International Journal of Recent Advances in Multidisciplinary Topics
Volume 4, Issue 3, March 2023
https://www.ijramt.com | ISSN (Online): 2582-7839

A Review on Moss Concrete

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***Abstract*: The level of pollution has been increasing day by day. One of the major causes of air pollution is the release of greenhouse gases. This issue can be rectified by developing some efficient solutions. Moss concrete is one of such innovations. These are classified as fungi that grow under extreme moist conditions and in an environment with more humidity. It includes algae, lichen, etc. This biological concrete can serve as a boon to the society since the prevailing conditions are worse in case of air quality. Moss has both merits and demerits when it comes to Construction field. This paper aims to summarise some of the previous studies related to moss concrete.**

***Keywords*: Biological concrete, greenhouse gas, moss, pollution.**

1. Introduction

Recent developments in Construction field are becoming vast. This is mainly because of the prevailing environmental conditions and pollution. Moss concrete is a form of biological concrete which is being developed by a University in Spain. It involves growth of lichen, fungi, etc. on the surface of structures which helps in purifying the air by absorbing excess carbon dioxide from the atmosphere. It consists of a usual concrete layer, a waterproof layer that separates the inner part and the surface on which growth of moss will occur. The outer layer allows rain water to penetrate which boosts the growth of such organisms, while the inner portion remains water-proofed. Studies are being conducted to know about the efficiency of this biological concrete and its durability.

2. 2. Moss and its History

Bryophytes are considered as the first plants that appeared in this world and are in existence for about 400 billion years [4]. These are non-vascular plants that do not have any roots [7]. There are a large number of fungi that exist in this world. Some may be harmless and some may be malignant. The harmless species are usually selected for moss concrete. The microbe should also have the ability to decrease the air pollution and maintain a cleaner and greener environment which is the need of the hour.

3. LITERATURE REVIEW

[1] Udawattha, C., Galkanda, H., Ariyarathne, I. S., Jayasinghe, G. Y., & Halwatura, R. (2018). Mold growth and moss growth on tropical walls. Building and Environment, 137, 268-279.

This paper elaborates the intrinsic properties of various types of blocks that are currently in use for Construction of buildings. These properties include sorpivity, water absorption, organic matter content, etc. It was observed that conventional bricks shoed a higher moss growth rate when compared to other building blocks and rough cement plaster showed negligible growth rate. Also, tropical climate owes to an increased rate of moss growth.

[2] Ramasubramani, R., Praveen, R., & Sathyanarayanan, K. S. (2016). Study on the strength properties of marine algae concrete. Rasayan Journal of Chemistry, 4, 706-715.

In this paper, marine brown algae is added at different percentages to M25 grade concrete with a water cement ratio of 0.5. A chemical reaction between cement and algae occurs which makes the environment pollution- free. It resulted in a compressive strength of 29.24 MPa, a split tensile strength of 4.6 MPa and flexural strength of 4.7 MPa for an algae quantity of 8% which has been selected as the optimum range. Impact test was also conducted and the initial crack was observed after 94 blows. Failure of the specimen was recorded after 96 blows for the specimen with 8% of algae in it.

[3] Chairunnisa, I., & Susanto, D. (2018). Living Material as a Building Façade: The Effect of Moss Growth toward Mechanical Performance on Pre-vegetated Concrete Panels. International Journal of Technology (IJTech) Vol, 9.

The authors of this paper have compared the behaviour of pre-vegetated and non-pre-vegetated panels made of concrete. For this research, three types of Bryophytes were grown on the surface of concrete. Before growing the moss, the concrete surface was prepared and conditioned. On the aspect of compressive strength, non-pre-vegetated panels showed an increase in its strength when compared to pre-vegetated panels. But, it was also observed that the tensile strength was affected due to the growth of moss on concrete.

[4] Radu, D. M., Trautz, D., & Cantor, M. (2015). Moss: Decorative and Ecological Potential in Landscape. ProEnvironment Promediu, 8(21).

This paper studies the possibilities of using moss in landscape architecture. Moss has the capacity to grow faster and spread through larger areas. It can be grown on soil, rocks, concrete and also on wooden surfaces. It can be used to enhance the aesthetic view of a structure and thereby, helps in reducing pollution by aiding in the purification of air.

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[5] Xiong, W., Tao, Y., Wang, P., Wu, K., & Chen, L. (2022). Impact of Environmental Factors on the Formation and Development of Biological Soil Crusts in Lime Concrete Materials of Building Facades. Applied Sciences, 12(6), 2974.

This paper summarises the adverse effects of microbial growth on the surface of structures made of lime concrete facades. In some cases, it led to discoloration of the buildings. In general, lime concrete is susceptible to water permeability and may develop micro-cracks at a faster rate when compared to conventional concrete. This property of lime concrete will pave the way for accumulation of moisture which leads to the growth of microbes.

[6] Bertron, A. (2014). Understanding interactions between cementitious materials and microorganisms: a key to sustainable and safe concrete structures in various contexts. Materials and Structures, 47, 1787-1806.

Microbes can lead to poor quality of indoor air too. It may lead to skin irritations, allergies, infections in respiratory systems and other ailments. Methodologies are being developed to examine the reactions between microbes and the cementitious materials. The microbes may lead to formation of organic acids due to the chemical reactions. Some microbes may lead to bio-deterioration of buildings.

[7] Mustafa, K. F., Prieto, A., & Ottele, M. (2021). The Role of Geometry on a Self-Sustaining Bio-Receptive Concrete Panel for Facade Application. Sustainability, 13(13), 7453.

This paper enumerates on the fact that how proper growth mechanism of moss can help in making wonders instead of random or irregular growth patterns. Geometry of these patterns plays a vital role in boosting the growth of moss. After three weeks, it was found that the optimum range of temperature for moss growth was found to be 20-24°C. These patterns were not only efficient but were also aesthetically pleasing.

4. Inferences

From the above study, it is proven that though moss growth may lead to building deterioration, proper care and accurate geometrical patterns can lead to efficient use of moss in the Construction field. Moss can grow in an environment that is both moist and humid in nature. Mostly, tropical climatic conditions are favourable for an increased growth rate.

5. Conclusion

To conclude, growth of moss on concrete follows the phenomenon of bio receptivity. Concrete panels with a pre-planned geometry which may aid in efficient growth of moss can be created and utilised for buildings. Tropical climatic conditions will propagate the growth rate of moss on concrete or other building materials. Appropriate moisture and humidity must be ensured to fasten the growth. Moss concrete not only purifies the environment, but also acts as a thermal regulator thereby maintaining an ideal temperature. Further studies may be conducted to test the durability of such concrete panels.

References

[1] Udawattha, C., Galkanda, H., Ariyarathne, I. S., Jayasinghe, G. Y., & Halwatura, R. (2018). Mold growth and moss growth on tropical walls. *Building and Environment*, *137*, 268-279.

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