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RESIDUAL SOIL AND COCO PEATS MIX MULTILAYER BRICKS OF ANTI-RADIATION

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ABSTRACT

In the current technologically developed countries where industrial technology developments have been focused, new products are constantly being introduced to either replace or enhance the existing products. Technology has always advanced with the purpose of making our lives better and easier. However, the development of technology also increases the possibility of exposure to radiation that affects human health. Therefore, anti-microwave materials are needed to absorb or eliminate electromagnetic radiation to protect human health. In this project, brick walls were designed as anti-microwave materials by using agricultural wastes, which are coco peat as absorbing materials. This project aims to develop anti-microwave multilayer bricks using residual soil and agricultural waste as absorbing materials and partial cement replacement. The absorption performance of the multilayer bricks was measured by using the Naval Research Laboratory (NRL) arch-free space method. The performance of the anti-microwave multilayer bricks was compared with the performance of the commercial clay bricks. The performance was analyzed in the frequency range of 1 to 12GHz at an angle of 0 degrees. The measurement results show that the anti-microwave multilayer brick walls produced a better performance with maximum absorption of -23.4676dB at the frequency 1.7GHz (L-band), while the maximum absorption of commercial clay bricks is -9.6265dB at frequency 1.07GHz (L-band). From the result obtained, this can be concluded that coco peat can be used as an absorbing material in the production of microwave absorbers.

Keywords: Anti-microwave brick, agricultural waste, coco peat, microwave absorbers

1. INTRODUCTION

A microwave absorber is a material that reduces the energy of an electromagnetic wave. Microwave absorbers are used in a variety of telecommunications applications to eliminate stray or unwanted radiation that might interfere with the operation of a system. Externally, a microwave absorber can be used to limit reflection from or transmission to specific objects, and internally, it can be used to minimize oscillations induced by cavity resonance (Choi et al., 2020; Elmahaishi et al., 2022; Zhao et al., 2013). According to several researchers, carbon has a crucial role in microwave absorption. Carbon is an excellent microwave absorber because it is easily heated by microwave radiation (Menéndez, 2010). Researchers have recently focused on identifying agricultural wastes (organic materials) as a potential microwave energy absorption material. Oil palm shells, rice husks, coconut shells, and other agricultural wastes

are examples (Tan, et al. 2008; Yew & Wee, 2014). In this project, coco peat was selected as raw material for the production of anti-microwave multilayer brick walls and the content of carbon in coco peat is 38-50%.

2. METHODOLOGY

The brick molds were prepared according to the size of the brick, which was 225mm in length, 125mm in width, and 75mm in height. To facilitate the removal of the brick from the mold, the brick mold was lubricated before the cement paste was poured into it. All the raw materials used in the manufacture of the multilayer brick walls were prepared and weighed based on the selected ratio. Table 1 shows the ratio and the weight of the raw materials for anti-microwave multilayer bricks for three different layers. Next, all raw materials were combined and mixed until everything was uniformly blended by using the concrete mixture machine. The cement mixture was then poured into the brick mold and allowed to cure for 3 to 4 days at room temperature before being removed from the mold and dried under direct sunlight. After the brick was completely dry, the absorption performance of the brick was then measured using the Naval Research Laboratory (NRL) arch-free space method (Fazin et al., 2022; Chen & Rodriguez, n.d.).

Raw Materials	**Cement**	**Soil**	**POFA**	**Water**	**Coco peat**
First Layer					
Ratio	25	15	25	25	10
Weight	10.625kg	6.375kg	3.750kg	11.250kg	750g
Second Layer					
Ratio	15	15	20	25	15
Weight	10.625kg	6.375kg	3.0kg	11.250kg	1.125kg
Third Layer					
Ratio	25	15	15	25	20
Weight	10.625kg	6.375kg	2.25kg	11.250kg	1.5kg

Table 1 Ratio and Weight of Raw Materials for Anti-Microwave Multilayer Brick Walls

3. FINDINGS

Figure 1 shows the graph of the absorption performance of the anti-microwave multilayer brick walls compared with the performance of commercial clay bricks in the frequency range of 1 to 12GHz. The maximum absorption of the bricks was analyzed in four frequency bands and the maximum absorption data were recorded in Table 2.

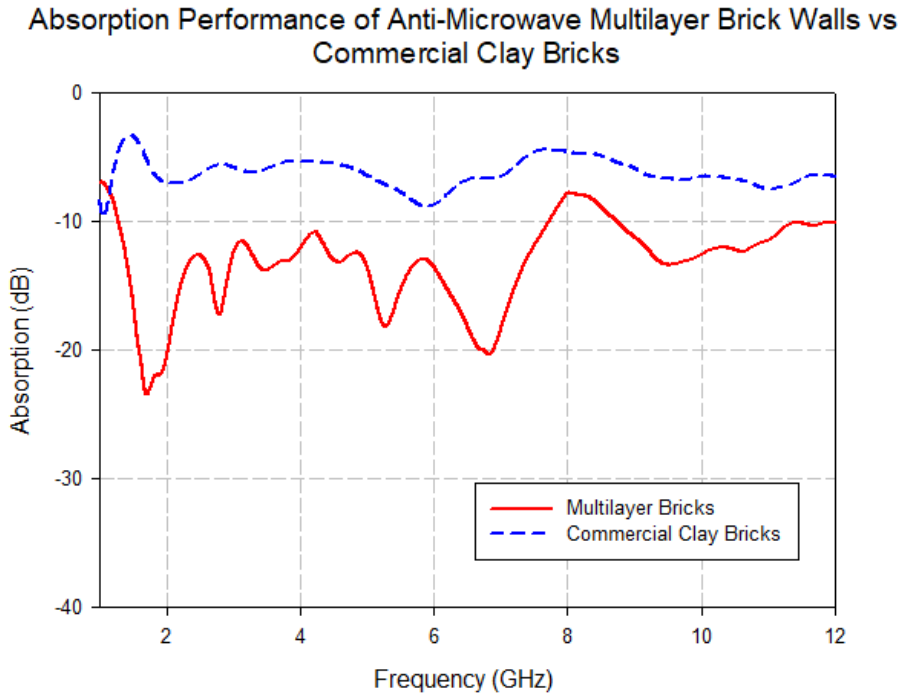

Figure 1 Absorption Performance of Anti-Microwave Multilayer vs Clay Bricks

Frequency Band	L-band	S-band	C-band	X-band
Multilayer Brick	-23.4676	-20.1992	-20.3188	-13.3830
Clay Brick	-9.6265	-7.0052	-8.8495	-7.4919

Table 2 Absorption Performance Data of Anti-Microwave Multilayer Brick Walls

4. CONCLUSION

The proposed multilayer bricks by using residual soil and agricultural waste were successfully developed as anti-microwave materials. The measurement results show that the anti-microwave bricks produced a better absorption performance compared to commercial clay bricks, and this proves that the anti-microwave multilayer brick walls made with coco peat can absorb electromagnetic radiation.

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