The Effect Of Fuel Made From Waste Cane To Boiler Efficiency

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Abstract. Boiler or Boiler is a tool that has a function to heat the water up into the high-pressure steam. In the industrial boiler is the main engine that plays a very important, because the steam boiler proceeds will be used for the needs of the production process of a factory. Boiler used in PG. Bungamayang is a boiler with a water pipe fuel types bagasse. These boilers operate with a maximum pressure of 25kg / cm^2 and a maximum steam generating as much as 25 tons / hour. To calculate the efficiency of a boiler can use the direct method is energy obtained from the working fluid than*h*the-*h* energy contained in thefuelboiler, or equations written=.2to 1:

$$efisiensi\ boiler\ (\eta) = \frac{B(h_2 - h_1)}{G\ .\ LHV}\ x\ 100\%$$

100%boiler efficiency rate can be caused by good or bad of the boiler fuel. In this final duty fuel used is bagasse, there is the content Results Purity (HK) end mill juice. Optimal boiler efficiency at PG. Bungamayang of 77% based on the calculation and the results of the analysis of the percentage of HK sap mill end of the fuel bagasse is 33%, but if HK sap in the fuel is rising to 46%, the efficiency of the boiler will decrease to 40%. So it can be said that if HK sap end mill bagasse fuel in the percentage is too high then the efficiency of the boiler will be very small, and causes the plant performance is not optimal. The incident occurred as HK roomie is a divisor of the percentage of sugar and non-sugar. The higher the percentage of HK sap, meaning the bagasse contains a lot of sugar content.
Keywords: Boiler, Fuel, Nira Purity Results, Efficiency.

1. Introduction

In a production process in the industry, the boiler has a very important role in the continuity of the performance of a factory, where the boiler has a function to generate steam through a heating process water vapor which then will be used for the needs of the process plant. In the event of damage to the smoothness and performance of boiler steam production will be interrupted so that the needs of the manufacturing process was not as planned. The efficiency of the boiler is one of the main factors whether or not the performance of the boiler, when the boiler efficiency is very small then there is damage to the boiler working system. There are several issues that cause a decrease in the efficiency of the boiler, which include fuel revenues that do not fit. In Bungamayang sugar mill boiler fuel used is bagasse. Bagasse is one of the existing waste at the sugar factory, but can be reused as a fuel in the boiler due to fall into the category containing lignocellulosic biomass is very possible to be utilized as alternative energy sources such as biogas. It has become common in the industrial world, especially the sugar factory, using bagasse as fuel for boilers, but there are cases in Bungamayang sugar mill, where the quality of fuel used bagasse still contains sap

2. Review of Literature

2.1 Definition of Boiler

Boiler is a plane (tool) which is used to convert water into steam at a pressure of more than 1 atm by transferring heat to the water in a vessel sealed , The plane is composed of two parts: a furnace or kitchen to produce heat by burning fuel, and boiler heat surface in order to evaporate the water in a closed vessel with the condition through the wall of the combustion chamber. In general, the boiler furnace must be achieved to generate the maximum combustion heat is absorbed and transferred to the water with maximum efficiency through heating surfaces of the boiler.

2.2 GroupingBoiler

A. FireTube Boiler (Boiler Pipe Fire)

where combustion takes place inside the fire box or kitchen (combustion chamber) that is then the result of the combustion heat will flow into the pipes, so that the heat generated will be delivered directly into barrels filled with water.\

B. Water tube boilers (Boiler Water Pipe)
Combustion occurs within the barrel, and then the result of the heat used to heat pipes filled with water

2.3 Fuel Sugarcane Pulp

Bagasseis one of the waste at the sugar mill, which is derived from sugar cane. Energy needs could be met by sugar mills bagasse portion of the end mill as fuel for the boiler. Based on the analysis, the bagasse is composed of 44-46% fiber, 2.5 to 4.5% sugar and 40-55% water. There are several analysis conducted terhapat bagasse, the first to perform an analysis of the value of HK sap levels in mill finish, because the bagasse is used for boiler fuel is taken from the ground to the end of the sugar cane milling station. In the sugar mills that use bagasse fuel for boilers, note-kandunngan content of which is attached to the bagasse itself, because it will affect the efficiency of the boiler. Bagasse is good for boiler fuel is bagasse is dry and there is a bit of sugar content. To obtain optimal results certainly require analysis of the bagasse itself following equation is used to obtain levels of HK juice in bagasse mill end =%:%

Where% pol (sugar) obtained from analysis using a *saccharomat* and% brix (non-sugar) obtained from analysis usingtool.

2.4 Referactor

The second analysis is the analysis of bagasse itself to find out what percentage of water content and fiber. Here is the equation used to search forcontentwaterandfibers of bagasse:

= /10

Where the weight of the water obtained from

$$\%air = {}^{berat\ air}/_{10} \quad (1)$$

the weight of water = a - b

with

a = weight of 1kg bagasse before drying + container

b = weight of 1kg bagasse after drying + container

$$\%serat = c - d \quad (2)$$

while= to look for the percentage of pulp fibers used the following equation:

With

c = dry matter content of the pulp

$$c = 100 - \%air \quad (3)$$

d =levels$_{100}$-brixdregs

where the levels of dry matterdregs obtained from:

and=content/ brix pulp obtained from:

By

e =% pol of analysis use tool *saccharomat*

f =% HK sap end mill.

2.5 Calculation of Boiler Efficiency

The efficiency of boilers is how adaptable boiler change the rate of chemical energy of fuel, whether it is solid fuels*(solid),*liquid*(liquid)*or gas.

$$\eta) = \frac{B\,(h_2 - h_1)}{G\ x\ LHV}\ x\ 100 \quad (4)$$

The following equations used to calculate the efficiency of the boiler=:() 100%Boiler Efficiency ( )

Where:

B = the production of steam per hour (kg / h)

h_2= enthalpy of steam (kcal / kg)

h_1= enthalpy of water (kcal / kg)
G = weight of the fuel / hour (kg / hr)
LHV = value low calorific
fuel(kcal / kg)
In the formula above are some equations to solve.
The equation is:

$$LHV = \{462: \ x\ serat\% + 404: \ x\ gula\%\} - \{(100 - t_1) + \cdot (t_2 - 100)\ x\ 0{,}48\ x\ air\%\} \quad (5)$$

1. Finding the calorific value of fuel
= {+4623%}
4041% - {100 - +}
540 + - 100 0.48%
where
t_1 = temperature of bagasse
t_2 = temperature of the chimney
2. determining the weight of the fuel to determine the amount of fuel consumption can be mathematically calculated using the equation
G =% BB. k. n
Where:
G = Heavy fuel / hour (kg / hr)% B = percentage of bagasse sign (%)

k = capacity of *bagasse feeder* (kg / h)
n = Number of *bagasse feeder* boiler (units)

3. Metodoogi Research

3.1 Experimental Procedure

A. Process Anaisis HK Nira mill End a. Finding the value of% Brix (non-sugar)
Take the juice sample and then do the analysis using a refractor, record results seen then skewer at room temperature (see table equation) then it will get results brix. The final step of the brix results add to the equation the result table didapatlah percent brix value.
B. Finding value% Pol (sugar)
Take the juice sample and then strain the juice using filter paper until it looks clear. Pour the juice that is filtered on a glass-measuring cup 100ml, add a purifying solution such as aqua and acetate up to 110ml. Move sap that has been given the condensation at polbois. Analyze the saccharomat tool that is to get the value of pol read, after reading pol value obtained skewer with brix values previously obtained. See the table equation then it will get the value of% pol.
C. Looking%=value(%%HK) (Results Purity) (%)

$$HK = {}^{(\%pol)}/_{(\%brix)} \quad (6)$$

D. Process Analysis Fuels
a. Weigh bagasse 1kg added to the weight of the container
b. Put into the oven to remove moisture contained on bagasse. Heat to 120 ° C temperature for 60 minutes.
c. After the water content in the bagasse is already lost, weigh back bagasse is already dried, it will get a weight of moisture contained in the bagasse by reducing the weight of the pulp before it is heated with dried pulp weight.
d. Perform the extraction process bagasse or less for 60 minutes, by evaporating bagasse and given extra water by 10 liters.

e. Filter bagasse that has been extracted earlier using filter paper and filter capacity results in 110ml sized glass. The filtering process is done until it looks clear filtrate, add a purifying solution such as aqua and acetate. Once filtered pour the liquid on polbois, perform analysis with a tool saccharomat, it will get the value of the pol reading, record the results indicated on the device and then skewer with a water content contained in the bagasse, see the list of tables equation polarimeter to determine what percentage of the levels of pol on the bagasse.
f. Conducting the analysis of the sap water mill end to get the value of HK (the result of purity).
g. Finding value in the bagasse brix levels by reducing levels of pol results on bagasse with end mill HK levels.
h. The last step to find the percentage of fiber contained in the bagasse by reducing dry matter bagasse on pulp brix levels.

4. Results and Discussion

4.1 Results Percentage of Nira Purity

Table 1. Percentage of Nira Purity

Tanggal analisis	Pol %	Brix %	HK %
Tanggal 3 juli	1,22%	2,65%	46%
Tanggal 4 juli	1,75%	4,36%	40%
Tanggal 5 juli	1,86%	4,26%	44%
Tanggal 6 juli	1,69%	4,06%	41%
Tanggal 7 juli	1,32%	3,15%	42%
Tanggal 8 juli	1,59%	4.86%	33%
Rata-rata	1,565%	3,89%	41%

4.2 analysis of Fuel Moisture

Table 2. analysis of Fuel Moisture

Tanggal analisis	Berat 1kg ampas tebu + wadah nya	Berat ampas tebu sudah dipanaskan + wadah nya	Kadar air Ampas tebu	Kadar zat kering ampas tebu
Tanggal 3 juli	2272kg	1759 kg	51,3%	48,7%
Tanggal 4 juli	2272 kg	1750 kg	52,2%	47,8%
Tanggal 5 juli	2272 kg	1757 kg	51,5%	48,5%
Tanggal 6 juli	2272 kg	1755 kg	51,7%	48,3%
Tanggal 7 juli	2272 kg	1756 kg	51,6%	48,4%
Tanggal 8 juli	2272 kg	1747 kg	52,5%	47,5%

4.3 Fiber Content Analysis Results Fuel

Table 3. Analysis Results Fuel

Tanggal analisis	Kadar pol ampas tebu	Kadar HK gilingan akhir nira	Kadar brix ampas tebu	Kadar serat ampas tebu
Tanggal 3 juli	1,81%	46%	3,9%	44,8%
Tanggal 4 juli	1,80%	40%	4,5%	43,3%
Tanggal 5 juli	1,81%	44%	4,11%	44,39 %
Tanggal 6 juli	1,81%	41%	4,4%	43,9%
Tanggal 7 juli	1,81%	42%	4,3%	44,1%
Tanggal 8 juli	1,80%	33%	5,45%	42,05 %

4.4 calculation oflow Fuel calorific Value

From the data obtained, it will be calculated using the following formula:

calorific value= 4623lower%Fuel +4041%

- 100 - + 540 + - 100 0.48%

After 6 times calculation then obtained a low calorific value fuel bagasse average of 1481.11922 kcal / kg

4.5 Determining Heavy Fuel Boilers

Given:

% B = the maximum capacity of the percentage of 100% with a rotation speed of 800rpm

k = bagasse feeder maximum capacity 8000 kg / h n = Number of bagasse feeder 4 units / boiler

$$BB \,.\, k \,.\, n \qquad (7)$$

Calculated%with.. using the equation G =

After 6 times the calculations are obtained the weight of fuel boiler average of 23 467 kg / h

4.6 calculation of boiler efficiency

Of all the data has been obtained will be made to the calculation of boiler efficiency usingmethods. Direct The equation used is the Boiler Efficiency In thecalculation firstobtained boiler efficiency by:

$$\text{Efisiensi Boiler } (\eta) = \frac{E\,(h_2 - h_1)}{G\ x\ LHV}\ x\ 100\ \%$$

$$\text{Efisiensi Boiler } (\eta) = \frac{27000\,(743{,}081 - 98{,}03)}{28480\ x\ 1521{,}40034}\ x\ 100\ \%$$

$$\text{Efisiensi Boiler } (\eta) = \frac{17416377}{43329481{,}6832}\ x\ 100\ \% = 40\%$$

dilakuakn6 time calculation of the importance of the average efficiency of the boiler by 54%.

Table 4. calculation results Boiler Efficiency:

Tanggal	Efisiensi boiler (η) %
3 juli	40%
4 juli	62%
5 juli	45%
6 juli	52%
7 juli	48%
8 juli	77%
Rata-rata	54%

4.7 Graph Efficiency boiler Against purity results Nira

Having obtained the boiler efficiency boiler efficiency graphed based on the analysis of the results of the purity of the juice.

Graph HK sap mill end of the fuel bagasse to boiler efficiency

Off the charts The above terliha boiler efficiency decreases when the content of the juice purity results in rising fuel and boiler efficiency is optimal if the content of the juice purity results in fuel decreases.

Figure 1. Graph HK nira %

The incident occurred due to the quality of fuel bagasse niranya content of high purity result still contains a lot of sugar, resulting in a decrease in the efficiency of the boiler.

5. Conclusion

5.1 Conclusion

Based on the calculation of the analytical results of fuel quality on the efficiency of the boiler bagasse in sugar mills Bungamayang, the importance of the data and the conclusions drawn in the form of:

Table 5. contents of bagasse to the calorific value fuel

Tanggal penelitian	Kadar serat %	Kadar air %	Kadar gula %	Nilai Kalor Rendah Bahan Bakar kkal/kg
3 juli 2017	44,8%	51,3%	1,81%	1521,40034 *kkal / kg*
4 juli 2017	43,3%	52,2%	1,80%	1464,93092 *kkal / kg*
5 juli 2017	44,39%	51,5%	1,81%	1504,5038 *kkal / kg*
6 juli 2017	43,9%	51,7%	1,81%	1491,6191 *kkal / kg*
7 juli 2017	44,1%	51,6%	1,81%	1492,75166 *kkal / kg*
8 juli 2017	42,05%	52,5%	1,80%	1411,5095 *kkal / kg*

Table 6. sap levels against the calorific value of fuel and boiler efficiency HK

Tanggal penelitian	HK %	Nilai Kalor Rendah Bahan Bakar kkal/kg	Efisiensi Boiler %
3 juli 2017	46%	1521,40034 *kkal / kg*	40%
4 juli 2017	40%	1464,93092 *kkal / kg*	62%
5 juli 2017	44%	1504,5038 *kkal / kg*	45%
6 juli 2017	41%	1491,6191 *kkal / kg*	52%
7 juli 2017	42%	1492,75166 *kkal / kg*	48%
8 juli 2017	33%	1411,5095 *kkal / kg*	77%

Effect of the Fuel Quality Sugarcane Dregs Of Boiler Efficiency

1. The higher the purity of sap on a percentage of the fuel, then the efficiencies gained the boiler will be smaller.
2. In addition to the results of the purity of the sap, the content of the fuel can also affect the efficiency of the boiler. There are some existing content in fuel is bagasse pulp fiber content, moisture content pulp, and sugar residue. The content will be associated with a low calorific value of the fuel, wherein the lower calorific value of fuel the boiler efficiency will be further optimized.
3. excess of production capacity of the fuel is also not good, because it can decrease the efficiency of the boiler.

After interpolation, the importance of the average value of the enthalpy of the water boiler 102.278 kcal / kg and enthalpy average on steam boilers 738.158 kcal / kg.

5.2 Suggestions

As for suggestions that may be filed by the author of *"The Effect of Quality IngredientsAgainst Sugarcane Dregs Fuel Boiler Efficiency*" is:

1. It improved work efficiency boiler with checks and regular maintenance of the boiler itself and the fuel boiler.
2. In the boiler fuel, more thoroughly analyzing the contents contained in the bagasse.
3. If you want to get optimal efficiency, increased steam flow again.
4. For anyone who wants to take onmatter,
   the same subject it should be discussed more deeply than what has been discussed by the author. Examples calculating boiler efficiency by means of the indirect method.

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