

# HEMPCRETE – Carbon Negative Concrete

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**Abstract:** As we know carbon emission is increasing at an alarming rate which is eventually the cause of global warming as CO<sub>2</sub> is the main contributing gas in it. In India, approximately 33 % of carbon emission is due to construction industry. Every tonnes of cement production emits up to 622 kg of CO<sub>2</sub>. To meet the demand of growing population, more and more infrastructure is building that means we cannot really reduce the production of cement which acts as a binder in concrete. Hence, hempcrete can be used as a partial replacement of cement which is an eco-friendly material so that carbon emissions can be reduced. Hempcrete is a mixture of hemp hurds and lime. This paper discusses the need of hempcrete, preparation of hempcrete, advantages of hempcrete over conventional concrete and major problems associated in making and implementation of hempcrete.

**Keywords:** Hempcrete, carbon negative concrete, sustainable building material.

## Introduction

India is a developing country and the second largest cement producer worldwide with over 7% of the global installed capacity (IBEF). In 2021, 294.4 million tonnes (MT) of cement was produced and it is likely to increase by 12% to 332 MT in 2022 (ICRA), which results in approximately 2.1 billion kg of CO<sub>2</sub> emission in the atmosphere. As India's population is growing rapidly, more houses as well as industries are required to meet their demands. Until India becomes a developed country, new infrastructure construction will definitely keep on increasing. Hence to reduce the carbon emissions we have to come up with different alternatives to replace cement that are eco-friendly, so that we can build more and more infrastructure without compromising the environment. One of the best alternatives available today is hemp or hemp shives which can partially replace cement in concrete and concrete made by hemp is known as hempcrete. It is basically a bio-composite mixture whose main ingredients are lime/cement, hemp, and water. Hemp is mixed with other ingredients in the form of hump hurd as shown in figure.1.



Figure 1. Hemp hurds

### Advantages of hempcrete

- First and foremost advantage of hempcrete is its eco-friendly nature. The amount of CO<sub>2</sub> absorbed after construction is almost four times the CO<sub>2</sub> absorbed during its growing phase. As global warming is nowadays the main concern all over the globe, every country is looking for likewise materials, therefore this property makes it more advantageous to use as a replacement of cement in concrete.
- It is a lightweight concrete, conventional concrete is approximately eight times heavier than hempcrete. Due to this property, self weight of structure is reduced.
- Hemp crop can be harvested within 4 to 5 months, hence its production can be increased exponentially. Additionally, use of hemp will eventually decrease the exploitation of natural resources (which are generally used in production of concrete).
- Hempcrete also acts as thermal insulator because of its less thermal conductivity (approximately 0.1 W/m/K) which is quite less as compared to the thermal conductivity of conventional concrete (approximately 0.62 to 3.3 W/m/K). Due to this property, it is helpful in reducing the use of cooling system in summer and heating system in winters. As a result, less energy is consumed.
- In terms of acoustic absorption, hempcrete has a very high noise reduction coefficient nearly equal to 1 which is considered as the perfect NRC absorption.

### Problems associated with the production of hempcrete

- The biggest problem is the production of raw material i.e hemp as this comes from the family of cannabis, and it is illegal in many countries to plant. As far as India is concerned, it has lifted the ban for planting hemp so that the production rate of hempcrete can be excelled. Nevertheless, there is lack of awareness about the uses of hemp as it can also be used for other purposes along with hempcrete.
- As the hempcrete is a new technology especially in India, standard specifications are not available for making the hempcrete. Extensive research work is being done in this regard as it is of utmost important to invent and use eco-friendly concrete to imitate carbon emissions.
- Indian standard codes are not available for hempcrete so the proportion or ratio of hemp, lime and water is not fixed, every time the proportion decided is based on experiments/tests performed and the desired strength is achieved based on trial & error method.
- Because of lack of research in this field, only few people know about the making process of hempcrete, therefore skilled worker required are not easily available.
- Based on the research conducted until now, hempcrete cannot be used as main supporting member such as beam, column and slab. Due to this, civil engineers are not exploring in this field.

### Conclusion

Being a developing country, India needs more and more alternatives to reduce carbon emissions. As of now, India is standing at third position in terms of carbon emission and one third of India's carbon emission is due to construction industry. A plethora of initiatives are being taken in this regard so that we can mitigate the release of CO<sub>2</sub> in the atmosphere. Replacement of cement in concrete with eco-friendly material is really necessary if we want to control carbon emission. Hempcrete has got great potential as the hemp used in it is eco-friendly as well as recyclable. A lot of research is needed in exploring the application of hempcrete because right now it is being used as only filling material, not as supporting member of a structure which can take direct loading. Also, the government needs to be more lenient at local/state or national level in terms of giving ease to produce hemp and more and more awareness programs needs to be conducted regarding the application of hemp as eco-friendly material not as drug.

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