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Vertical Greening Façade as Passive Approach in Sustainable Design

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Abstract

To overcome the excessive heat in tropical climate countries during the day, the types of skin or façade play a vital role in regulating the temperature and the amount of heat transmission in a building. This research was carried to evaluate the percentage of temperature reduction of two building samples, one with “vertical greening” and one without. The result proved that the temperature reduction of the building with the green façade system is higher than the building without the green façade system. Therefore, it justifies that Vertical Greening Façade does act as an acceptable passive approach for sustainable design.

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Keywords: Façade; vertical greening; passive approach; sustainable design

1. Introduction

Green architecture is one of the many ways to reduce the impact of construction of a new building on nature. The term green architecture is not just by preserving and conserving the trees on site but can also be implemented as part

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of the buildings component. One of the ways to implement nature on architecture is by using the 'breathing walls' on facade or what we call as vertical greenings.

Vertical greening façade is an exterior wall that is planted with plants mainly used for aesthetic and ecological purpose. To create the vertical greening facade, the plant must be of certain characters and the wall or support structure must be occupied with soil and water system. Usually, the plant that is used for the vertical greening facade is aerial roots plant, vines and also climbing plants. The support structure is used for the plant to be able to climb or cascade down the structure.

According to (Sunakorn and Yimprayoon, 2011) vertical garden or green façade are also becoming popular landscape design for home and building. It is widely known that plant absorb heat and light from the sun for photosynthesis process and the best solution to improve the air quality in a certain places since it absorb the carbon dioxide during the day. Based on these criteria, we can conclude that the vertical greening system can reduce the heat and temperature and also improve the air quality in a building.

Lastly, based on the research by the National University of Singapore, the electricity can be reduced by 5% if the temperature of a building decreased by 1°C. This strongly supports the evidence prior to a research by (Sheweka and Mohamed, 2012); vertical greening system can reduce the temperature in a building by 2 degrees during the day and 0.4 degrees at night.

1.1. Problem statement

Most of electricity is used to provide a thermally and visually comfortable built-environment through air-conditioning and artificial lighting. Earlier studies by Goulding et al. (1992) and Krarti (2000), on energy audits and surveys of commercial premises revealed that air-conditioning and artificial lighting account for, respectively, 40–60% and 20–30% of total electricity use. One of the ways to reduce the energy used is through the implementation of passive design approach. The passive design approach is where the heating and cooling system of the building is provided without any means of mechanical energy use whereas, the bioclimatic design is the application of climate study into the design and building's technology mainly to regulate the heat transfer. Therefore, the combination of these two approaches is essential in promoting an energy saving building as well as ensuring thermal comfort for the building's occupant.

In designing a building based on the bioclimatic approach, the most important part of the building is the skin or the facade. It acts as the control medium of any forces that passes the building. Therefore, the design of the skin or envelope of an office building plays a vital role in maintaining the thermal comfort of the building's occupant from the climate condition. Many projects using the vertical greening system as facade can be seen across the world. However, these designs are not making the full use and benefits of the vertical garden itself. For example in Jakarta, most buildings with vertical garden facade are implemented mainly because of its aesthetic value. This is due to the lack of research concerning the thermal effect of vertical garden and the exact percentage of temperature reduction.

1.2. Purpose of study

The aim of this research is to determine the temperature and the humidity in an office building that use vertical greening system thus proving that this method can be best implemented in tropical climate countries. By observing the temperature differences in both office and the humidity percentage in a building, the effectiveness of vertical greening facade can be obtained. This investigation was done by recording the temperature in both office (one with vertical greening façade and one not using the vertical greening façade system) from the same location during the day and observing the energy used by both buildings during the working hour period.

1.3. Aims and objectives of research

This research was carried to evaluate the percentage of temperature reduction of two building samples, one with "vertical greening" and one without. The aim of the study is to investigate whether there are any differences in temperature and humidity in both office buildings during the day. The objectives of this research are listed below.

- To obtain the temperature and humidity differences in both offices.

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