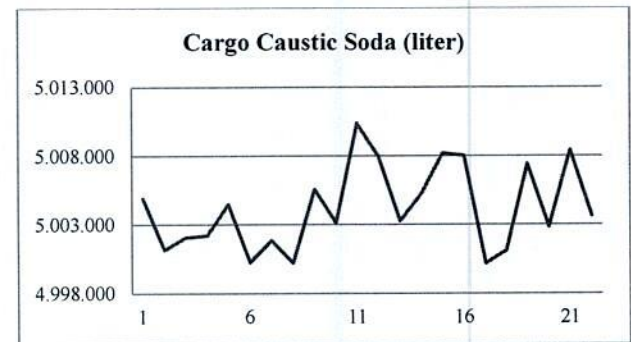
Table 1. Descriptive Statistics

	Statistic	
	Loading Time (Hours)	Cargo Caustic Soda (liter)
Mean	36.3636	5004216.63
95% Confidence Interval for Mean	Lower Bound: 35.9637 Upper Bound: 36.7636	5002851.75 5005581.52
5% Trimmed Mean	36.3485	5004107.42
Median	36.0000	5003445.50
Variance	.814	9476534.71
Std. Deviation	.90214	3078.398
Minimum	35.00	5.00E+6
Maximum	38.00	5.01E+6
Range	3.00	10179.00
Interquartile Range	1.00	5860.00
Skewness	.021	.418
Kurtosis	-.646	-.985

Graphic 1. Caustic Soda Loading Time (Hours)



Graphic 2. Amount of Caustic Soda Cargo (Liters)



Normality test

Normality test for Loading time

- H_0 : Loading Time have a Normal Distribution
- H_1 : Loading Time did not have a Normal Distribution

H₀ is rejected if the significance value < 0.05

Table 2 Test Of Normality for Loading Time

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Loading Time (Hours)	.214	22	.010	.884	22	.014

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The Kolmogorov-Smirnov Normality Test Significance value for load time shows a value of $0.01 < 0.05$ and the Shapiro-Wilk Normality Test has a value of $0.018 < 0.05$, which means H₀ is rejected or the Caustic Soda loading time data did not have normal distribution.

Normality test Amount Cargo of Caustic Soda

H₀ : Amount Cargo of Caustic Soda have a Normal Distribution

H₁ : Amount Cargo of Caustic Soda did not have a Normal Distribution

H₀ is rejected if the significance value < 0.05

Table 3 Test Of Normality for Amount Cargo of Caustic Soda

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Cargo Caustic Soda (l)	.123	22	.200*	.933	22	.139

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on calculations using SPSS, the Significance value of the Kolmogorov-Smirnov Normality Test shows a value of $0.200 > 0.05$, and the Shapiro-Wilk Normality Test shows a

value of $0.139 > 0.05$, which means H₀ is accepted so that the amount of Caustic Soda Cargo have a Normal Distribution.

Correlation test

Hypothesis for Correlation Test Amount of Cargo Caustic soda with Caustic Soda loading time.

H₀ : There is a correlation between the amount of cargo and the loading time of Caustic Soda

H₁ : There is no correlation between the amount of cargo and the loading time of Caustic Soda

H₀ is rejected if the significance value > 0.05

Table 4 Pearson Correlation

		Loading Time (Hours)	Cargo Caustic Soda (l)
Loading Time (Hours)	Pearson Correlation	1	.840**
	Sig. (2-tailed)		.000
	N	22	22
Cargo Caustic Soda (l)	Pearson Correlation	.840**	1
	Sig. (2-tailed)	.000	
	N	22	22

** . Correlation is significant at the 0.01 level (2-tailed).

The significance value of the Pearson correlation between loading time and the amount of Caustic Soda Cargo is $0.000 < 0.05$, which means H₀ is accepted or there correlation between the amount of cargo and the loading time of Caustic Soda. The Pearson Correlation value is 0.840, indicating a very strong correlation between the amount of cargo and the loading time of Caustic Soda.

Linear Regression Test

Regression test is carried out by taking the variable Amount of Cargo of Caustic soda loads

as the independent variable and the dependent variable is the Loading time of Caustic Soda.

With hypothesis:

H_0 : The variable Amount Cargo of Caustic Soda has a relationship with the length of loading time and a linear regression model can be used to predict the variable loading time of Caustic Soda.

H_1 : The variable Amount Cargo of Caustic Soda has a relationship with the length of loading time and a linear regression model cannot be used to predict the variable loading time of Caustic Soda.

H_0 is rejected if the significance value > 0.05

Table 5 Model Summary

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.840 ^a	.706	.691	.50118

a. Predictors: (Constant), Jumlah Muatan

b. Dependent Variable: Waktu Bongkar/Muat

The coefficient of determination R Square is 0.706 indicating that the dependent variable is influenced by the independent variable by 70.6%, while the remaining 29.4% of the dependent variable is influenced by factors other than the independent variable (ghozali et al, 2016). The R Square value of 0.706 indicates that the dependent variable has a moderate relationship with the independent variable (Hair et al, 2011).

Table 6. ANOVA

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.067	1	12.067	48.042	.000 ^b
	Residual	5.024	20	.251		
	Total	17.091	21			

a. Dependent Variable: Waktu Bongkar/Muat

b. Predictors: (Constant), Jumlah Muatan

- The Anova Significance value shows a value of $0.00 < 0.05$ which indicates that H_0 accepted or the regression model can be used to predict Caustic soda loading time (Liters) According on the amount of Caustic Soda to be loaded (Hours)
- Based on SPSS calculations, the (F_{value}) 48.042 > 4.351 (F_{table}) so it can be concluded that the regression model can be used to predict the loading time of Caustic Soda

Based on the significance value and comparison of the calculated (F_{value}) with the (F_{table}) value, it can be concluded that the amount of Caustic soda load (X) can be used to predict the loading time of Caustic soda (Y).

Table 7. Coefficients

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1195.90	177.78		-6.727	.000
	Cargo Caustic Soda (l)	.000246	.000	.840	6.931	.000

a. Dependent Variable: Jumlah Cargo Caustic Soda (l)

- The Significance value for the Constant is $0.000 < 0.05$ and the significance value for the Amount of Cargo Caustic Soda is $0.000 < 0.05$, so it can be concluded that the Amount of Cargo Caustic soda and the constant value have an influence on the loading time of Caustic soda
- The (t_{value}) for Constant is $-6.727 < -2.086$ (t_{table}) and the (t_{value}) for Total Cargo Caustic Soda is $6.931 > 2.086$ (t_{table}) so that the constant value and Total Cargo Caustic Soda give influence to the loading time of Caustic Soda.

Unstandardized Residual Normality Test

H_0 : Amount Cargo of Caustic Soda have a Normal Distribution

H_1 : Amount Cargo of Caustic Soda did not have a Normal Distribution

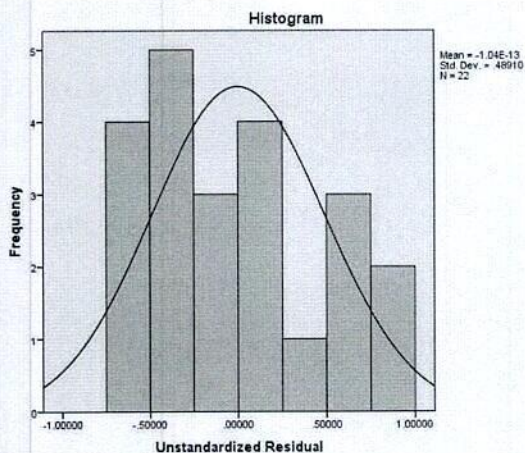
H_0 is rejected if the significance value < 0.05

Table 8 Unstandardized Residual Normality Test

One-Sample Kolmogorov-Smirnov Test		Unstandardized Residual
N		22
Normal Parameters ^{a,b}	Mean	.0000000
	Std. Deviation	.48910040
Most Extreme Differences	Absolute	.134
	Positive	.134
	Negative	-.103
Test Statistic		.134
Asymp. Sig. (2-tailed)		.200 ^{c,d}

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.
- d. This is a lower bound of the true significance.

Graphic 3. Unstandardized Residual Histogram



Kolmogorov-Smirnov Normality Test Significance value for Unstandardized Residual is $0.200 > 0.05$, means that H_0 is accepted indicating that the Unstandardized Residual are normally distributed, reinforced by the Unstandardized Residual histogram which has a pattern close to the Normal distribution curve.

4. CONCLUSIONS

According to statistical calculations of data on the amount cargo of Caustic Soda Load, as well as data on the time required to carry out Caustic Soda Loading activities to the MT AKRA 102 Ship, the results show that:

- The Pearson Correlation value shows a positive and fairly strong relationship between the amount Cargo of Caustic Soda Load (l) and the time required during the implementation of Caustic Soda loading activities to the MT AKRA 102 ship.
- The coefficient of determination R Square is 0.706 indicating that the dependent variable (Loading time of Caustic Soda) is influenced by the independent variable (Amount cargo of Caustic soda) by 70.6%. Where the Determination value of 70.6% is categorized as the independent variable giving a moderate influence on the dependent variable.
- ANOVA significance value $0.00 < 0.05$, and $(F_{value}) 48.042 > (F_{table}) 4.351$ it can be concluded that the amount Cargo of Caustic soda cargo can be used to predict the Loading time of Caustic soda.
- Total Cargo Caustic Soda $(t_{value}) 6.931 > 2.086 (t_{table})$ so that the constant value and Total Cargo Caustic Soda affect on the loading time of Caustic Soda .
- The Significance Value of the Kolmogorov Smirnov Normality Test for Unstandardized residuals is $0.200 > 0.05$, indicating Unstandardized residuals are normally distributed.

So it is concluded that the amount Cargo of Caustic Soda has an influence on the loading time of Caustic Soda, and the amount of Cargo Caustic Soda can be

used to predict the loading time of Caustic Soda to MT AKRA 102 Ship with the equation

$$\text{Load Time} = 0.00246 \text{ Amount Cargo} - 1195.909$$

Where each addition of every 1 liter of Liquid Caustic Soda provides an additional time of 0.00246 hours.

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No	Jenis Pemeriksaan	Tanda
1	Abstrak : Latar belakang Tujuan& manfaat penelitian Metode Kesimpulan Kata kunci	
2	Pendahuluan : Latar belakang permasalahan. Review studi terdahulu. Tujuan dan manfaat dari penelitian	
3	Metode :	

Deskripsi objek penelitian.
Perlakuan pada objek penelitian..
Metode / cara dan prosedur pemecahan yang digunakan untuk meneliti.
Alat dan/atau bahan yang digunakan dalam penelitian.

4 Hasil :

Hasil penelitian
Penjelasan hasil
Komparasi hasil dari variabel yang berbeda

5 Kesimpulan :

6 Format :

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Persamaan matematika (2 kolom no border tabel, menggunakan equation editor, equation di center, nomor eq. di sisi kanan)
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7 Daftar Pustaka :

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