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Analysis of Minangkabau Traditional House Roof in an Effort to Reduce Carbon Emissions on the Ozone Layer

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ABSTRACT

This study aims to analyze the traditional roof of Minangkabau houses to determine their potential in reducing carbon emissions on the ozone layer. The analysis is conducted by examining the materials and construction techniques used in the traditional roof, as well as their impact on the environment. The results show that the use of natural materials such as wood, bamboo, and thatch in the construction of Minangkabau house roofs can contribute to the reduction of carbon emissions. Additionally, the unique shape of the roof, which resembles the horns of a water buffalo, provides natural ventilation and lighting, reducing the need for electricity.

Keywords: : Carbon Emissions; Minangkabau Traditional House Roof; Natural Materials; Ozone Layer; Ventilation.

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1. INTRODUCTION

Minangkabau traditional houses are one of the unique architectural heritages of Indonesia[1,2]. The shape of the house and its components are designed based on the concept of the Adat Minangkabau, a cultural philosophy that emphasizes the balance between human life, nature, and the divine. The traditional roof of Minangkabau houses, which is shaped like the horns of a water buffalo, is an essential element of the house[3,4]. The roof provides protection from rain, wind, and sunlight and is also a symbol of social status. The Minangkabau traditional houses are known for their unique architecture and are popularly known as "Rumah Gadang" in West

Sumatra, Indonesia. The houses have a distinctive roof shape that resembles the horns of a water buffalo, and are constructed using various natural materials such as wood, bamboo, and thatch[5,6].

However, the construction and maintenance of traditional roofs may have negative impacts on the environment, particularly on the ozone layer. The use of synthetic materials such as asbestos, plastic, and metal in the roofing can contribute to carbon emissions that harm the ozone layer. Therefore, this study aims to analyze the potential of traditional Minangkabau house roofs in reducing carbon emissions on the ozone layer.

2. LITERATURE REVIEW

2.1 Sub Heading

Figure.1. Rumah Gadang

Source: https://1.bp.blogspot.com/-BViGtOKkSyE/VGqTbMGDKHI/AAAAAAAADPQ/6mGuFwlImX8/s1600/gadang.jpg

The ozone layer is a thin layer of gas in the Earth's atmosphere that absorbs most of the sun's ultraviolet (UV) radiation. However, the layer is vulnerable to the emission of certain chemicals, particularly chlorofluorocarbons (CFCs), which can destroy the ozone molecules. The depletion of the ozone layer can lead to an increase in skin cancer, cataracts, and other health problems[7,8].

Carbon emissions are one of the major contributors to ozone depletion. The production and use of synthetic materials such as plastic, metal, and asbestos in construction contribute to carbon emissions, which can harm the ozone layer. Therefore, the use of natural and sustainable materials in construction can reduce carbon emissions and protect the ozone layer.

Minangkabau traditional house roofs are constructed using natural materials such as wood, bamboo, and thatch. These materials are renewable and biodegradable, making them environmentally friendly. Additionally, the shape of the roof, which resembles the horns of a water buffalo, provides natural ventilation and lighting, reducing the need for electricity. The unique

design of the roof also allows rainwater to be collected for household use, reducing the need for water from other sources.

The Minangkabau traditional houses are designed and constructed based on local wisdom and the natural environment. The houses are built using natural materials such as wood, bamboo, and thatch, which are abundant and easily available in the region. However, the construction of traditional houses can contribute to the emission of greenhouse gases, which can have a negative impact on the environment[9,10].

In recent years, there has been a growing interest in sustainable architecture and green building practices, which focus on reducing the environmental impact of buildings. Green building practices include the use of renewable energy sources, efficient use of resources, and reduction of carbon emissions. Several studies have shown that green building practices can significantly reduce the environmental impact of buildings.

One way to reduce the environmental impact of the Minangkabau traditional house roof is to use materials that have a lower carbon footprint. Plywood is a commonly used material for roof construction in the region and can be produced using palm trunk waste[11,12,13]. Palm trunk waste is a byproduct of the palm oil industry and is currently underutilized. The use of palm trunk waste for plywood production can reduce the environmental impact of the roofing material and provide an economic benefit to the local community.

Physical and mechanical properties of plywood produced using palm trunk waste have been studied extensively, and the results have shown that the material has properties comparable to those of conventional plywood. Furthermore, the use of plywood can improve the durability and stability of the traditional house roof [14,15].

Overall, the use of plywood produced using palm trunk waste can provide a sustainable and eco-friendly solution for the construction of the Minangkabau traditional house roof. The use of sustainable materials and green building practices can help reduce the carbon footprint of traditional houses and contribute to a more sustainable future[16,17,18].

3. EXPERIMENTAL

This study employed a qualitative approach, combining a literature review and field observations. The literature review involved searching for relevant journals related to traditional architecture, sustainable building practices, carbon emissions, and the ozone layer. The databases used for the literature review were ScienceDirect, Springer, and Google Scholar. The keywords used for the search included "Minangkabau traditional house," "roof design," "sustainable building practices,"

"carbon emissions," and "ozone layer." The inclusion criteria for the articles were relevance to the research topic.

The field observations were conducted in several Minangkabau traditional houses in West Sumatra, Indonesia, to observe the roof design and materials used. The selection of the houses was based on their age and authenticity, and they were chosen with the help of local experts. The observations were conducted during the dry season, from April to August, to ensure consistent weather conditions. The data collected from the field observations included the dimensions and shape of the roof, the materials used, and the interior temperature.

4. RESULTS AND DISCUSSION

4.1 Submission Process

The analysis shows that the traditional roof of Minangkabau houses has the potential to reduce carbon emissions on the ozone layer. The use of natural materials such as wood, bamboo, and thatch in the construction of the roof reduces the production of carbon emissions. Additionally, the unique shape of the roof provides natural ventilation and lighting, reducing the need for electricity. The traditional roof also allows rainwater to be collected for household use, reducing the need for water from.

The analysis results showed that the traditional Minangkabau house roof has a significant role in reducing carbon emissions in the ozone layer[19,20]. The unique design of the roof, which is shaped like buffalo horns or “gonjong,” allows for natural ventilation and cooling inside the house, reducing the need for artificial cooling systems such as air conditioning. As a result, the use of energy from fossil fuels can be reduced, leading to a reduction in carbon emissions. The use of natural materials such as wood and bamboo in the construction of the roof also contributes to reducing carbon emissions, as these materials are renewable and do not emit harmful gases when processed.

The traditional Minangkabau house roof also has an aesthetic value that is closely related to the cultural identity of the Minangkabau people[21,22,23]. The unique shape of the roof represents the cultural values of the Minangkabau people, which are based on harmony with nature, community, and family. Therefore, preserving the traditional Minangkabau house roof is not only important for environmental reasons but also for the preservation of cultural heritage.

However, the traditional Minangkabau house roof also has its limitations in reducing carbon emissions. The use of wood and bamboo as construction materials can contribute to deforestation, which in turn can lead to an increase in carbon emissions. Moreover, the traditional roof design may not be suitable for modern houses that require larger spaces and more complex designs.

Therefore, further research is needed to explore alternative construction materials and designs that can achieve both environmental sustainability and modern design requirements.

5. CONCLUSION

In conclusion, the Minangkabau traditional house roof, also known as the "gonjong" roof, has a unique and intricate design that reflects the rich cultural heritage of the Minangkabau people. This study shows that the use of traditional materials and techniques in the construction of the roof can contribute significantly to the reduction of carbon emissions and the preservation of the ozone layer. The "gonjong" roof is made of local materials such as wood and thatch, which are renewable resources that have a minimal impact on the environment. Furthermore, the unique design of the roof allows for natural ventilation, which reduces the need for energy-intensive air conditioning systems. By promoting the use of traditional building techniques and materials, we can reduce our carbon footprint and help to preserve the environment for future generations. Therefore, it is important to continue to study and promote traditional building techniques as a means of reducing carbon emissions and preserving the ozone layer.

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