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ROOF INSULATION MATERIALS USING CEMENT, WOOD (SAWDUST) AND POLYSTYRENE

KROVNI IZOLACIONI MATERIJALI PRIMENOM CEMENTA, DRVETA (IVERICE) I POLISTIRENA

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Ključne reči
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- prenos toplote
- iverica
- polistiren
- kompozitni cement

Abstract

This study aims to use the environmental elements and how to exploit and deal with them to reach a green building that embodies full cooperation between the various engineering disciplines, and focuses on the importance of studies and environmental design of buildings in terms of economic, aesthetic and climatic aspects and their friendliness of the ocean, in addition to offering practical architectural and engineering solutions as solutions to deal with the environment and climate. Starting with straw, clay, and indoor courtyards, they display the most prominent materials available in Jordan that can be used in environmentally friendly buildings.

Izvod

U radu je izložen cilj primene prirodnih elemenata i na koji način se oni mogu eksploatisati u zelenim zgradama, u kojima se u potpunosti integrišu različite inženjerske discipline i ističe značaj studija i projektovanje zgrada s obzirom nad zaštitu životne sredine. Posebno se sagledavaju aspekti: ekonomski, estetski i klimatski, kao i njihov pozitivan odnos prema okeanu. Dodatno se predlažu praktična arhitektonska i inženjerska rešenja koja obuhvataju životnu sredinu i klimu. Razmatraju se materijali kao slama, glina i unutar-građevinska dvorišta, kao istaknuti materijali i dostupna rešenja u Jordanu, koja se mogu primeniti na ekološke zgrade.

INTRODUCTION

This study aims to produce effective materials for insulation (heat, moisture, and waterproofing insulation) using materials consisting of polyester, wood (sawdust) and cement as shown in Fig. 1. These samples are prepared using a polyester die casting method with sawdust and cement, and experimental results have shown that the sample has minimum heat and moisture transfer values. Experimental results showed that additives (fillings) polyester and sawdust add moisture and heat insulation.

Polyester consumption accounts for more than 50% of the weight in the industry and its waste is gradually increasing every year. In this study, polyester is recycled to produce insulating compounds. The ratio 1:1:1 is prepared by mixing the cement : sawdust : polyester, then it is stirred well. The mixer produces absorption compounds for five hours to give a coherent mixture. Initial results of the mixture show an increase in the mixture's resistance to moisture and heat and decreased density, which has reduced the collapse on the surface /1/.

(a)

(b)

(c)

Figure 1. Raw materials: a) polystyrene; b) sawdust; and c) cement.

Literature review

This research studies the ceiling insulation method for prefabricated offices that use vinyl-filled wood sawdust to reduce air conditioning loads, which also isolate internal heat. The new roof insulation method has been compared to four types of ceilings on prefabricated offices. It is also a recycling of scrap wood disposed of building construction projects. The evaluation of a new method for roof insulation using sawdust shows the advanced use of sawdust which reduces the environmental load in the building construction process. On the other hand, the amount of solar energy absorbed from the ceiling increases the temperature of indoor air and increases the cooling load. This research contributes to the environmental design of offices and develops a method for reusing sawdust, /2/.

This sheet introduces a new system for roof insulation using natural materials made of polystyrene and concrete as a thermal insulator. This new system reduces the negative environmental impacts caused by the use of artificial insulation materials. The study also shows the effectiveness of heat insulation as well as cooling and its advantages in that it is less weight than artificial insulating materials, /3/.

In this study, waste is used in the manufacture of insulation materials in an attempt to reduce, minimize waste, and recycle this waste into sustainable engineering products. Sawdust with polystyrene would show improved physical and mechanical properties. A known amount of sawdust is mixed with the polystyrene-compound. Then samples are produced from different compounds that were used to perform the tensile strength and water absorption tests. Experimental results demonstrated the highest tensile and insulation strength, with increased absorption of water and moisture. When compared to some manufactured insulation samples it is noted that the strength of the compound increases with time. Therefore, the use of sawdust associated with polystyrene waste provides a compound with excellent environmentally friendly properties, /4/.

This study addresses the most important issues in the construction industry and its development by finding an alternative building from environmentally friendly materials that reduces the amount of energy consumed during the manufacturing process, and these materials include wood waste, polystyrene waste, paper, traditional lime and water, which reduces the amount of energy consumed during the construction material manufacturing process and the ease with which this building material is developed. This work presents the treatment of technologies and factors that affect the performance and properties of the new compound in heat and moisture insulation and is characterized by the strength of pressure and the elasticity factor compared to building materials such as concrete and steel, /5/.

This study is concerned with finding solutions to recycle materials to become environmentally friendly and also to take advantage of their advantages and exploit natural resources such as sawdust, as it is produced annually over 2 million cubic meters in developing countries, and this poses huge environmental challenges related to air pollution, greenhouse gas emissions, and destruction of plant and water life. In this study it is recommended to use sawdust compounds as an insulation compound to absorb water and moisture. These compounds consist of panels, concrete and sawdust. It is also distinguished by its low thermal conductivity, high sound absorption and good sound insulation properties to the feasibility of using it in construction. These results indicate that the increased use of sawdust compounds in construction will reduce the potential environmental pollution of sawdust, conserve energy and reduce construction costs, /6/.

In our study we recommend the use of a compound containing waste wood, polystyrene and cement as an insulation material for roofs and walls because of its physical and chemical properties and benefit from them to reduce air pollution and reduce cost, pressure and stress on roofs.

MATERIAL AND METHODS

The material used in this study are:

1. ASTM type I Portland cement
2. Wood (sawdust)
3. Polystyrene
4. Water

MATERIAL AND METHODS:

Sawdust wood, several studies were conducted to measure the effectiveness of sawdust as a basic ingredient in insulating materials and it was found that the presence of sawdust increases by 50% from heat and moisture insulation in addition to its light weight. The results show that this weight ratio could be as high as 3:1 without changing the catalytic activity. The size of the wood chips as one of the most important experimental parameters has also been investigated /7/.

1. Cement is the main component known in construction. We used it with roof insulation materials. Cement is a bond between the three components with sawdust and polystyrene, and it works to effectively isolate the roofs, /8/.

The most critical objective is to provide a good insulation between the roof up to the surface and wall, and this over a time of several years. This study focuses more on the ability of hard cement to insulation and to provide a long lasting bond. In the field, the cement bond effectiveness is most often evaluated through water infiltration and measure amount of humidity. The communication between zones is sometimes tested by injecting water or completion fluid and

measuring either directly the fluid flow or the pressure transmission between two sets of perforations, /9/.

2. Polystyrene is a solid, hard and shiny substance produced by styrene polymerization. It is widely used in food service industry such as trays and rigid containers, disposable eating utensils, foaming cups, dishes, and bowls. Polystyrene is also used as an insulating material and is characterized by its ability to absorb moisture and lightweight and maintains the cold and prevents heat transfer, so in this study we mixed it with cement and sawdust and the results were amazing can be used as an effective insulation material for the ceiling and walls, /10/.
3. After the composite are prepared, we add the polystyrene and mixing with water to form a mixture then put on the roof as shown in Figs. 2 and 3.

Figure 2. The way to isolate the roof.

Figure 3. Composite of cement and sawdust.

CONCLUSION

– The importance of knowing the use of sustainable design that is compatible with the environment and interacts with it in order to reduce the negative environmental impact resulting from the buildings, in addition to preserving natural resources.
– Setting goals and strategy followed according to the chosen scenario and linking environmental goals to plans and programs.
– Environmental aspect within clear time programs, design, planning and integration with engineering plans on the one hand and with policies and laws on the other hand.

RESULTS AND DISSCUSION

Initial results over the course of a whole month showed the effectiveness of the mixture, where a direct relationship is observed between the increase in polystyrene and sawdust on the compound and the increase in insulation, where the humidity decreases significantly and the temperature is kept long /11/, as shown in Chart 1.

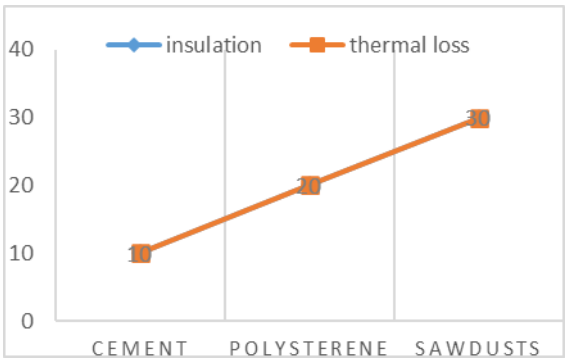

Chart 1: we notice an Incremental relationship between mixture with sawdust, cement, polystyrene and insulation values.

From this study, it is found that the use of sawdust, polystyrene and cement is a good addition to insulation materials, where a noticeable increase in hardness, insulation and lightweight is observed around one month, as shown in Table 1.

Table 1. Amount of deflection and thermal transfer.

Days	Deflection mm	Thermal transfer
1	0	0
7	1	0
14	1	0
21	1	0
28	1	0
30	1	0

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ECF23, European Conference on Fracture 2022
June 27 – July 1, 2022. Funchal, Madeira, Portugal
Fracture Mechanics and Structural Integrity
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Unfortunately, the Corona virus pandemic problem has evolved to a situation that makes the realization of ECF23, on its present schedule, not possible. New deadline for ESIS Support for Researchers: March 31st, 2022

Dear Colleagues,
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