Poll Res. 39 (1) : 64-67 (2020)

ISSN 0257–8050

UTILIZATION OF THE REMAINING PRODUCTION OF THE WOOD PROCESSING INDUSTRY IN KEDIRI REGENCY, INDONESIA

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(Received 16 June, 2019; accepted 13 August, 2019)

ABSTRACT

The wood processing industry has to conduct environmental management by Law 32 of 2009, which is to suppress waste generation at the zero waste point, including the wood processing industry located in Sambirejo Village, Pare District, Kediri Regency. This industry processes various types of wood to become a community of goods or furniture for households. This study aims to examine aspects of the utilization of the remaining products of the wood processing industry in terms of technical aspects, environment, and economy. In terms of technical aspects, the utilization of wood processing industry waste is feasible because of an analysis of product design, capacity design, process, and facility design and analysis of human resources. While from the environmental aspect, of a total of 16,073.68 m^3/year, the waste produced can be fully utilized. 10,800 m^3/year is used as Boiler fuel, 3,600 m^3/year is sold to the public as tofu and tempeh fuel, and the other 1,673.68 m^3/year is used as wood pellets. Concerning the economic aspect, the cost of making wood pellets is IDR 1,412 /kg, including labor costs and maintenance of equipment, so the profit of selling wood pellets to Europe at IDR 3,480 / kg is IDR 2,067 / kg.

KEY WORDS: Wood industry, Waste production, Utilization of waste, Wood pellets

INTRODUCTION

The wood processing industry currently faces considerable challenges related to the obligation to conduct environmental management as mandated by the Law of the Republic of Indonesia number 32 of 2009, which is how to suppress waste generation at the zero points. The Wood Processing Industry located in Jl Kediri - Pare Sambirejo Village, Pare District, Kediri Regency, processes various types of logs in the form of logs and boards (Sawn Timber) to be used as a variety of furniture products for export commodity, as listed in Table 1. This production process has resulted inwaste, as shown in Table 2.The collection, sorting, and handling of separate wood waste can improve the quality of wood waste resources and potentially achieve cleaner recycling practices (Faraca and Astrup, 2019). The waste produced in Table 2 is used for various activities; one of them is boiler fuel in the wood processing industry. The remaining production used for boiler fuel is then sold to *tempe* producers and tofu as ± 3,600 m^3, and it still has a residual waste of ± 1,673 m^3 which has not been utilized. This residual waste will be sold to Europe as pellets. Wood pellets currently dominate, although some efforts have been attempted to make pellets from non-woody biomass (Pradhan and Arora, 2018). Remaining logging residues, pine bark, wheat straw, reeds, coppiced willow, poplar, and beech have also been produced as pellets (Agar and Larsson, 2018). Combining pellets from wood and biomass has also been carried out (Dai and Yoshikawa, 2018). To meet emission reduction targets, pre-processing of wood waste is needed to reduce the components that makeup N_2O as long as energy conversion (Roder and Thornley, 2018). Sustainable pellets showed that it was suitable to be used as a solid biofuel (Hernandez and Gabriel, 2019). The performance of pellets was evaluated based on durability, bulk density, moisture content, lower calorific value (LHV), energy density, diameter, length, and

density of pellets (Garcia and Pevida, 2019). High humidity also caused increased levels of pellets and dust produced (Deng and Bradley, 2019). The addition of alternative biomass raw materials for pine sawdust could reduce energy consumption in industrial pelletization (Bowd and Guilfoyle, 2017). In addition to pellets, wood waste can also be used for concrete, where mechanical properties are significantly enhanced by wood fibers, especially flexural strength (Xu and Chen, 2019). Comparison of energy use between pellets and coal has been conducted in China, with the result that pellet emissions are lower than coal, but the cost of pellets is higher than coal (Wang and Hao, 2017). On the other hand, in North America, the harvest rates increased due to pellet production and the useof heat pellets could increase greenhouse gas emissions (Buchholz and Saah, 2017). In contrast, wood-based pellet production in the southeastern US could increase the absorption of greenhouse gases (Dale *et al.,* 2017). In many South American countries, direct effects produce additional indirect effects and induction effects, which results in total effects or cumulative benefits for the local economy (Henderson and Hubbard, 2017). The use of dead trees from all wood degradation classes can be an attractive raw material for pellets because wood density is only slightly affected by wood degradation (Barrette and Grandpre, 2017). In Finland, Europe, wood pellets are not economically competitive with other fuels (Proskurina and Vakkilainen, 2017).

RESEARCH METHOD

Technical aspects involved descriptive analysis techniques on variables, namely product design, capacity planning, process planning and facilities, and human resources.

Environmental aspects were applied descriptively to find out and measure benefits so that the utilization of wood processing industry waste can be optimized, including the identification of environment, residual production produced and its utilization, mass balance calculation, and design of Temporary Shelter.

Economic aspects include the production of wood pellets, investment and production costs of wood pellets.

RESULTS AND DISCUSSION

The results of the analysis of the technical aspects of the wood processing industry are as follows:

Production capacity is sufficient to meet the production targets and the target market taken by the company. The production target can utilize all waste wood powder, which can produce wood powder pellets.

The availability of machinery facilities allows for mass production. Production facilities include production machines of wood powder pellet owned by the company that makes it possible for mass production.

The wood processing industry has trained and competent workers in terms of manufacturing and supervising the timber production to wood pellet production.

The business location is suitable because the location of wood pellet production uses an unused ware house building that is still in the area of the company, making it easier in production supervision.

The results of the analysis of the environmental aspects of the wood processing industry are as follows:

Of the total 16,073.68 m^3/year, the waste produced can be fully utilized, which 10,800 m^3/

Table 1. List of products of wood processing industries in Kediri

No	Production Type	Total Production (m^3/year)
	Sawn Wood	6.600
	Dry Klin	6.600
	Molding/ Dowel	3.000
	Jointed board	6.500
	Picture frame	1.300
	Table chairs, cabinets, components of piano table components made from wood	3.000
	Container, newspaper holder and lampshade	1.350
	Etc.	11.000

Table 2. List of waste producedby Kediri Wood Processing Industry

Types of Raw Materials	Powder waste (m^3/year)	Waste pieces (m^3/year)
Sengon Log	2.106,25	10.531,25
Sengon Sawn Timber	267,47	1.604,82
Nyato Sawn Timber	89,69	538,11
Pinus Sawn Timber	133,72	802,37
Total	2.597,13	13.476,55

year is used as Boiler fuel, 3,600 m^3/year is sold to the public as tofu and tempeh fuel, and the other 1,673.68 m^3/year is used as pellets wood.

The pellet production process has been arranged in several stages, namely: pulverizing, drying, drying, cleaning, pelleting, cooling, and packaging of wood pellets.

The environmental impacts of the activities are routinely managed and monitored according to a document of Environmental Management Efforts and Environmental Monitoring Efforts.

The results of the analysis of the economic aspects of the wood processing industry are as follows:

The cost incurred to produce wood pellets is Rp 1,412,194/ton or Rp 1.412/kg. The total cost of production includes the cost to pay the workers and maintenance of tools.

The selling price of wood pellets, from various online buying and selling sites in Indonesia, is Rp. 189,000/10 kg or Rp. 18,900/kg, while the average selling price of wood pellets in Europe is Rp. 3,380 /kg.

The selling price of pellets is higher than the cost of making pellets so that the benefits are higher than the cost.

CONCLUSION

From the technical aspect, the utilization of wood processing industry waste is feasible because of the analysis of product design, capacity design, process design and facilities, and analysis of human resources.

From the environmental aspect, out of a total of 16,073.68 m^3/year, the waste produced can be fully utilized, which 10,800 m^3/year is used as Boiler fuel, 3,600 m^3/year is sold to the public as tofu and tempeh fuel, and the other 1,673.68 m^3 / year is used as wood pellets.

Regarding the economic aspect, the cost of making wood pellets is Rp. 1,412/kg, including the cost to pay the workers and maintenance of equipment so that the price of wood pellets in Europe isRp. 3,480/kg and the profit obtained is about Rp.2,067/kg.

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