Analysis of biomass energy in wasted fruit bunches and palm skins

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Abstract. The biomass energy has advantages, such as low-cost production, friendly electricity supply, no damage to the ecosystem, and efficient. Based on the advantage, we have focus research discusses the energy of the palm oil factory and waste fruit bunches. The kernel bark from palm oil to be the biomass energy source, and then to fill the shortage of electrical energy sources. The Biomass uses a combustion process to produces hot steam, so it drives the steam turbine and generates electrical energy. The fresh fruit bunches and palm kernel shells are resized and the water content made dried in the biomass is reduced. Furthermore, the biomass is fed into the boiler and produces electrical energy for generates a power unit. The energy produced varies depending on the size of the biomass and the biomass drying process. The deficiency of electrical energy can be added from biomass energy to supply electrical energy.

1. Introduction

The rise at every human in the past years has made more of electric sources not only a fossil fuel but also many things. Various sources of electricity have gathered for replacing fossil fuel like turbines, the energy of solar, the power of hydroelectric, biomass. The specification from material to become biomass has collected seriously for many years because of the progress at creating the energy with sustainable and then sources that unwanted. Between the many transform progress or changes from different biomass, the waste from conversion into something has clear luck at less investment in producing some of CO to every biofuel. One of them is by using biomass potential [1].

Coal is a source of fuel used because it is cheap and has constant use. The use of coal is quite rapid in the future because of the increasing number of coal power plants being built and planned and then made into a form of renewable energy. However, the coal obtained by importing and burning coal carried out to increase the power to produce or emit very high levels of carbon dioxide (CO₂) and were also a major lead for warm-up. Biomass might result in global warming. A total number of the fresh bunch is estimating at about hundreds of million metrical tons. The process has involved a removal for oil palm fruit as of a branch and then extract the oil, concerning seventy percent from a mass of the mass of fresh fruit bunches (FFB) is left at heavy shape whose is an empty bunch, oil fiber, kernel bark, and the fluid shape in palm mill effluent. Among others, Empty Fruit Bunch was generated, covered twenty-two percent for fresh fruit bunches with heaviness. The strict fibred ingredient is surfeited by water as a consequence of biology factors combine by the process of steam sterilization at the palm mill. Raw water content empty bunch around 65-67%. So, thermal pretreatment is needed before an empty fruit bunch should consider the best fuel. At a other hand, VFD whom was a bark fragment lag behind beans have erased after being crushed, it has a poor haze ingredient among eleven to fifteen percent. Especially kernel bark too for fiber has some high till regular heat value empty bunch and kernel bark because thither is a trace from oil residue at it. Biomass residues are explained in Table 1 If there are any technical obstacles, it would cope with at combining empty bunch and
kernel bark by coke within coke power plants. The technique of small fuel mixing the coke ingredients is replaced by the empty bunch and kernel bark at a furnace.

Meanwhile, minimum modifications are merely needed for repository systems. In addition, costs power plants can be reduced because there are no criteria for building biomass power plants, therefore there are no additional downstream costs for network connections. However, logistics costs to obtain empty bunch and kernel bark out of a set place can get very higher as from palm tree factories were spread all over the land, especially within the interior. Empty bunch and kernel bark behoove for getting cultivated first for erasing haze although increase the nature of the fuel [2]. If using wind and photovoltaic power plants, the source of electrical energy is unstable and does not meet the managed energy supply is needed. Empty bunch has characteristics out of high lignocelluloses compound content which creates several a problem for its management because of the large numbers fiber creates during fulfillment.

This was wherefore Empty Fruit Bunch many times flared because of farmers seldom more high climate contamination. As a result, it always includes several remnants from oil and then should attractive towards establishment biogas (grease and then protein) has a higher potential of methane. By reason of it’s getting degrade biodegradable cause through a lot out of ingredient from lignin and cellulose was more notable for ingredient pre-treatment. That should have finished at divers methods: machinal, feverish, physics, and then chemistry [3]. Oil palm from the bunches of fresh is going to be a Mill (PKS) to produce palm oil. The empty fruit bunches has celluloses, hemicelluloses, and then lignin, Empty fruit bunches who were used for alternative fuels and energy can be used effectively. Among these pretreatment methods, a method for treating water at elevated temperatures and pressures is called compressed hot water which is usually used for this process in order to run effectively. Solid waste out of palm oil namely empty bunch, palm tree fiber, and palm kernel bark will cause serious effects living environment. Therefore, the use for an empty bunch of outturn values very higher synthetical is an expectant way to nothing.

Table 1. The attribute of biomass from wasted fruit bunches and palm skins

| The Biomass          | Empty Bunches                  | Palm Fiber                    | Kernel Bark                  |
|----------------------|--------------------------------|-------------------------------|------------------------------|
| Description          | Strict shape and burned-out    | Soft shape and strong for burned at boilers | Strong shape, can be handled in bulk and strength for burned at boilers |
| Percent from fresh bunch | > 21                          | > 13.4                        | > 5.4                        |
| Dirty Weight         | 18.90 ± 0.75                   | 19.10 ± 0.35                  | 20.10 ± 0.45                 |
| Haze Ingredient      | 67.10 ± 1.45                   | 37.10 ± 2.10                  | 12.10 ± 1.10                 |
| Ashes Ingredient     | 4.70 ± 0.60                    | 6.20 ± 0.95                   | 3.10 ± 1.30                  |

Cesspool processing. Because there contains cellulose, hemicelluloses and lignin hence the added value from empty bunch towards firing and then alternative strength as well as ethane and outturn Empty bunch and kernel bark outturn demands a way of pretreatment so that accessibility and reactivity towards carbon sources (celluloses and then hemicelluloses) after microorganism. Between away, treatment of water techniques upon altitude mercury, and then strain named compressed thermal water presently exists. A way of pretreatment used was the manner was broiled towards a mercury series out of one hundred fifty-four to 260° and then elevated pressure from ten to thirty bar where the water shows since no ion lateness and then dissolve hemicelluloses, and then lignin out of lignocellulose empty bunch and kernel bark. That requires a lower amount of period from five to twenty minutes, if not hemicelluloses are a polysaccharide that is converted to inhibit the growth of microbial. That technology was declared to get an appropriate technology because nothing hothouse
gases are produced and then there is nothing needed of chemicals. Water being a sub-critical condition will break the bonds between the lignin-carbohydrate complex down so as to result at preferable accessible for the celluloses contexture. That leverage can increase the efficiency of deep cellulose hydrolysis consequent celluloses depolymerize with enzymes whether microorganism. Towards zymosis, corporate saccharification, and then zymosis was usually well-thought-of desire amalgamated legal action towards ethane outturn. The furnishes several diverse merits from being distinct saccharification and then zymosis at clearance from the final proceeds inhibits hydrolysis of cellulose and then shuffles it entire of processing time of grape sugar is revamped to ethane. If the temperature is optimal towards commerce cellulose the activity of the enzyme was much supreme till the original growth of microbial at 30° C to 37° C, like 50° C towards cells Novozymes and accelerate. Later, ethanol produces hydrolysis, and the fermentation process is grabbed inside the benchmarking of account corporate saccharification and then zymosis and distinct saccharification and then zymosis from certain enzymes and then microorganisms utilized. It aims to modify the oil empty bunch to generate firing ethane. Hemicellulose fractionating comes out of an empty bunch because of thermal-compression technique for watering destroys a

Table 2. The shape of biomass from wasted fruit bunches and palm skins

| Treatment                  | Empty Fruit Bunches, EFB (mm) | Palm Fresh Fibre, PPF (mm) | Palm Kernel Shells, PKS (mm) |
|----------------------------|-------------------------------|---------------------------|------------------------------|
| Unrefined Wasted Bunch     | 110 – 160                     | 0.9 – 2.9                 | 0.25 – 1.5                   |
| Compression, tearing + chopping (Kinetic Disintegration System) | 60 - 85                        | -                          | -                             |
|                            | 5 - 25                         | < 1                       | < 1                          |

Figure 1. Magnifying Device (KDS)

Structure of an empty bunch so that SHF and then SSF are produced. The temperature at corporate saccharification and then zymosis and distinct saccharification and then zymosis at the hydrolysis of
enzyme results and then ethane zymosis results will develop [4]. Biomass crushed, cut, and then sent to the size setting [5]. The magnifying device (KDS) for this research as follows in Figure 1.

2. Literature Study

2.1 Enlarged Size of Wasted Fruit Bunches

The enlargement of size at the fresh bunch, it can be done by monitoring on plantations to get treatment according to the standard so that the wasted ie the bunch of palm empty and the skin of palm kernel is processed to become suitable biomass energy. Previously, Fresh Fruit Bunches weighed 10 – 40 kg. And then, the table out of the shape of biomass from wasted fruit bunches and palm skins is a fiber which is derived from oil palm fresh fruit bunches. This is used for different sizes. Then, this measure is also used as a reference. Table 2 and Fig.1. are as follows [5]. As for a process to reduce the water content of waste to improve the combustion process in a boiler with a study to find out the gasification is changing biomass into fuel gas. Use various exemplar from empty bunch, and kernel bark gathering not handled and then medicated empty bunch and kernel bark then conducting gasification experiments using a mixture palm kernel cover and then cover of coconut at the form of a gasifier from the downdraft.

The outcomes pointed lest gasified from the mingled shell produce performance matching to woody empty bunch and kernel bark. Some experiments use lumber shavings and then candleberry tree cover since raw material and then build lest equality ration is zero points thirty-five produces a topless product gas broil remove for both biomass. A study evaluates four different types of raw materials, scilicet fir lumber, dobbin dung, and then pasteboard. That should be noted the gasification survey is riveted notably at no treated empty bunch and kernel bark. Not that one staggering given the substantial costs embroiled at it medium treatment of raw biomass. And then compare thermodynamics and then gasification exhibition from unrefined Indian cane to baked Indian cane with bake mercury from 200° C to 350° C. The result of the analysis shows lest the result of supreme bake temperatures in syngas outcomes is supreme. The strength from the palm shells since extensible strength sources and then fail from studies at downdrafts adopting a used gasifier, this work focuses on baked and then unrefined gasification performance kernel bark upon diverse equality proportions. That a product gas contexture is sized and then reduce broiling grade from a gas ranked [6]. Some results are known from the research, namely to eliminate high water and potassium content from Oil Empty Bunch and then Kernel Bark. Biomass became an energy source of renewable by replacing the fuels of fossil to overcome the damage of environmental.

Shell and EFB biomass contain lignocelluloses (cellulose, hemicelluloses, and lignins) that should convert for firing extensible strength sources. How to convert lignocelluloses can past after lineal combustion, gasification, liquefaction, bake and pyrolyze. Pyrolyze is used upon that pick up since that produce charcoal, liquids, and the gas has distinctive functions. Output contexture should have supervised to legal action supervise. The results are obtained by showing that it is flammable gas heating value increases at pyrolyze the mercury rises. Empty bunch and kernel bark pyrolyze were influenced to stuff group (measure and then lignocelluloses), gauge, mercury, broil level, and then others. The purpose of that research was for gage to produce gas in legal action by pyrolysis from oil shells and an empty bunch (EFB) influenced by temperature [7]. There are several of methods used in oil palm fresh fruit bunches. The process from producing bioethanol consists of pretreatment, hydrolysis, and distillation to get pure ethanol as ethanol substitute fuel with enzyme hydrolysis to increase glucose content, which is to obtain efficiency by increasing cellulose content. The purpose of pretreatment is lignification and then should have finished for crush lignins contexture and then to provide optimal results in bioconversion lignocelluloses can be fermented. Basa middle treatment (Natrium Alcohol) was usually for change in a contexture cellulose empty bunch and kernel bark because of erasing lignins and then hemicellulose. Distinct saccharification and then zymosis incriminates three consequent steps, enzymatic saccharify and then zymosis lest permits work in best executing term towards enzymes and then microorganism. The corporate saccharification and then
zymosis legal action had many merits. Since surgery decreases every expense, down enzyme requirements, and then increased fecundity. The middle treatment legal action would produce large quantities of wastewater at superior synthetic oxide solicitation and then cheap solvable oxide. Accordingly, that was dangerous for the ecosystem of aquatic whether discharged immediately for the water sans a special maintenance tract. Accordingly, previous to being undone into a milieu, wastewater must have handled because of erasing whether degrading definite dangerous factor utilizing physics, chemistry and then biologics ways and also minimizing liquor of black should have finished to reusing liquor of black since middle treatment lateness towards empty fruit bunch whether another pretreatment lignocellulosic stuff other than empty fruit bunch, such regarding bagasse of sorghum whether corncobs. Except this, aptitude physics, chemistry, and then biologics legal action towards biomethane wastewater handling has inspected.

Some methods such as frosting, fenton and then suction were usually outworn for handle neat pollutants. Polyaluminum Chloride had built to get the efficient coagulants for degrading synthetic oxide solicitation and then a coloring at mush manufactory wastewater as regards eighty-four percent and ninety-two percent, serially, and then were deposited ninety nine point five percent of delayed solids. The legal action of fenton works erase coloring, synthetic oxide solicitation, biologics, oils, and then stinks out of factory cesspool. Suction uses propel charcoal well-thought-of the supernumerary way for removing organics pollutants with economic viability, deep modesty pattern, and then surgery. The purpose of this quest is to analyze EFB potency towards deciding an aptitude from chemistry ways towards wastewater upkeep [8].

2.2 Fertilization Process

Biomass can get demineralization using leach methods [9]. The conversion from thermal can result in a CO neutral [10]. The affects the size of the bunch of empty fruit and core skin of palm bunch, is good and regular fertilization. The fertilizing, by giving fertilizer when there is no rain or dry when using urea fertilizer and also fertilizing is done evenly on the edges in a circle. It can also use kieserite fertilizer. Fertilizer is an ingredient or element in the form of organic or inorganic compounds for soil and plant nutrition. Fertilization must be done in a manner that consists of the right type, the right dose, the right time, the right way, and the right target. So, fertilizing activities must receive strict supervision from the supervisor. Doses and types of fertilizers use standards from leaf analysis results, soil analysis results, observations of plant growth, symptoms of nutrient deficiencies that occur or appear in the garden, production of fresh fruit bunches achieved per ha/year and the realization of fertilization before taking into account the age of the plant. Fertilization is done twice a year.

3. Research Methods

3.1 Size Adjustment Process

Palm Kernel Shells that have been processed and removed from the air gate output, will be put together with Palm Oil from the bunch of empty fruit that could produce the energy of renewable. Size from the bunch of empty fruit, the oil of palm core and fiber can be regulated by squeezing and shredding the fruit bunch of empty, the palm of oil, also needed a tool to be able to set the size from the bunch of empty. The size from the bunch of empty fruit will also be arranged in the same manner on the Palm Core Skin then as for the size to be 7 – 28 mm and the size of the palm shell to be under 1,2 mm. The process, namely: palm kernel shells are inserted into the air gate input and then the shells of palm were accommodated in a rotor chamber then squeezed and then the shells of palm were peeled in a peeler room then torn in the peeler room and the palm kernel shells have been squeezed and torn, brought to the union so that all the palm kernel shells that have been squeezed and torn, dried and then acoomodated at the air gate output. The same thing is done at the palm oil of empty fruit.

3.2 Thermal Drying Process

Thermal drying, namely Wasted Bunches was put into the special place to dryer containing dry air so that there is a mass transfer of water out of the bunches of empty by a drying air. The results of the
Palm Kernel Shells and the bunches of empty are put together and then put into the steam generator boiler that is stoker which has an efficient nature when fueled with low CO content, so that it has a high enough heating ability and then produces lower carbon emissions compared to the type other boilers. Flowcharts are explained and explained in sentences. First, start research. Then insert the palm empty bunch and kernel bark to the KDS (Kinetic Disintegration System) tool that will squeeze and tear the palm empty bunch and palm kernel shells. When the KDS (Kinetic Disintegration System) tool works, the empty bunch and kernel bark were squeezed strong enough and shredded to have a suitable size. After that, the Kinetic Disintegration System (KDS) tool gives results, namely Empty Fruit bunches that have been squeezed and torn to have an appropriate size and then collected. And then, inserting the empty bunch and kernel bark into a room for being dried so that the empty bunch and kernel bark do not have unnecessary ingredients such when water content. In the process, there is an exchange of water and steam for the dryer so that water content is lost at an empty bunch and kernel bark. Then, the empty bunch and kernel bark were dried so as they should have used for biomass processing. The biomass that is taken is that which has no water content. After obtaining the appropriate biomass, then there will be the results of the an empty bunch and kernel bark that had been dried. Then, biomass from empty bunch and kernel bark is put inside a boiler to be used as renewable energy from biomass. And, the research ended.

4. Results And Discussion

4.1 Test Values for Size Settings

After it is inserted into a device which then the device will adjust the size needed for biomass energy. The data obtained as follows in Table 3 Size settings are a data collection that can be used to adjust the size of the biomass at oil palm empty bunches. On data collection, taking data from the size of palm empty bunches and palm kernel bark which had a different initial value from the final value. So, the size settings are a collection of values after the size of biomass such as palm empty bunches and palm skin is enlarged. After that, conduct research at excerpt energy value from palm empty bunches and kernel bark.

| Biomass Name      | Initial Size (mm) | Final Size (mm) |
|-------------------|-------------------|-----------------|
| Empty Fruit Bunches | 150 – 175         | 7 – 28          |
| Palm Kernel Shells | 1 – 2,25          | Below 1,2       |
Table 4. Biomass energy results

| Biomass Size (mm) | Temperature (°C) | Enthalpy (kJ/kg) | Power (kW) |
|------------------|-----------------|-----------------|------------|
| 9.6              | 110.08          | 450.18          | 1673.2     |
| 15.9             | 129.8           | 2809.15         | 2057.8     |
| 21.0             | 179.04          | 2819            | 3057.9     |
| 27.1             | 239.19          | 2917.79         | 3577.5     |

Figure 2. Graphic of biomass energy

To turn the steam turbine and then drive the generators to produce the required electrical energy. The data and graphic obtained as follows in Table 4 Graphic of biomass energy is a graph which shows a result of biomass energy where the size of the biomass has different sizes, as depicted in Fig. 2. The conclusion of the graphic is that the greater the size of the biomass, the greater the power. Biomass energy results is the result obtained by burning biomass consisting of palm empty bunches and kernel bark. This combustion is combined to produce biomass energy. The biomass produced can be made using the following graph.

5. Conclusion

From the results of the analysis that has been done it can be seen that the size can affect the energy produced later by using other methods, the results can also be obtained, namely Palm Kernel Shells and Empty Fruit Bunches are squeezed to have a finer size and in accordance with what is needed, when it has a calorific value, biomass can be utilized to become fuel which is then converted to electricity as renewable energy and renewable energy from biomass has different values, depending on the size of the biomass when conduction research.

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