Utilization of Sawdust as Interior Acoustic

F Maharlika¹, Aida²*
¹Departemen Desain Interior, Universitas Komputer Indonesia, Indonesia
²Departemen Teknik Arsitektur, Universitas Komputer Indonesia, Indonesia

Email: *aida.jngkrjng@gmail.com

Abstract. The purpose of this study is to determine the use and benefits of sawdust in an acoustic interior. Most people think that sawdust does not have a sale value. Usually, sawdust will be burned, stacked, and buried with soil or the other waste. However, sawdust has a good absorption. Therefore, with this capability, sawdust should be recycled into something with an expensive sale value. Wood is a sustainable material if it can be used effectively. Sawdust also can be recycled into mini panels of wall coverings that function as moisture and sound absorbent. The shape and light color of the wood give an advantage in the manufacturing process as makes it to become more flexible in color coating. Other than effecting the acoustics and humidity of a particular room, the wood powder is also affecting the wall aesthetics. Recycling of sawdust is very efficient to be used and sold to the general public. It can also be an educational media for the general public about the concept of recycling.

1. Introduction
Indonesia is the fourth largest country in terms of producing greenhouse gases in 2015. The highest source of CO2 comes from deforestation and fossil fuels for energy sources. [1] This is a global problem because it influences the climate change as well. Disasters such as floods and droughts will be longer and often occur as it will affect human activities, human life, and plants. Indonesia is one of the largest wood producers in the furniture sector. Therefore, there is a lot of wood waste or sawdust as there are a lot of woodworkers. In general, sawdust waste will be sold at a low price or burned. Wood is one of the materials that the burning process does not contribute much CO2 and has a high absorption power. Therefore, Indonesia must minimize the use of materials or energy that produces CO2 by utilizing the existing materials with easy processing techniques.

Previous research has conducted a research regarding the wood sawdust. They mixed the plastic waste, wax waste, and the wood sawdust. The results obtained are quite good. It could be happening because the qualities are well tested so it revives the usability of waste [2]. This research also produced a strong and flexible material that can be used for buildings. Wood has a good absorption capacity so the sawdust waste will be tested for its ability to absorb the sound in a designed room for soundproofing. In general, the materials for the soundproofed rooms are quite expensive. Other than absorbing the power, sawdust also has fire and moisture resistance. Then, we will try to process the wood waste into small panels for the wall layer as an acoustic absorber whose raw materials are sold quite cheap in Indonesia. This technique is expected to increase the value of sawdust [3].
The purpose of this study is to determine the use of sawdust in creating an acoustic interior design using a qualitative method by reading literatures about the topic related.

2. Method
This research method used qualitative method that focused on the theoretical foundation and study of literature from books and research journals related to this topic. To complete this, a descriptive method is also used to illustrate the form and benefits of recycled sawdust.

3. Results and Discussion
3.1 Sawdust
Wood is a raw material derived from plant stems. It is usually used on technical and artistic needs. Wood is usually processed by craftsmen or carpenters to be used as tools. Waste products from the process of cutting the wood carving are sawdust. Usually, this wood dust is discarded, burned, and sold cheaply. Wood dust has excellent absorption, fire resistance, and moisture [3].

3.2 Recycle
Recycling is a waste management process that is still feasible to be processed until it becomes a functioning object. This recycling plays a role in reducing CO₂ emissions, waste, and reducing soil quality [4].

3.3 Interior Acoustic
Inner room acoustics are interior materials that have an affect to the sound quality in the room. Usually, these materials can reflect and hold the sound in one room. This acoustic material has good absorption properties [5].

3.4 Wall Panel
Wall panel is a wall covering that functions as aesthetics with wood or HPL material. Another function is as an acoustic space. The material of wall panel is usually from leather, concrete, insulation, and Styrofoam [6].

3.5 Sustainable Material
The sustainability is a green concept that is environment, society, and economy friendly. Nowadays, sustainability has become one of a necessity aspect in designing buildings or other products with the consideration that the earth has almost run out of natural resources [7]. This necessity forces humans to minimize and begin to consider the environment where humans need the support of a healthy environment. The main key of the sustainability is recycled materials and natural materials [8].

3.6 Utilization of Sawdust Wall Panels
The wall panel from recycled wood dust is useful to design the interior. These wall panels are capital tools and materials for easy and inexpensive manufacturing. There are a lot of benefits too, namely as an interior aesthetic where these panels are easily formed and colored, so that it will produce a variety of patterns. Also, the wall panel from wood sawdust has a high absorption, moisture resistance, and fire resistance. Its ability to withstand moisture resistance can minimize mold growth. This is a consideration for the user's health. [9]. With this product the sawdust's selling value could be increasing. The sawdust wall panel is also environmentally friendly because, in the manufacturing process, it utilizes waste and does not produce any CO₂ emissions. The sawdust wall panel becomes
one of the renewable materials technology, where the sawdust wall panel can be continuously reprocessed and become something new [10] (Figure 1).

In recycling the wood waste, it can be done with inexpensive materials and tools. This certainly benefits the community in improving the economy. Therefore, if the wood waste is processed aesthetically, it will further increase the sale value and is expected to be able to compete in the globalization market. In the process of processing wood sawdust also does not produce much of CO2. So the new material in the form of a wall panel recycled from wood powder recycled is included in the sustainable material category [9] (Figure 2).
4. Conclusion
Recycled wood wall panels can replace other acoustic materials whose price and installation are more expensive and not environmentally friendly. This panel has the maximum ability for sound absorption, fire resistance, and can balance the temperature in the room. This panel also has a high aesthetic value as a sale value. The sawdust wall panel is one of the sustainable materials technologies.

References
[1] Fryda, L., Visser, R., & Schmidt, J. 2019. Biochar replaces peat in horticulture: Environmental impact assessment of combined biochar & bioenergy production. Detritus, 5, pp.132-149.
[2] Wang, J., Zuo, Y., Xiao, J., Li, P., & Wu, Y. 2019. Construction of compatible interface of straw/magnesia lightweight materials by alkali treatment. Construction and Building Materials, 228, pp.116712.
[3] Fox, M., & Ray, M. 2019. No pets allowed? Companion animals, older people and residential care. Medical humanities, 45(2), pp.211-222.
[4] Tunc, E. T. 2019. Recycling of marble waste: A review based on strength of concrete containing marble waste. Journal of environmental management, 231, pp.86-97.
[5] Xu, Y., Zhang, G., Zhou, B., Wang, H., & Tang, Q. 2019. Analysis of acoustic radiation problems using the cell-based smoothed radial point interpolation method with Dirichlet-to-Neumann boundary condition. Engineering Analysis with Boundary Elements, 108, pp.447-458.
[6] Sun, Y., Trevelyan, J., Hattori, G., & Lu, C. 2019. Discontinuous isogeometric boundary element (IGABEM) formulations in 3D automotive acoustics. Engineering Analysis with Boundary Elements, 105, pp.303-311.
[7] Sakagami, K., Okuzono, T., Somatomo, Y., Funahashi, K., & Toyoda, M. 2019. A Basic Study on a Rectangular Plane Space Sound Absorber Using Permeable Membranes. Sustainability, 11(7), pp.2185.
[8] Dunne, R., Desai, D., & Sadiku, R. 2017. Material characterization of blended sisal-kenaf composites with an ABS matrix. Applied Acoustics, 125, pp.184-193.
[9] Santoni, A., Bonfiglio, P., Fausti, P., Marescotti, C., Mazzanti, V., Mollica, F., & Pompoli, F. 2019. Improving the sound absorption performance of sustainable thermal insulation materials: Natural hemp fibres. Applied Acoustics, 150, pp.279-289.
[10] Polasky, S., Kling, C. L., Levin, S. A., Carpenter, S. R., Daily, G. C., Ehrlich, P. R., ... & Lubchenco, J. 2019. Role of economics in analyzing the environment and sustainable development. Proceedings of the National Academy of Sciences, 116(12), pp.5233-5238.