INNOVATION TECHNOLOGY FOR THE USE OF CORN COBS FOR RENEWABLE ENERGY

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ABSTRACT

This research aims to examine the potential of corn cobs as a renewable energy source and explore optimal processing methods as well as the economic and environmental impacts of their use. Research methods cover various stages from data collection, laboratory experiments, technical and economic analysis, to environmental and social impact evaluation. Using quantitative and qualitative approaches to explore the potential for using corn cobs as a renewable energy source. Utilization of corn cobs as renewable energy is a potential solution in facing energy and environmental challenges. The research results show that corn cobs have significant calorific value and can be processed using methods such as briquette production. Although there are still challenges in terms of technology adoption and investment, the resulting economic and environmental potential is very promising. Community empowerment through corncob-based energy production can be a strategic step in developing renewable energy in rural areas. Briquettes as an Alternative Fuel. Production of briquettes from corn cobs offers a practical solution for people who need alternative fuel at an affordable price. The quality of briquettes produced from corn cobs is sufficient to meet energy needs in households and small industrial scales. In addition, briquettes from corn cobs are also cleaner to use compared to coal or firewood.

Keywords: Corn Cobs, Renewable Energy, Briquettes.

INTRODUCTION

The global energy crisis and increasing greenhouse gas emissions have driven the search for environmentally friendly and sustainable renewable energy solutions. In Gorontalo, the agricultural sector produces a large amount of waste, one of which is corn cobs, which are often not utilized optimally. Although a small portion of this waste is used as animal feed or traditional fuel, the majority is simply thrown away or burned, causing pollution and wasting resources. The energy potential of this waste has not yet been widely developed, although several studies have shown that corn cobs have a calorific value comparable to other biomass that is commonly used as fuel. Therefore, using corn cobs as renewable energy is a potential solution to reduce dependence on fossil fuels while simultaneously overcoming environmental problems.

The need for energy continues to increase along with population growth and economic development. However, most of the energy used still relies on non-renewable resources, such as petroleum and coal, which are limited in quantity and have a negative impact on the environment. Therefore, the search for renewable energy

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alternatives is very important. One source of renewable energy that has great potential but has not been utilized optimally in Indonesia is biomass, especially from agricultural waste.

Gorontalo Province, which is one of the largest corn producing regions in Indonesia, produces large volumes of corn cobs as agricultural waste every year. After harvest, most of these corn cobs are thrown away or burned, which causes air pollution and wastes potential energy. In fact, corn cobs have significant energy content and can be used as an alternative fuel through various technological processes such as gasification, pyrolysis, or making briquettes.

Utilizing corn cobs as a renewable energy source can not only reduce dependence on fossil fuels, but can also help overcome environmental problems caused by agricultural waste that is not properly managed. Apart from that, the development of renewable energy from corn cobs can also provide additional economic value for farmers and communities in Gorontalo, as well as opening up new business opportunities in the waste-based energy sector. This research aims to optimize the use of corn cobs as a renewable energy source through the biomass briquette production method. In addition, this research also examines the economic, technical and environmental impacts of implementing this technology at the local level, especially in agricultural areas. It is hoped that the research results can contribute to the development of renewable energy based on agricultural waste that is more efficient and environmentally friendly, as well as empowering rural communities through the management of economically valuable corn waste.

RESEARCH METHODS

This research uses quantitative and qualitative approaches to explore the potential for using corn cobs as a renewable energy source. The method applied involves several important stages as follows:

1. Data Collection

Primary Data: Primary data was collected through direct observation in the field, interviews with farmers, and laboratory experiments.

Secondary Data: Secondary data was obtained from research reports, scientific journals, agricultural statistics, as well as related literature regarding biomass energy and agricultural waste.

2. Laboratory Experiments

Chemical Composition Analysis: Testing the cellulose, hemicellulose and lignin content to identify the potential energy that can be produced.

Calorific Value Testing: Corn cobs are tested to determine the calorific value (MJ/kg) using a bomb calorimeter, to determine the potential energy that can be produced.

Briquette Making: Corn cobs are processed into biomass briquettes, measured in terms of physical durability, density and combustion efficiency.

3. Technical and Economic Analysis

Energy Efficiency: Calculation of the energy efficiency of each briquette processing method is carried out by comparing the amount of energy produced with the raw materials used. Production Cost Analysis: Calculate the cost of producing energy from corn cobs, including initial investment, equipment, operational and distribution costs.

Economic Potential: An analysis of the economic potential of using corn cobs was carried out, especially in creating new business opportunities for local communities.

4. Community Empowerment

Field Case Study: A case study was conducted in a rural community to understand how the use of corn cobs can be applied on a small scale, as well as how the technology used can empower communities through training and the construction of biomass-based energy processing units.

Research was conducted to analyze the physical and chemical characteristics of corn cobs. Laboratory tests include:

RESEARCH RESULT

a. Characteristics of Corn Cobs as Biomass

Chemical Composition: Analysis shows that corn cobs contain cellulose (35-40%), hemicellulose (20-30%), and lignin (15-20%). This composition makes it a potential material to be used as biomass fuel.

Calorific Value: Test results show that corn cobs have a calorific value of around 17-19 MJ/kg, which is comparable to other biomass such as wood (18-20 MJ/kg). This shows that corn cobs are capable of producing quite a lot of energy.

Availability: In the research area, especially in corn farming areas, corn cobs are available in abundance and are often not used optimally, only being thrown away or burned on the land.

b. Energy Processing Methods

3Biomass Briquettes: Making briquettes from corn cobs shows good results in terms of compaction and durability. The resulting briquettes have a fairly high energy density and can be used as alternative fuel in households and small industries.

c. Economic Aspects

Production Costs: Economic analysis shows that the production costs of briquettes from corn cobs are quite low, especially in areas rich in raw materials. The cost of producing biomass briquettes from corn cobs is around 30-50% cheaper than fossil fuels such as coal.

Economic Opportunities: Utilization of corn cobs can open up new economic opportunities for farmers and local communities through the production of renewable energy and derivative products such as bio-oil and briquettes.

d. Environmental Aspects

Emission Reduction: Using corn cobs as an energy source can reduce greenhouse gas emissions, especially when compared to burning fossil fuels. The pyrolysis process also produces biochar which can be used for carbon sequestration in the soil.

Reducing Agricultural Waste: Optimizing the use of corn cobs as fuel can reduce the amount of unused agricultural waste and reduce open burning practices that pollute the environment.

DISCUSSION

a. Availability of Raw Materials and

Processing Corn cobs are abundant agricultural waste, especially in corn farming areas. However, the challenge faced is that the collection process is still relatively manual in many places. To optimize the use of corn cobs, it is necessary to develop a more efficient collection system and processing technology that is affordable for rural communities.

b. Energy Efficiency

Based on research results, gasification and pyrolysis have proven to be effective methods for converting corn cobs into energy. However, this technology is still not widely adopted at the community level due to the high initial installation costs. Gasification produces a synergy between energy efficiency and environmentally friendly aspects, while pyrolysis provides product diversification in the form of gas, liquid and charcoal, all of which can be utilized.

c. Briquettes as an Alternative Fuel

Production of briquettes from corn cobs offers a practical solution for people who need alternative fuel at an affordable price. The quality of briquettes produced from corn cobs is sufficient to meet energy needs in households and small industrial scales. In addition, briquettes from corn cobs are also cleaner to use compared to coal or firewood.

d. Environmental Impact

Overall, the use of corn cobs for renewable energy offers positive impact on the environment. By utilizing this waste, researchers found that CO2 emissions from

burning biomass were much lower than fossil fuels. In addition, biochar produced from the pyrolysis process can increase soil fertility and reduce erosion.

e. Community empowerment

The application of renewable energy technology based on corn cobs has great potential to empower communities in rural areas. With adequate training, communities can be involved in briquette production, gasification system operations, or bio-oil production. This not only creates a sustainable energy source but also opens up new jobs and increases the income of local communities.

CONCLUSION

From the results of the research that has been carried out, it can be concluded that corn cobs have great potential as a source of renewable energy, including:

Energy Potential of Corn Cobs: Corn cobs have a fairly high calorific value, around 17-19 MJ/kg, which is comparable to other biomass such as wood and rice husks. This shows that corn cobs can be used effectively as an alternative fuel.

Efficient Processing Method, namely Biomass Briquettes: Briquettes made from corn cobs show good quality as an environmentally friendly alternative fuel, with lower production costs than fossil fuels.

Economic Aspect: Utilization of corn cobs as renewable energy offers economic opportunities for society, especially in agricultural areas. Energy production from corn cobs has the potential to create new jobs and increase local community income.

The cost of producing energy from corn cobs is lower than fossil fuels, making it economically viable for use on a household and small industrial scale.

Environmental Benefits: Using corn cobs can reduce agricultural waste and reduce greenhouse gas emissions resulting from the use of fossil fuels. By-products such as biochar also have the potential to improve soil quality.

The corn cob processing process also contributes to reducing the practice of burning agricultural waste which causes air pollution.

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