Analysis Of Heat Effect Of Fuel Made Of Palm Fiber And Kernel Shell On The Efficiency Or Water Pipes Boiller

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Abstract. boiler is a steam generator which is composed of a combination of complex form of economizer,boiler, heating up, reheat, and initial air heater. Fiber and shells is one example of a solid boiler material. Each fuel boiler has a value LHV different.Value Low Heating Value hightest by fuel boiler shells kinds pure with a value 44184.391 Kcal / Kg, while for LHV fuel value of the smallest boiler boiler fuel owned by pure fiber types by value 29959.325 Kcal / Kg. , Obtained with the use of boiler types of pure and mixed fiber B is 80% + 20% fiber shell boiler produce the highest efficiency with the value of 83.6236948% the number of different fuels to fuel pure fiber as fiber spent 129.1945968 Kg / H while mixture B spent 108.788094 kg / H. Keywords:boiler,fiber,pulverizer, fan, shell type boilers, Low Heating Value

1. Introduction

*boiler*or boiler is avessel / container that contains water or other fluid to be heated. The heat energy of the fluid is then used for various purposes, such as for a steam turbine, heating, steam engines, and so forth. In the energy conversion process, *the kettle* has a function to convert the chemical energy stored in fuel into heat energy that istransferred to the working fluid. Heat is provided to the fluid in the boiler comes from the combustion process with various types of fuel that can be used, such as liquid fuels, solid fuels, and fuel gas. With the advancement of technology, nuclear energy was also used as a fuel to generate heat sources on *the boiler*. It can be seen that the boiler fuel requirements must have a calorific value which was enough to turn water into steam, andthe calorific value of a fuel also affects the efficiency of *the boiler* itself. *Fiber* and the shell is just one example of the solid fuel used in the boiler. This fuel is the output or *output* resulting from the processing of palm oil mills.According to research conducted by Pesulima Coal (2014) in its Palm Oil Mill, North Sumatra with a working capacity of 45 ton TBS / hour using a boiler fuel that is a mixture of *fiber* and shell with perbandigan ratio of 75% *fiber* and 25% shell. Retrieved high combustion calorific value (HHV) is 21323.584 KJ / Kg, lower combustion heating value (LHV) is 18083.584 KJ / Kg, while the value of *boiler efficiency* the highestproduced by 71.05% andvalueefficiency *boiler* the lowestresultingamounting to 69.49%. The author's purpose of this thesis is: Getting the calorific value of fuel *fiber* and shell through laboratory testingtool using a bomb calorimeter, calculate *the efficiency ofboilers* water tubethat use fuel *fiber* and shells.

2. Literature Review Definition *Boiler*

Boiler is a steam generator that isconsisting of a complex combination of form economizer, boiler, heating up, reheat, and initial air heater. In addition to these systems, particularly those with coal fuel, have a variety of equipment such as the combustion chamber, *pulverizer,*burner, *fan,*emission control equipment, chimney and ash handling equipment. Kettle is a part of the steam generator where the saturated water vapor is converted becoming saturated, although it may be difficult to separate them by ekonomiser. In some literature, the term boiler*(boiler)*is sometimes used to mean the steam generator.

2.1 Classification Boiler

Boilertank*(shelltype*boilers)is a *drum* or sleeve*(shell)*closed cylindercontaining water. Part of the sleeve such that the bottom is simply terepose to heat, the combustion gases outside. Kettle type of

casings develop slowly into a modern form as an electric kettle, in which heat is supplied by electrodes placed in the water, or accumulator, in which heat is supplied by steam from an external source that flows through the pipes*(tube*s) within the sleeve.Fire tube boiler has been used since the late eighteenth century, since the beginning of the development of the boiler, in various forms to produce steam for industrial purposes. Fire tube boiler is used diindustri power plants to produce saturated steam at 250 psig pressure limit (about 18 bar) and a capacity of 50,000 LBM / hour (6.3kg / sec). Although the size, hasgrown bigger, but rancanganya not really changed in 50 years tramstop. Fire tube boiler is a special form of development kettle types of casings. The hot gas, steam it open, flowed through the reeds (pipes). The increase in the fire tube boiler heat more efficiently than the sleeve and can mecapai boiler efficiency of 70 percent.

Boiler water pipe Early in the development of modern steam generator, boiler water pipes developed by George Babcock and Stephen Wicox in 1869. Since theearly century, twentieth with thedevelopment of steam turbines require a high steam pressure and flow, development of commercial boiler water pipes become increasingly rapidly. With the steam pressure and greater capacity, fire tube boiler requires large diameter casings. With this large diameter, selogsong must operate under pressures and temperatures so high that should be thick. Price becomes very expensive.

2.2 Various fuels boilers

Solid fuelcontained in our earth is derived from organic substances. Solid fuel contains elements such as: carbon or carbon (C), Hidrogin (H), acid or oxygen (O), nitrogen or nitrogen (N), sulfur (s), Ash and Water, all of which it is bound in a chemical persenyawan.Liquid fuels derived from petroleum. Petroleum is obtained from the soil by way diadang-oilfield drill it, and pump it up above the earth's surface, to then be further processed into a variety of fuel oil.Gaseous fuels in the ground are contained: gas (petrol gas) or sometimes referred to as natural gas, which arise during the process of the formation of petroleum, mine gas and swamp gas(CH4 or methane). As with oil, the natural gas obtained by drilling from the soil, both on land and offshore to locations that are suspected of natural gas content.

2.3 parts boiler

1. *Drum* on befungsi placeevaporation of water that has been heated by pipes circulation regulated sedekimian such by a casing mounted on *drum,*the so that the steam rises miss out on continuously through the sieve of steam, the steam will continue to flow kepipa*superheater* and hot water re-circulation to *drum* down through the pipes BR and SHC, regularly feed water fed into *the drum* on thepump*electrik* or turbine pump.
2. *drum* Underserves as aincorporating a water heating plates for easy disposal of sludge collectors out *(blow down).*
3. *Front header*tube, *side header*tube,and the*tuberear header* serves as apipeevaporation of water, where the pipes directly related to or contact with flame.
4. *superheater*Serves as aShaper / producer of dry steam, by reheating steam from the *upper*drum,where the vapors from the *upper drum* flows in *superheater*andthe outer pipe is exposedhot gas that has a very high temperature so that the grains will evaporate in the *superheater* dry steamand obtained.
5. Kitchen or grate is the space where the combustion of fuel, floor grate made of cast iron is called *firebar,*also equipped with holes and the wind,Wind of FD *Fan* into the fuel space through these holes to accelerate the process of burning and the wind also serves as a coolant *fire bar.*
6. ID *Fan* is a suction blower or wind tug to pull the hot gases from the combustion chamber fuel haasil kitchen keeps out the chimney.
7. *Secondary fan* is additional windwhich serves as the driving fuel into the kitchen, and for the improvement of fuel combustion in the kitchen.

8. Turbine *pump* is a water filler *boiler* pump-pressureplus 10 kg / cm2 ofthe steam pressure in *the*boiler.to *electrikpump*,switch on or off there were paneled andampere meter manual electro motors.
9. Coarse ash funnel is located below *drum* the bottomfront portion, serves tocollects coarse ash carried by the wind suctionID, *fan*must often be discarded, if allowed to happen what is called a second combustion that is not diinginin.
10. Dust colectorBerfungsi to catch a fly ash or fine dust. Dust colectorsedekemian designed in such a funnel fitted bottom water lock, which regularly can reduce the fine ash.
11. Safety valve (safety valve) serves to maintain the excess pressure *steam*boiler,whenthepressure*steam*exceedspressure, *steam* the prescribed the safety valve will open itself, and closed again, when the pressure has dropped to normal.
12. Glass probe mounted on *the drum* top, serves to control / see the water level in *the drum* top. Glass should be cleaned every other probe will operate *the*boiler,and can also be cleaned during *boiler* operation.
13. Alarm sign full or less water in the *drum* will sound, and the red light low level of water insign of life *the drum* has been lacking, immediately add water by opening the tap by-pass until the green light, a sign of water in normal dru.

3. Research Methodology The place and time of the study

This study was conducted in April s / d in August 2017. Sampling was conducted at PT. Palm Lampung right way Persada District, Lampung Province. Analysis of activities conducted in the Laboratory of Mechanical Engineering UniversityBandarand Laboratory AnalystLampung,Lampung State Polytechnic.

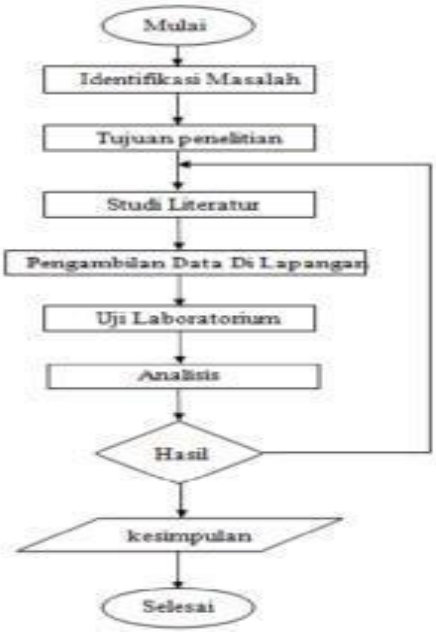
3.1 Tools and materials

Testingwill use a tool bomkalori meter, which is a tool used to find the calorific value of a material. While the material being tested is a boiler fuel that is *fiber* and shells.

3.2 Variables loaded

On testing the *fiber* and the shell will use the tool bomkalori meters, with the parameters tested is *heat* (energy). The variables of this testing will be used to find the calorific value of fuel, namely the High Heating Value (HHV) and the Low Heating Value (LHV).

3.3 Design Flow Diagram



4. Results Analysis and Discussion

4.1 Data Designers Research data bomkalori meter

Sampel fibre murni

NO	T_1 (°C)	T_2 (°C)
1	28,68	30,62
2	28,60	30,12
3	28,66	30,60

Sampel campuran 90% fibre + 10% cangkang

NO	T_1 (°C)	T_2 (°C)
1	28,89	30,72
2	28,58	30,76
3	28,56	30,72

Sampel cangkang murni

NO	T_1 (°C)	T_2 (°C)
1	27,74	30,30
2	28,19	30,92
3	28,14	30,68

Sampel campuran 80% fiber + 20% cangkang

NO	T_1 (°C)	T_2 (°C)
1	28,44	30,23
2	29,50	31,29
3	28,38	31,16

4.2 Calorific value fuel

In calculating the calorific value of fuel fiber and shells this time using a formula derived from laboratory tests, namely:

1. The calorific value of combustion (High Heating Value)

   HHV = (T2 - T1 - 0.05) x Cv Where:

   T1 = temperature of the water before it is turned on(^{o}C) T2 = temperature after the water is turned on(^{o}C) Cv = heat value type of bomb calorimeteris 73529.6 (KJ / Kg$^{\circ}$C)

   0.05 = the value of the temperature rise due towires lit
2. burninglower calorific value (low Heating value)

   LHV = HHV - 3240 (KJ / Kg)

4.3 boiler efficiency calculation

boiler efficiencyis given by:

η = useful heat for evaporation heat supplied to the boiler

$$\eta = \frac{\text{kalor yang berguna untuk penguapan}}{\text{kalor yang diberikan pada ketel}}$$

$$\eta = \frac{B(H_1 - H^1)}{G \times LHV} \quad \text{..... (1)}$$

Where:B: The flow rate of steam (Kg / H)

H1: enthalpy of water at the turbine inlet (Kcal / Kg)

$H^{1:}$ enthalpy of water at the turbine inlet (Kcal / Kg

G :Total fuel consumption (Kg / H)

LHV: the calorific value under fuel (Kcal / Kg)

5. Conclusion

Based on testing and analysis conducted found some important points that can author kemukankan, among others:

a. Value boiler efficiency is the highest generated 83.6236948 of boiler fuel using pure fiber and fuel mixture that is 80% B + 20% fiber shell, while the lowest value of the boiler efficiency generated at 83.6236937% of boiler fuel using a mixture of 90% fiber + 10 % shell.

2. Lower calorific value fuel boiler has a different value, such as pure fiber has a value of 29959.32 Kca / Kg, pure shell has a value 44184,34466,85645 Kcal / Kg, a mixture of 90% + 10% fiber shell has a value of 34466, 85 645, and a mixture of B is 80% + 20% fiber shells coined 35579.044 value.
3. Number of boiler fuel consumption for each type of fuel for the boiler has a value that varies. Togenerate steam 241,113.3 kg / H highest amount of usage ispure fiber fuelas much129.1945968 Kg / H, while the lowest amount of usage is as much pure fuel 87.6006864 shell Kg / H.

4. A large amount of fuel used for boiler operationdepends on low heating value (LHV) of the fuel for the boiler itself. The higher the value of a fuel LHV the less the amount of fuel used, and vice versa the lower the value of a fuel LHV the more the amount of fuel used to operate the boiler.
5. Waste from the production of palm oil companies are *fiber* and shells. Palm shells still have economic value or selling price to consumers is Rp 200 / kg it, compared with *fiber* the samedoes not haveselling price.

So that I, as the authors concludebased on these parameters that the use of fuel for the boiler at the company PT.Palm Lampung Persada better use of fuel types f*ibre* pure. Can we know fiber is waste for companies that can not be recovered compared with a shell which is a waste as well but still have economic value because it is sold to consumers, as well as of the calculationsobtained turns out efficiency boiler fuel use fiber pure is not much different kind other fuels.

5.1 Suggestion

As for suggestions that can be submitted to the company PT.Palm author Lampung Persada and the reader, to enhance the research on the analysis of calorific value of fuel fiber and the shell and the effect on the efficiency of the boiler is:

1. Better to use the type of fuel boilers pure fiber because of its value heat is not so much with a calorific value of fuel other and boiler efficiency ishigherthan other types of fuel used.
2. To note back testing calorific value of fuel, would be much better if the search for fuel heating value HHV and LHV use the material composition analysis test so that the calorific value can be determined using the formula petit Dulong.
3. Similarly, look for the value ofthe boiler efficiency, better use of the equation that is more complete than using the energy balance equation is simple.
4. In terms of economy, fuel fiber is suitable for boiler fuel, because fiber does not at all have a different value for the fuel sold shell still has a sale value to the consumer.
5. To purchase a new boiler unit to consider the capacity of the boiler, in order to purchase in accordance with the rotation allowed by the turbine to turn a generator, so that the boiler is not working as over-capacity in Lampung PT.PalmPersada.

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