

# HEMPCRETE

 [materialspalette.org/hempcrete](https://materialspalette.org/hempcrete)



## Carbon Impact of Hempcrete

Hempcrete is a monolithic wall system that consists of hemp hurd, lime, and a hydraulic additive over a structural support. Hemp hurds of processed quality are currently available to US markets from the Netherlands, China, and possibly a few small scale processors in the US and Canada.

Lime, in this application uses about 80% less energy to calcine than when used in concrete. As an “air set” material, the lime in hempcrete reabsorbs the CO<sub>2</sub> that is driven off in calcining [ $\text{CaCO}_3 \rightarrow \text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 \rightarrow \text{CaCO}_3$  with evaporation of water and sorption of CO<sub>2</sub>].

## Statistics

hemp based composite sequesters and stores an estimated **325 kg carbon** per metric ton of hemp based composite<sup>1</sup>

## Carbon Smart Attributes

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### Hemp sequesters carbon

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Hemp naturally sequesters carbon both in stalk itself and by storing carbon into the soil. The amount of carbon sequestered depends on the type of hemp, where and how it was grown, and on harvesting methods.

## Material Attributes

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### Hemp is fast-growing

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Hemp is a very efficient and fast-growing plant, growing as tall as 15 feet in a season.

### Hemp utilizes an agriculture by-product

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Hemp is typically grown for fiber, seed, medicinal CBD's, animal feed and other uses. Hempcrete uses the woody core (hurd) of the hemp plant that is often considered a waste or byproduct.

## Thermal Performance

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Hempcrete wall systems are highly insulative and act as thermal mass. Walls that are typically 12" thick provide requisite R-Value (~2.5/in.)

### Durability: moisture, fire, and insect Resistance

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The hempcrete wall system transmits humidity, is fireproof, deters insects and rodents, resists mold, (can recover from water penetration without molding), has excellent acoustic performance, is recyclable, has no VOC or other toxins, and can endure for centuries.

### Hempcrete can create an air-tight wall assembly

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Finished with lime render, there is no opportunity for air flow when the finish is properly wrapped to windows and door openings.

### Hempcrete can be used in multiple applications

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Hempcrete could be used in new construction or retrofitted over existing framing. With proper equipment, hempcrete can be sprayed, including onto masonry walls, or as pre-cast panels. There is some speculation that a hemp/lime slurry could be 3-d printed.

## Design & Construction Guidance

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## Hemp hurd should be appropriately processed

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Processing of hemp hurd should yield pieces that are less than  $\frac{3}{4}$  inch, have most of the dust removed, and have a suitable moisture content (~10-15%). Specify hemp hurds that meet these standards.

## Pay attention to what binder is being used

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Some type of binder is needed for hempcrete construction. This may be achieved by using Natural Hydraulic Lime (NHL), by adding Portland Cement, or by including an additive that has been formulated to mimic the Pozzolanic constituents of NHL. If using hydrated lime as a binder, ensure that it has at least 90% calcium content. Reference CONCRETE for carbon-smart cement.

## Portland cement should be used strategically

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Portland cement and other binders can interfere with the thermal and moisture performance of a hempcrete wall. Understand how the binder used will influence the thermal and moisture performance of your hempcrete mixture.

## Acknowledged Challenges, Questions & Unknowns

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Hemp hurd processing is currently available to US markets from the Netherlands, China, and a few small scale processors in the US and Canada. The embodied carbon of hempcrete could be greatly reduced if hurd processing and binder formulation were made locally or regionally available.

The various growth habits and varieties of hemp present different processing challenges. Tall plants that are harvested for fiber are the easiest to process for hurd. Bushy varieties grown for seed require a different processing method; these stems may be more suitable for paper and other products

Natural Hydraulic Limes (NHLs) are not typically mined in North America, as there have been few uses for them before. Sources of naturally occurring hydraulic limes are not well studied or documented in the US, though they may exist wherever ancient sea beds were exposed to volcanic activity. Alternatively, correct proportions of silicates and other mineral additives may be formulated to mimic the NHLs of European usage. (Additives are currently available in Europe.) The contents include commonly occurring minerals in the form of clay, silicates/alumina, and ashes.

Proprietary blends of hempcrete binder are available in the US. Price and quality need to be evaluated for practical use.

Hempcrete properties vary depending upon method used to build. Though hand packing can create inconsistent densities, it hasn't been shown to affect performance.

Studies indicate insignificant performance gain between 9”(22cm) and 12”(30cm) walls in the UK.

Studies need to be conducted to validate properties of hempcrete, and building codes adapted, so that municipalities can permit these buildings. Criteria needs to be adjusted towards performance objectives rather than other industry prescribed conveniences.

## RESOURCES

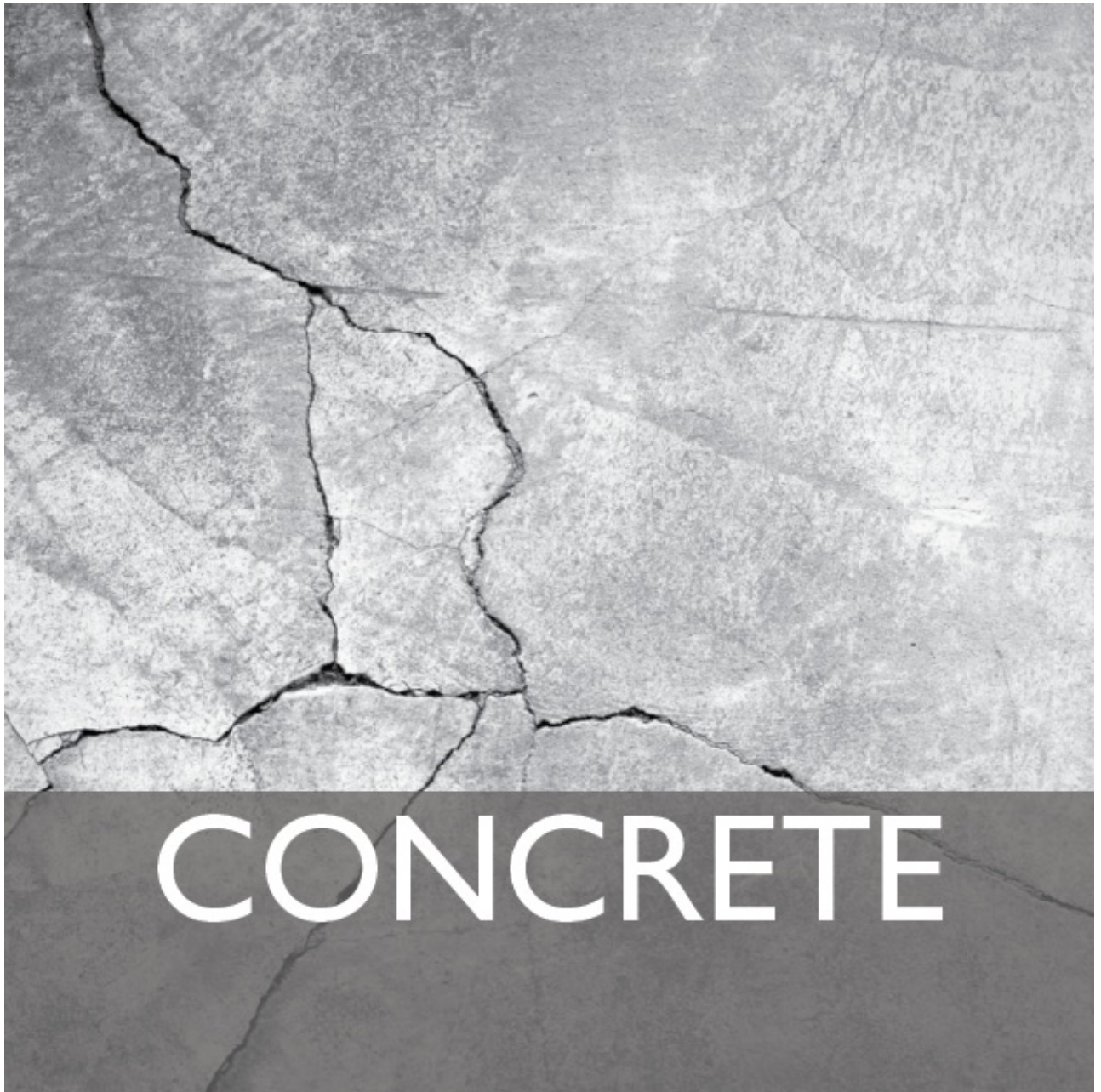
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1 | “Carbon storage potential in natural fiber composites,” Muhammad Pervaiz, Mohini M Sain, 2003.

Essential Hempcrete Construction, The Complete Step-by-Step Guide, Chris Magwood, 2016

## SEE ALSO

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# INSULATION





# CARPET

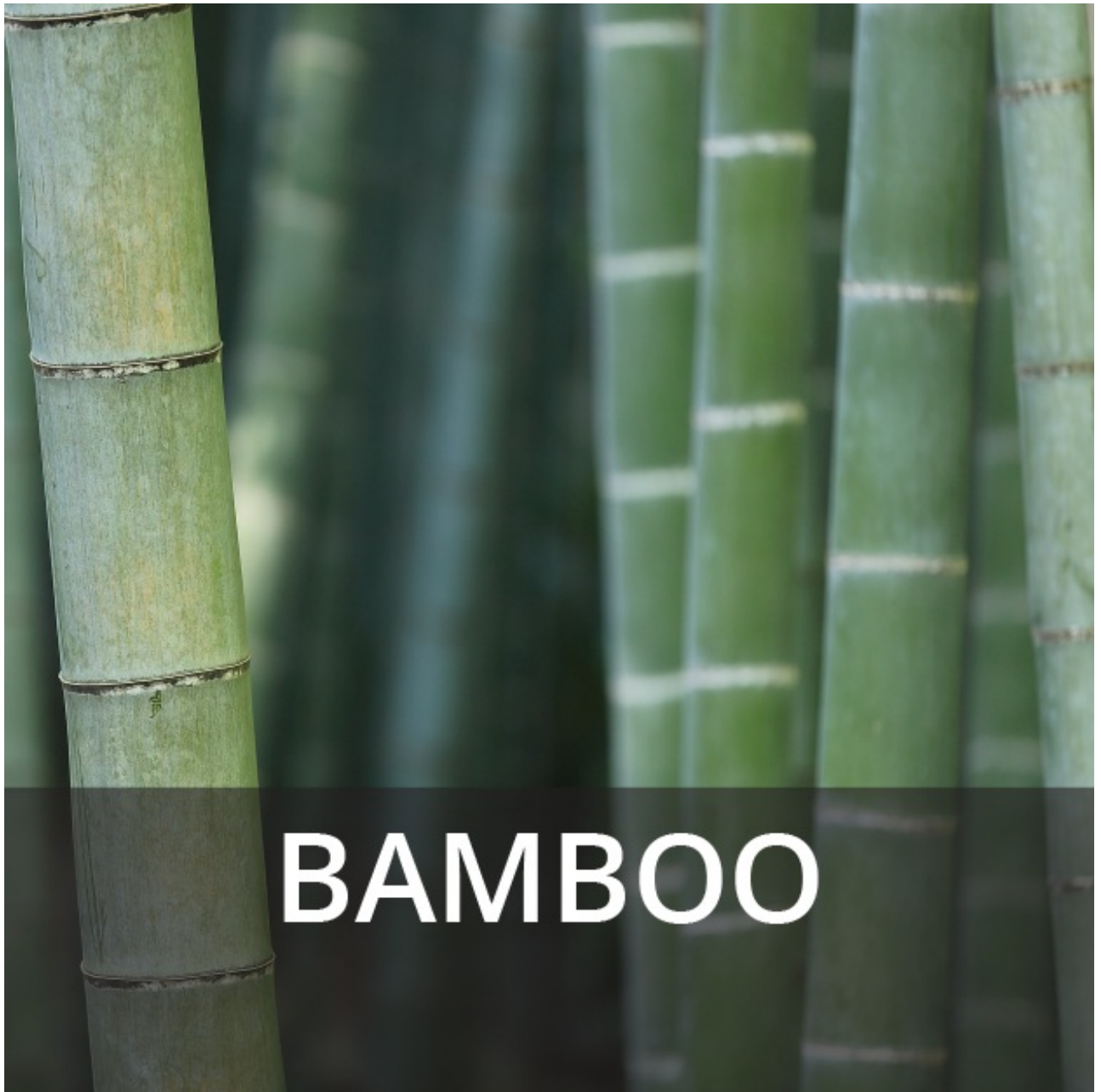


# GYPSUM BOARD













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## CONTACT

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