



POTENTIAL ANALYSIS OF INDUSTRIAL WASTE USING SEVEN BASIC QUALITY TOOL PARETO DIAGRAM

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Abstract

The rapid development of the industrial sector in Indonesia today has an impact on other environments, both positive and negative impacts. The positive effects of industrial expansion are seen in sectors of the economy, many new jobs are created and many new applications for new technologies are used. The negative impact that cannot be avoided is caused by industrial waste, sometimes also caused by liquid waste containing substances that are harmful to the surrounding population. Every company must carry out industrial waste treatment from the negative impacts caused. PT TGLC, a company engaged in the manufacture of liquid sugar (glucose). In the process of producing liquid sugar (glucose) there is a regeneration process, namely the process of recovering the resin used in the ion exchanger column, which produces liquid waste in the process. Methods for dealing with the problem of industrial waste products, by identifying the contribution made by each system to the industrial data for all systems. The "Pareto Principle" was popularized by Joseph Juran, a business management consultant in 1950. Pareto analysis is used to identify the contribution made by each individual component of a system to the system. According to this analysis, 80% of the effect is due to 20% of the causes, 80% of the cost of reducing the risk results from 20% of the risks identified, and 80% of the value received comes from 20% of the benefits. In Pareto analysis A table is made of the reasons or causes and their frequency. Every industry has different problems. Every problem can be solved by applying the Pareto principle. For example, if you're not productive and you're always procrastinating, you can identify 20% of the reasons why your team isn't productive. by applying the Pareto Principle can increase productivity. This principle will encourage businesses to concentrate on areas that require extra resources to achieve efficiency. Therefore, companies only need to concentrate on the most important 20% aspects to deliver the expected 80% results. Companies will be stricter in distributing daily necessities and faster in rejecting unnecessary things if they understand this principle. Achievement Target Industrial waste that is generally produced by industrial waste or production process waste, then we must know how to manage it. A mandatory requirement from the Government that every industrial player must have is having a waste treatment plan. Any profits generated from industrial processes must be accompanied by waste treatment so as not to harm the environment. There are several types of waste treatment, according to each type of waste, to carry out waste management, we analyze it with the Pareto Principle, we can make a Pareto diagram to manage and manage waste. There are several steps that need to be done. First, collect data related to the problem for analysis. The data can include the type of issue, how it was measured, and the timing of the chart. The second step, carry out a more detailed identification. For example, the extent of damage to the product and what are its causes, the time and period of analysis should also be determined. The type of period in question can be a matter of days, weeks, or months. Next, we need to know the number of events to be analyzed. From these data, it can be created with bar graphs and line graphs. Then, the results can be communicated and become the basis for taking appropriate action for the company. The advantages of Pareto charts are that they are easier to read because they combine bar and line chart methods. In addition, it can more easily identify problems that occur within the company. The goal to be achieved in this study is to manage the potential of industrial waste, water regeneration in ion exchangers and may utilize liquid waste, using the application of the Decision Support System method or DSS (Decision Support System) Pareto diagram analysis.

Keywords: Industrial waste, regeneration, analysis, pareto diagram.

INTRODUCTION

For an industry, waste generated by residual companies or production process waste will become a problem if it is not managed properly, then the company must know how to manage it. A mandatory requirement from the government that every industry player must have is having a waste management plan, commonly called a WTP (wastewater treatment plant) or WWTP, a wastewater treatment plant. Every advantage derived from industrial processes must be accompanied by waste management so as not to harm the environment of living things around the industry. Industrial waste that is disposed of carelessly into the environment without prior processing can have a negative impact on the environment and living things, there are several adverse effects caused by industrial waste, including:

Hazards of industrial waste in water

Disposal of industrial waste into the environment in waters or rivers is one of the main causes of water pollution. Disposing of industrial waste into the sea or river will damage or even kill life in the sea or river. This is due to the high levels of BOD or COD in the waste which will deprive the source of oxygen in seawater or river water. Coarse material derived from waste will also spread and cause bacteria or viruses that are harmful to the environment, therefore if the water is consumed by humans or other living things it will cause health problems to humans or other living things.

Dangers of Industrial Waste in the Air

Industrial waste can produce toxic gases with an unpleasant odor which will pollute the air which will cause respiratory problems. The gas hazard posed by industrial waste will be more easily felt by the vulnerable elderly or children under the age of 14. And someone with a congenital disease, the gas can also cause various diseases if inhaled by humans in the long term, such as asthma, lung disease, heart disease and other diseases.

Dangers of Industrial Waste on Soil

Industrial waste that is disposed carelessly on the ground or buried in the soil can damage the fertility of the soil so that it interferes with plant productivity. The total pollutant population in plants can even be higher than that in soil contaminants because molecules in industrial waste can accumulate in plants, plant products that are contaminated with industrial waste if consumed can endanger human health.

Industrial Waste Management

To avoid the bad impact caused by industrial waste, it is necessary to manage the industrial waste which will be disposed of into the environment. There are several ways of managing industrial waste, including:

Liquid Waste Management

The management of liquid industrial waste produced by production is carried out to remove pollutants or hazardous substances in the liquid waste content so that the waste that is disposed of is clean and does not cause damage or environmental pollution. Liquid waste management is divided into three ways, including physical management, chemical management and biological management.

In the physical process of managing liquid waste, the separation of all dirty materials contained in the liquid is carried out. The separation is carried out by precipitating, absorption floatation, and by filtering. Meanwhile, chemical wastewater treatment can be carried out in several modes, namely ozonization mode, oxidation mode, coagulation mode, and ion exchange mode. The use of a physical treatment mode can be adjusted according to the type of pollutant that needs to be removed. Meanwhile, the biological treatment of industrial waste, pollutants or hazardous substances in waste is described by utilizing biota or living things in the form of micro-organisms.

The biological process of managing liquid waste can be carried out using three methods, namely: the Aerobic method, the Anaerobic management method, and the Facultative management method. Liquid industrial waste management can also be carried out in several ways, namely primary management, secondary management, tertiary management, disinfection management, and sludge treatment or sludge management. Primary management is the management of liquid industrial waste by filtering, pre-processing, settling, and flotation. This treatment is appropriate for processing liquid industrial waste in the form of oil and grease pollutants. While secondary management is the management of liquid industrial waste which is carried out using microorganisms to decompose pollutants in liquid waste.

Solid Waste Treatment

Solid industrial waste processing can be done in several ways. The method of processing solid waste which is organic and non-organic is different. Organic waste in general will be generated to be broken down by micro-organisms so as to maintain and increase soil fertility. However, the accumulation of organic waste cannot be done haphazardly. It is necessary to apply special methods to prevent soil contamination. One method that can be carried out and used is the sanitary landfill method. The application of the sanitary landfill method is carried out by placing solid waste into a hole that has previously been covered with plastic and clay which can prevent water from seeping into the ground. The methane gas produced from this process can be used as electrical energy.

Gas industry Waste Management

This type of industrial waste in the form of gas is more dangerous than liquid and solid industrial waste because it is not visible directly. Therefore, the treatment of waste gas industry needs to be done properly so as not to cause too much harm to all parties. One of the things that can be done to manage

gas industry waste is by reducing the amount of wasted gas by the desulphurization method using a wet filter. Another way that can be done to manage industrial waste is by applying the gas phase method to disguise the unpleasant odor that is generated. Unpleasant odors emitted from industrial gas waste can also be reduced by using a solid phase. Through this solid phase method, the unpleasant odor released from the gas will be absorbed using a solid adsorbent in the form of activated charcoal. Sealing industrial waste gas treatment in the above way industry players also control and reduce the amount of gas emissions by using more environmentally friendly fuels.

Pareto diagram

In conducting industrial waste treatment in this study we will use the 7 Basic Quality Tool Pareto diagrams, we can make Pareto diagrams for managerial and industrial waste management, there are several steps that need to be taken, including: Collecting data related to the problem we are going to analysis, the data can include several types of problems, methods of measurement, and when the diagram makes a more detailed and thorough identification.

For example: To what extent is the damage to the product and what is the cause? The time and period of analysis must also be determined. The type of period in question can be a matter of days, weeks, or months. Next, we need to know the frequency or number of events to be analyzed. From these data, bar graphs and line graphs can be created. Then, these results can be communicated and become the basis for taking appropriate actions for the company.

Why do you have to use pareto chart analysis, the advantage of this pareto chart is that it is easier to learn and read because in this pareto chart it combines bar charts and line charts, besides that we can also more easily identify problems that occur in the field or problems in the company. With a Pareto diagram, the right solution for the problem that occurs can also be determined, and the results can be assessed more accurately. So the principle and the Pareto diagram are very important in a data collection and analysis. As a company as a business owner, implementing or using the Seven Basic Quality Tool Pareto diagram will be a strategic step solution in making decisions for improvement.

METHOD

The method used in this study is analysis using the Seven basic quality tool Pareto diagram in the process aspect and management of liquid sugar (glucose) production starting from how to prepare raw materials, followed by how the process goes through to be able to carry out the planned process and how to control it. things that are not suitable in production management so as to increase profits and efficiency in the liquid sugar production process(glucoseThis, with the Seven basic quality tool pareto diagram system method that will be used in this study is an analysis with a simple pareto diagram, namely a statistical method that functions to test the extent of the causal relationship between the causative factor variable (x) and the resulting variable in the implementation of method activities. The

research used several methods to obtain the right data and analysis. In addition, it also uses several methods by way of direct observation in the field of the process and management system for liquid sugar production (glucose). This observation includes direct interaction including interviews, discussions and the introduction of employees who work in the production section of this company. Interaction is carried out as a supporting activity in an effort to clarify and analyze existing problems.

Definition: System analysis activity is an activity to look at an existing system, see which parts are good and which are not good, and then document the requirements that will be met in the new system. It looks simple, but actually it's not. Many obstacles will be encountered in the process.

Realization of Problem Solving. In many systems research projects a process, analysis and design processes often go hand in hand. So during research and analysis activities, design activities are also carried out because in many cases, companies often find it difficult to define their needs and deficiencies.

Data collection techniques, the first thing to do in the analysis of the research system 7 basic quality tool Pareto diagram is to collect data which is often done, among others, using the following methods: Interview techniques, Observation techniques, Questionnaire techniques

1. Interview Techniques

Collecting data using interviews has several advantages, including:

- a. Can explore user needs more freely, if there are certain parts that we think need to be explored more deeply, we can directly ask our sources.
- b. It's easier to explore which parts of the system are considered good and which parts are considered not good. Users can express their needs more clearly.

In addition to having these advantages, the interview technique also has some disadvantages. Here are some disadvantages of the interview technique:

- a. Interviews will be difficult to do if the source is unable to express his needs.
- b. Questions can become undirected, too focused on certain things and ignore other parts, there are several guidelines in conducting interview activities in order to obtain the data we expect
 - Use questions that are clear and easy to understand.
 - Create an interview guide that we will use as a guide so that questions can focus on the things needed.
 - Schedule interviews with informants and inform them of the purpose and objectives of the interviews. We record or record the results of the interview.

Try to dig into the advantages and disadvantages of the system that has been running before. we can improvise by trying to outsmart certain parts that we think are important.

2. Technique Oservasi

Collecting data using observation has the following advantages: Analysis can see firsthand how the old system was running, able to produce a better picture when compared with other techniques. While there are weaknesses by using observation techniques, among others:

- a. Can interfere with the work of people on the part being observed.
- b. It takes a long time because if the observation time is very limited, it will be difficult to obtain an overview of the system as a whole. The people being observed usually have different behavior from their daily behavior (tend to try to be better). This will cause the picture obtained during the observation to be different from everyday behavior.

Here are some pointers for making observations:

- If there's something we don't understand, try asking, don't make your own assumptions.
- Try as little as possible so as not to interfere with other people's work.
- Determine what things will be observed so that the observation activities produce what we expect.
- Ask permission from the person in charge of the part to be observed.

3. Questionnaire Technique

Collecting data using a questionnaire technique has several advantages, including:

- The time needed is shorter.
- The results obtained are more objective, because the questionnaire can be administered to many people at once.

While the questionnaire technique also has its drawbacks and weaknesses, including:

- It is difficult to make short, clear and easy-to-understand questionnaire questions.
- Respondents tend to be lazy to fill out the questionnaire.

There are several things that can be done to make the questionnaire technique produce good data including:

- Make questions that are not too many and long-winded.
- Avoid fill-in questions, it is better to use multiple questions, because usually respondents are lazy to write a lot, and when respondents write something it is often difficult to understand and also with multiple choice questions it will make it easier for us to recapitulate the data from the questionnaire results.
- Make questions concise, short and clear.

In this activity as a data seeker and data collection, we carried out data recapitulation from field observations and interviews followed by writing a report, we did it by working together in the field, in synergy with employees at PT TGLC in the first semester period of this year.

Benefits of applying Pareto analysis

1. Increase Pareto

Pareto analysis can help us to focus on areas that require resources to achieve efficiency. With this method of analysis, we only need to focus on 20% of the main problems to be able to deliver 80% of the expected results. With this, we can save time and get solutions that have long-term value.

2. Increasing Profits

To find out potential areas that must be developed so that it will increase company profitability, we can use the Pareto Analysis method. An example is that we can find out the top 20% of problems that account for 80% of our total problems.

3. Identify the Problem

Every job has its own problems. It turns out that we can solve these problems using the Pareto Principle. For example, when we are unproductive and often finish analysis tasks late, we can find 20% of the reasons why the team is unproductive and finished.

For example, it turns out that our team members cannot divide their time between doing assignments and resting, or it turns out that our team's soft skills are not qualified to carry out these tasks. We can solve these problems so that we can have an 80% positive impact on the company by using the right strategy and approach. There are several advantages with the application of the Pareto Principle in the field of work and problem analysis research, including,

1. Work becomes more targeted
2. Save time and effort
3. Minimizing rejection or negative responses from fellow employees during work.

Statistical data processing can be done using various methods, one of which is by using this Pareto chart. This type of data processing belongs to the Seven Basic Quality Tools section. Seven Basic Quality Tools is a statistical tool that can be used to find the root causes of quality problems for defective products, so that companies can find out the causes of defects and minimize problems that occur due to the same causes. In fact, a Pareto Chart is a bar graph that depicts a problem based on the order of the number of times the number of events occurs. The first order will start from the problems that have the greatest frequency to the problems that have the least frequency. So that we can prioritize the problems that we must solve first. Causes and effects are arranged in descending order and a causative number is created. The results are displayed on a Pareto chart, which shows the cause and effect relationship in terms of frequency. This combination of vertical bar graphs and line graphs shows the decreasing size of each component and the cumulative effect of all components as shown in the figure below.

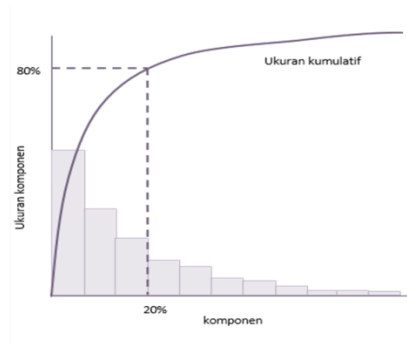


Figure 1. An example of grouping problems and creating a cumulative frequency and percentage of problems

RESULTS AND DISCUSSION

The management of liquid industrial waste produced by production is carried out to remove pollutants or hazardous substances in the liquid waste content so that the waste that is disposed of is clean and does not cause damage or environmental pollution. Liquid waste management is divided into three ways, including physical management, chemical management and biological management. In the physical process of managing liquid waste, separation of all dirty materials contained in the liquid is carried out. The separation is carried out by precipitating, absorption floatation, and by filtering. Meanwhile, chemical wastewater treatment can be carried out in several modes, namely ozonization mode, oxidation mode, coagulation mode, and ion exchange mode. The use of a physical treatment mode can be adjusted according to the type of pollutant that needs to be removed. Meanwhile, biologically industrial waste processing, pollutants or hazardous substances in waste are described by utilizing biota or living things in the form of microorganisms. To manage this industrial waste we will do it with the Pareto principle, we can make a Pareto diagram to manage and manage this industrial waste. Some steps that need to be taken include:

Collect data related to the problem to be analyzed. Such data can include the type of problem, how it is measured, and the time of the chart.

Do a more detailed identification. For example: To what extent is the damage to the product and what is the cause? The time and period of analysis must also be determined. The type of period in question can be a matter of days, weeks, or months. Next, we need to know the frequency or number of events to be analyzed. From these data, bar graphs and line graphs can be created. Then, these results can be communicated and become the basis for taking appropriate actions for the company.

The advantage of Pareto charts is that they are easier to read because they combine bar and line chart methods. In addition, we can also more easily identify problems that occur in the company. With a Pareto chart, the correct solution to the problems that occur can also be determined. The results can be assessed more accurately. So the Pareto chart is very important in data collection and analysis. For companies as employees who are required to solve existing problems, the Pareto analysis system applies

principles that will become strategic steps that need to be practiced in the field, to solve existing problems.

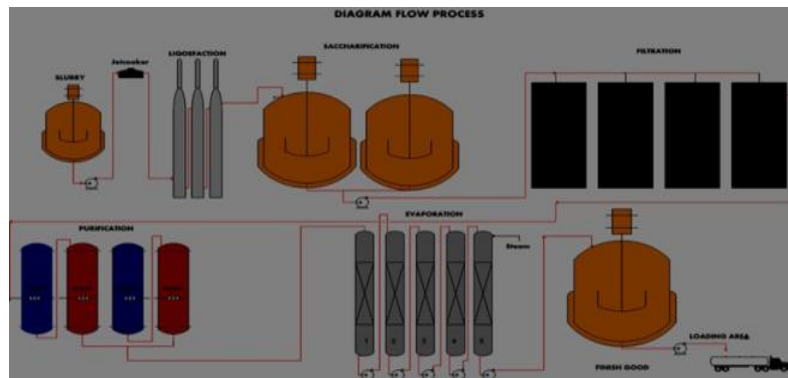


Figure 2 Improvement of the filtered area

Pareto analysis is used to identify what contribution the individual components of a system make to the whole system. It is often revealed that 80% of the impact is for 20% of the causes, for example 80% of the cost of risk mitigation arises from 20% of the identified risks or 80% of the value received by 20% of the benefits. In Pareto analysis a table is made of causes and frequencies. Causes and effects are arranged in descending order and a causative number is created. The results are displayed on a Pareto chart, which shows the cause and effect relationship in terms of frequency. This combination of vertical bar graphs and line graphs shows the decrease in the size of each component and the cumulative effect of all components as shown in the figure below. Amount of Liquid Waste Produced in TES Glucose

Table 1 Solid and Liquid waste period January – June 2022

Period	Amount	Waste
	Solid waste(tonnes)	Liquid Waste(Tons)
Sep 2022	203,9	20104
Oct 2022	249,8	17290
Nov 2022	258,4	17296
Rate-rate	237,3	182030

Table 2 liquid Waste has a greater amount than the Solid Waste produced by Glucose, which reaches 18230 tons/month

Defect	Total	%	% Cumulative
Regeneration Ion Exchanger(M ³)	50640	93%	93%
Fabric Washing Filter Press Machine(M ³)	4050	7%	100%
Total	54690	100%	

Table 3 liquid waste resulting from Ion Exchanger Regeneration is the most liquid waste produced by Glucose, reaching 18,230 m³/month

Defect	Total
Backwash Waste(M ³)	21060
Waste Fastrinse(M ³)	14580
Waste Inject(M ³)	9113
Slowrinse Waste(M ³)	7021
Forward Waste(M ³)	2916

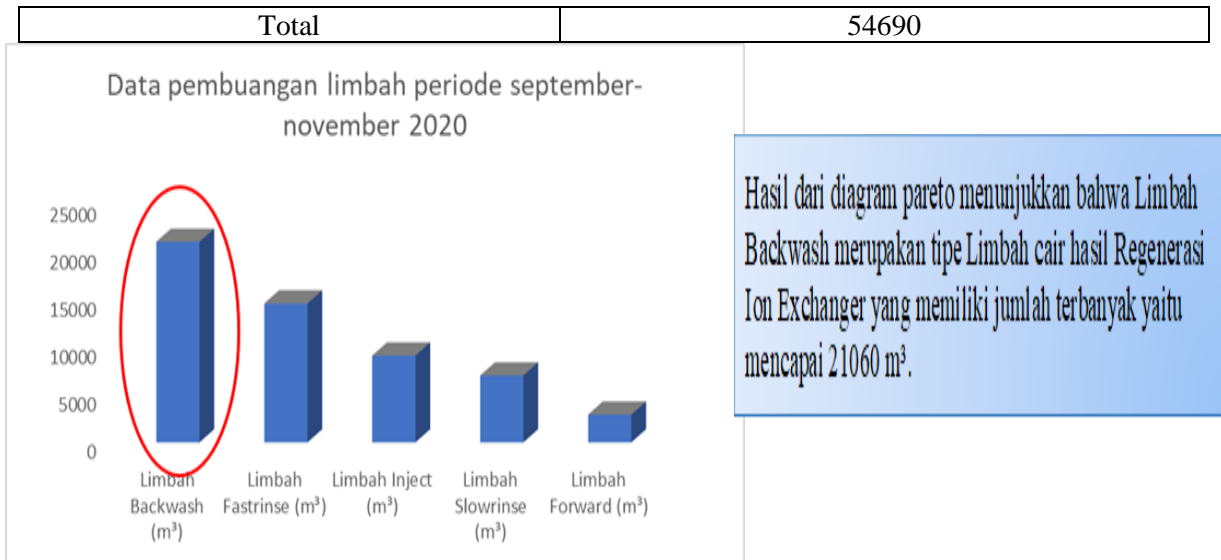


Figure 2. Grafik type of Liquid Waste from TES Ion Exchanger Regeneration



Figure 3. Grafik type of Liquid Waste

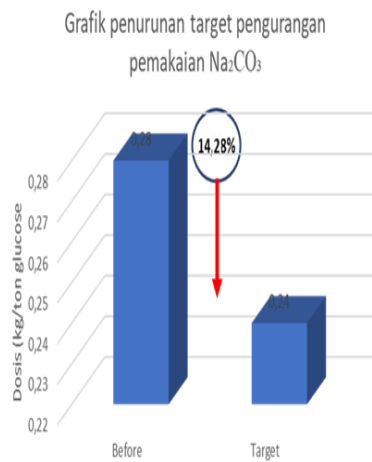
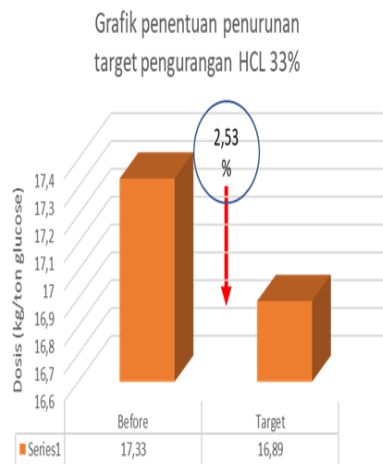
Table type of Liquid Waste from TES Glucose Ion Exchanger Regeneration based on Chemical Content in Wastewater September – November 2022 Period

Month	SodaAsh(Kg)	Calcium(Kg)	HCl(Kg)	NaOH(Kg)
Sep	2.774,1	284,9	145.851	106.352
Oct	3.282,5	258,1	208.922	156.670
Nov	2.734,2	233,8	190.231	143.356
Total	8.790,8	776,8	545.004	406.378

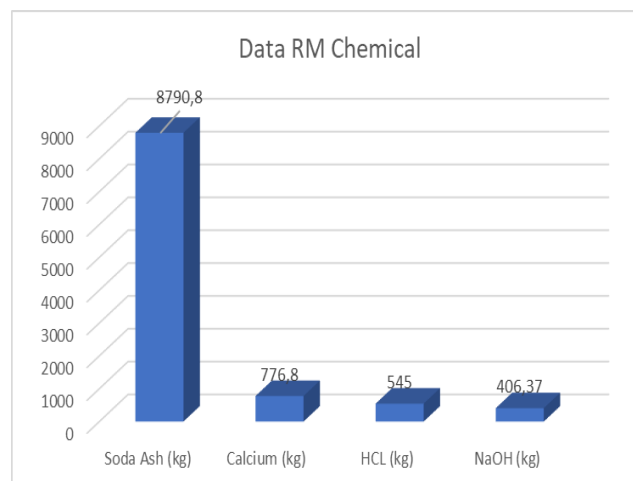
From the pareto diagram above, the highest RM chemical usage was HCl, NaOH, Soda Ash, and Calcium, respectively. RM chemicals that may be replaced by using acidic and alkaline waste are HCl and Soda Ash. NaOH is only used to regenerate ion exchangers so it cannot be replaced with other chemicals. While Calcium is used as an enzyme catalyst so it cannot be replaced with other compounds

Table Defining Theme Goals

Jenis Chemical	Chemical Usage(Kg/ton Glucose)					Reduction Target (%)
	Sep'22	Oct'22	Nov'22	Rate-rate	Target	
Na ₂ CO ₃	0.33	0.22	0.24	0.28	0.24	14.28%
HCL33%	17.36	17.33	16.89	17.33	16.89	2.53%



Penentuan target dari pemanfaatan Limbah H sebagai pengganti fung HCl 7% Existing yaitu sebesar **2.53%** dan pemanfaatan Limbah Na sebagai pengganti fung Na₂CO₃ adalah sebesar **14.28%**



Factor	Analysis of existing conditions	Standard	Results observation	Nope there	When	Conclusion
Man	Operator error when injecting Chemical	HCL 6.9(M ³) NaOH 11.3(M ³)	HCL 6.9(M ³), NaOH 11.3(M ³)	Name	Nov'22	No effect
Machine	-	-	-	-	-	-

Method	More use of Chemical HCL and NaOH	HCL 6.9(M ³) – NaOH 11.3(M ³)	HCL 6.9(M ³) – NaOH 11.3(M ³)	Proof	Nov'22	No effect
Matrial	Resin requires a greater amount of chemical compared to new resin	HcL 6.9(M ³) – NaOH 11.3(M ³)	The new resin and the old resin have the same amount for the Chemical injection regeneration process, namely HcL 6.9(M ³) – NaOH 11.3(M ³)	Wiyanto	Nov'22	No effect
Environm ent	Regeneration results still contain Chemical	Does not contain chemical (ph5.0 – 8.5)	Cation pH analysis results: 1.1 -1.39 and Anion pH: 13.26 – 13.29	Dian	Nov'22	Influential

No	Category	Root Cause of the Problem	Immediate effect
1	Environmen	It has never been checked whether the waste is reused	Results of analysis of the results of ion regeneration Ph Exchange - Cation 1.1 - 1.9 - Anion 13.26 – 13.29

Air Limbah Cair hasil regenerasi Ion Exchanger memiliki pH yang rendah untuk Kation dan pH tinggi untuk Anion

Air Limbah Cair hasil regenerasi Ion Exchanger memiliki pH yang rendah untuk Kation dan pH tinggi untuk Anion

Tanggal	Waktu pengambilan (Menit)	Hasil Pengamatan			
		pH		Konsentrasi (Beume)	
		Limbah Inject Cation	Limbah Inject Anion	Limbah Inject Cation	Limbah Inject Anion
12/09/2020	10	1.29	13.28	4.80	7.00
12/09/2020	20	1.22	13.29	4.80	7.20
12/09/2020	30	1.21	13.22	4.80	7.20
12/09/2020	40	1.15	13.24	5.00	7.20
12/09/2020	50	1.10	13.23	5.00	7.20
12/09/2020	60	1.12	13.21	5.00	7.20

Hasil pengecekan pH dan Konsentrasi (Be) terhadap sampel Limbah Inject HCl dan NaOH menunjukkan bahwa Limbah Inject HCl menghasilkan nilai pH sangat rendah yaitu sebesar 1.12 – 1.29 dengan konsentrasi sebesar 4.80 – 5.00 sedangkan Limbah Inject NaOH menghasilkan pH yang sangat tinggi yaitu sebesar 13.21 – 13.29 dengan konsentrasi sebesar 7.00 – 7.20

Hasil pengecekan menunjukkan pH bersifat asam untuk sampel Limbah Inject HCl dengan kisaran pH 1 dan bersifat basa untuk Limbah Inject NaOH dengan kisaran pH 13.

Table 3 list of alternative solutions

Reason	Consequence	Solution
Regenerated water still contains chemicals	It has never been checked whether the waste can be reused	<ul style="list-style-type: none"> - Utilization of waste HCl as a substitute for the existing 7% HCl function and utilization - NaOH waste as a substitute for Na₂CO₃ function - Reprocessed using the WWTP system

Table 4 determine the best solution

Reason	Solution Description
Reuse of Waste Inject HCl and NaOH to replace the use of HCl in the saccharification process and Na ₂ CO ₃ in the slurry condition process	Utilizing a dilute NaOH tank to accommodate HCl Inject Waste. Utilizing Liquefaction Tank no. 13 Line 36 to accommodate NaOH Inject Waste. Make a line for waste HCl and NaOH from Ion Line 22 to the dilute NaOH tank and the Liquefaction Flow Tank.

Reason	Rease evaluation of waste containing chemical has not been carried out
Why	So that the liquid waste that is disposed of does not contain too many chemicals
What	a. Accommodate HCl Inject Waste into Dilute NaOH tank and NaOH Inject Waste into Liquefaction tank no. 13 Line 36. b. Make a Line Installation from Ion Exchanger Tank to Dilute NaOH Tank and Liquefaction Tank no.13 Line 36. c. Make a line installation from the dilute NaOH tank to the Sakari tank and make a line installation from the Liquefaction Tank no. 13 Line 36 to Tank Buffer Lines 22 and 36.
Where/Who/When	Area B/Area of Liquefaction, Saccharification and Ions Exchanger/Desember 2020
How much	Rp. 200,000,000,-

CONCLUSION

Based on the achievement of the Work Target Energy Consumption: Water for the Oct – Dec period, it is obtained that the trend data shows that water usage is in the same range following the achievement data trend. Analysis using the Pareto chart is easier to read because it combines the bar and line chart methods. In addition, we can also more easily identify problems that occur in the company. With a Pareto chart, the correct solution to the problem that occurs can also be determined. The results can be assessed more accurately. So both Pareto principles and diagrams are very important

in data collection and analysis. With the above analysis shows that the use of the right dose will be a lot to produce output or production results. Thus, improvements are needed to reduce water use. The longer the backwash process time, the clearer the resulting backwash waste water will be, as evidenced in the 60th minute it has a clearer color when compared to the 20th minute for backwash cations and anions.

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