

# Hempcrete

## A Sustainable Lightweight Biocomposite Alternative

### What is Hempcrete?

Hempcrete is a bio-aggregate concrete made from lime-based binder and hemp hurd. The most complicated part is getting the correct ratio of components in the mix. The type of binder used can have different effects on the overall performance of the material. In the construction phase, tweaking its density allows hempcrete to be used as a timber frame infill, roofing insulation or floor application (*Updike, & Flker, n.d.*). Hempcrete locks carbon dioxide within its fibers, has exceptional acoustic performance, low thermal conductivity and vapour permeability. Hempcrete can sequester 19 pounds of carbon dioxide per cubic foot, while concrete and its binding cement accounts for about 8 percent of human generated carbon dioxide emissions annually (*Berg, 2020*). With a mean noise reduction coefficient of 0.69 (*Abbott, 2014*), Hempcrete's acoustic absorption contributes to the economic value of the material. Hempcrete is also a highly breathable material thanks to its porosity. At times of high humidity, vapour condenses into the liquid state and clings on the surface of the pores. This process can be reversed in times of low humidity, essentially allowing hempcrete to act as a natural humidifier that maintains the quality of the air, aided by its antifungal and antimicrobial properties. This exchange modifies the specific thermal conductivity and regulates the indoor temperature, reducing the need for heating and cooling systems (*Arnaud, Samri, & Gourlay, 2013*).

### How Environmentally-Friendly is Hempcrete?

#### + Low Embodied Energy

Naturally sourced and does not require pesticides, herbicides or a large amount of energy during production (*Barrett, 2019*).

#### + Carbon Neutral/Negative

Lower carbon footprint than and reduces the greenhouse gas emissions associated with the manufacturing process of traditional concrete (*Updike, & Flker, n.d.*).

#### + Quick Renewable Source

Seeding/harvesting time gap of hemp ranges from 70 to 140 days (*Johnson, 2015*) and has a maximum yield of 170 bushels per acre (*Williams, & Mundell, 2015*).

#### + Resistant to Fire

Hempcrete walls perform satisfactorily for use in bushfire prone areas to BAL 40 when rendered with 10mm lime render (*The Australian Hemp Masonry Company, 2021*).

#### + Resistant to Mould

With traditional industrial building materials, condensation is more likely to build upon the wall, leading to damp and mold spores which are harmful to health. On the other hand, a square meter of hemp wall can absorb up to 4 gallons of water (*Huttenlocker, 2021*).

#### + Resistant to Pests

pH levels of hempcrete prevents termites from attempting to eat mass (*OzHemp, n.d.*).

#### + Safe for Living Organisms

Biodegradable, recyclable, reuseable, non-toxic, chemical-free and does not off-gas (*Huttenlocker, 2021*).

#### + Good Insulation Properties

Reduced need for costly mechanical ventilation systems, energy required to run building and operating costs as hempcrete stores heat in the thermal mass of its walls (*Huttenlocker, 2021*).

#### + Lightweight

Weighs a sixth of concrete, lends efficiency to the construction process, can be easily transported to great heights (*Barrett, 2019*).

#### + Durable & Low Maintenance

Protect building structure from the elements and able to last hundreds of years (*Lynch, 2020*) with very little caring (*Barrett, 2019*).

#### - Decreased Mechanical Performance

Porous structure of the hempcrete and low rate of compressive strength (3.5 MPa as compared to concrete's lowest of 17 MPa) prevents it from being used as a load-bearing material/ structural block (*Arizzi, 2015*).

#### - Shortage of Skilled Labour

A niche practice at the moment without an abundance of expertise, may need to source for and fly in builders, but labour costs for these labour intensive thicker-than-most walls will decrease as hempcrete buildings become more commonplace (*Arizona Pest Control, 2017*).

#### - Regional Packaging & Distribution

Two thirds of Australia's total commercial production output is in Tasmania as the cool climate is conducive for hemp cultivation, not on Mainland Australia (*Medical Cannabis Network by Health Europa, 2020*).

### The Process of Making Hempcrete

A basic hempcrete recipe is 4:1:1. 4 parts industrial hemp hurd, 1 part lime-based binder (50% lime, 50% metakaolin) and 1 part water.

Hempcrete can be made either by hand or with a mortar mixer. Dumping the water into the hempcrete mix is the most effective way of adding it. The whole process should take 10 minutes. The mix is ready when the hempcrete is dry enough to retain its shape when packed into a ball yet moist sufficient to crumble when force is added (*Coel, 2021*).

Too much water will impact the drying time once it is made into a wall. Once properly mixed and set, about 30 minutes later, the hempcrete is ready to be used.

Curing can take up to 6 to 8 weeks and is affected by weather changes, hence might be unsuitable for use in certain climates (*Lynch, 2020*).



(*Designing Buildings, 2020*)

### Hempcrete can be Applied in Four Different Forms:

1. Monolithic Casting between formwork
  2. Spraying against formwork – requires installers with purpose-built machinery and training
  3. Ready-to-use hempcrete block construction
  4. Pre-cast wall unit construction
- (*Hempcrete Australia, 2013*)

## Bibliography

- Abbott, T. (2014). Hempcrete Factsheet. The Limecrete Company, Ltd: Sustainable Construction  
<http://limecrete.co.uk/hempcrete-factsheet>
- Arizona Pest Control. (2017, October 27). Bug Blog: Houses Made of Hemp are Termite-proof.  
<https://www.azpest.com/bug-blog/houses-made-hemp-termite-proof/>
- Arizzi, A., Brummer, M., Martin-Sanchez, I., Cultrone, G., & Viles, H. (2015). The Influence of the Type of Lime on the Hygric Behaviour and Bio-Receptivity of Hemp Lime Composites Used for Rendering Applications in Sustainable New Construction and Repair Works. *PLoS One*, 10(5), 1-19.
- Arnaud, L., Samri, D., & Gourlay, E. (2013). Bio-Aggregate-Based Building Materials: Applications to Hemp Concretes. *Hygrothermal Behavior of Hempcrete*, 179-243. ISTE Ltd, United Kingdom. Wiley. New Jersey.
- Barrett, A. (2019, September 12). What is Hempcrete?. *Bioplastics News*.  
<https://bioplasticsnews.com/2019/09/12/what-is-hempcrete/>
- Berg, N. (2020, October 22). Out of Hemp's Many Promising Uses, One of the Best Could Be in Construction. *Greenbiz*.  
<https://www.greenbiz.com/article/out-hemps-many-promising-uses-one-best-could-be-construction>
- Coel. (2021, January 21). Growing, Processing, and Building with Hempcrete. Margaret River Hemp Co..  
<https://hempco.net.au/growing-processing-and-building-with-hempcrete/blog>
- Designing Buildings. (2020, September 24). Hempcrete Blocks. *Hempcrete*.  
<https://www.designingbuildings.co.uk/wiki/Hempcrete>
- Hempcrete Australia. (2013, April). 2: General Information.  
<http://www.hempcrete.com.au/pdf/2.%20General%20Information-April2013..pdf>
- Huttenlocker, K. (2021, December 16). Five Amazing Ways Hempcrete Can Eliminate Sick Building Syndrome. *Environmental Living Industries*. <https://eli.inc/learn/add-hemp-to-your-crop-rotation/>
- Johnson, R. (2015). Hemp as an Agricultural Commodity. Congressional Research Service.  
<http://fas.org/sgp/crs/misc/RL32725.pdf>
- Lynch, P. (2020, November 4). Biggest Disadvantages of Hempcrete as a Building Material. *WayofLeaf*.  
<https://wayofleaf.com/hemp/disadvantages-of-hempcrete-as-a-building-material>
- Medical Cannabis Network by Health Europa. (2020, April 21). Australia's Growing Industrial Hemp Industry. *Health Europa*.  
<https://www.healtheuropa.com/australias-growing-industrial-hemp-industry/99504/>
- OzHemp. (n.d.). Tradical® Hempcrete. *OzHempAU*.  
<https://ozhemp.com.au/tradical-hempcrete/#:~:text=Tradical%C2%AE%20Hempcrete%20has%20significant,is%20termite%20and%20mould%20resistant.>
- The Australian Hemp Masonry Company. (2021, June 16). Peace of Mind from Using Fire Retardant Building Materials.  
<https://www.hempmasonry.com.au/fire-retardant-building-materials/>
- Updike, J., & Felker, T. (n.d.). (rep.). Hempcrete as a Sustainable Building Material. Rapid City, South Dakota.
- Williams, D.W., & Mundell, R. (2015). An Introduction to Industrial Hemp, Hemp Agronomy, and UK Agronomic Hemp Research. UK Department of Plant and Soil Sciences, Kentucky Tobacco Research and Development Center.