



## Building with hempcrete (hemp-lime): Essential tips for the beginner (Part 2)

by Alex Sparrow

*Disclaimer: The author provides this overview of hempcrete construction in the spirit of advancing the knowledge and skills of people wanting to use the material. This article does not constitute a full training programme in the use of hempcrete and it remains the responsibility of designers and builders to detail and specify materials for their own buildings, and to ensure that contractors are fully trained. The author can accept no liability for the actions of his readers.*

In the previous issue of The Last Straw (#64) I began to outline some key “dos and don’ts” for people wanting to build with hempcrete (hemp-lime composite). My business partner William Stanwix and I, along with the rest of our team at Hemp-LimeConstruct, have been building commercially with hempcrete in the UK for 6 years now, and have learned a lot of tricks along the way which we’re happy to share with TLS readers. For those wanting more in-depth information details of our forthcoming book *The Hempcrete Book: Designing and building with hemp-lime* can be found at the bottom of this article.

In the last issue we covered the nomenclature of hemp building, the basics of using hemp in construction (including different methods for applying it on site), and the first steps for building a hempcrete wall. Having looked at the plinth, the structural timber frame, fixings, and how services are brought into the building, we will now move on to discuss the method of mixing and applying the hempcrete itself.



Shuttering under construction for a hempcrete wall.





Shuttering

Temporary shuttering (formwork) is constructed around the timber frame to form the void which will be filled with the freshly mixed hempcrete. In our own practice we use OSB (oriented strand board) as we find it hard wearing and flexible (it can be cut to form unusual shapes). It can also be recycled into a roof deck or garden shed at the end of the build. Curved walls can be formed using flexible plywood as the shuttering. Commercial plastic or metal formwork systems can also be used which speed up the work considerably on a large square building, but these are costly and somewhat less flexible on smaller, or more individualised, buildings.

When erecting the shuttering, care must be taken to ensure that it is straight (true) and plumb, so that the eventual face of the hempcrete wall is also straight. This is presuming that you want a straight, plumb wall – they are not to everyone’s taste! Angled window reveals are attractive and help to maximise natural light in a building with thick hempcrete walls. These can be formed in the shuttering, or the reveals can be formed square and scratched back after casting with a nail float. This technique is also used to soften external corners after casting, for aesthetic reasons and to eliminate the need for corner beads in the plaster.

Mixing hempcrete

Hempcrete is usually mixed in a large (180 gallon) forced action pan mixer. It can be done in a conventional drum cement mixer, but it is more difficult to ensure an even mix and in a new build the quantities needed for anything other than the smallest extension preclude this as a viable method. At a push, once you have mastered the technique, one person can run two cement mixers at a time which doubles the output, but really a big pan mixer is the thing for larger buildings.

The critical thing to remember when mixing hempcrete is to use the exact proportions of hemp shiv, binder and water, as specified by the binder manufacturer. Especially critical is the amount of water added, which should be no less and no more than what is required. This is because the dry hemp immediately sucks up some of the water in the mix and, because the binder needs water to achieve its hydraulic set, the amount of water specified includes extra water for the hemp, to ensure the binder gets all the water it needs. This extra water added at the mixing stage is what needs to dry out of the wall after the shuttering is removed. This drying (to the point where wet finishes can be applied) normally takes around 8 weeks, depending on the thickness of the wall, contractor skill during placing, and local weather conditions. As discussed in the last issue, long drying times are the main cause of problems with the build schedule, so it is vital to add enough water without adding too much, which will extend drying times.

The hemp, binder and water should be mixed for the minimum time possible to ensure a consistent mixture with the binder evenly distributed and coating all of the hemp. Mixing for longer than necessary (especially in a drum mixer) causes the mix to start “balling”; small balls of binder start forming in the mixture. The readiness of a hempcrete mixture is tested by taking a handful out of the mixer and squeezing it into a ball between your hands. Push a finger into the ball. It should break cleanly into two or three pieces; if it crumbles it’s too dry, if it’s squidgy it’s too wet. Once mixed, hempcrete should be used promptly before it starts going off, and buckets waiting to go into the wall should be protected from rain (adding more water) or direct sunlight (drying the material out).

◀ Top: Joining two shuttering boards together for the next lift.  
Bottom: A hempcrete wall with shuttering partially removed.



Mixing hempcrete in a drum mixer is more difficult, but it's possible if you don't need large quantities.



Mixing hempcrete in a large pan mixer. This is the usual method since large quantities are easily mixed.



The constituents of hempcrete; hemp shiv, lime binder and water.

Placing hempcrete

Tubs of freshly mixed hempcrete are ferried to the shuttering and tipped into the void in layers of no more than 100-150mm (4-6 inches) at a time. The mixture is then spread around with a gloved hand to ensure that it is evenly distributed around the void, taking special care in hard-to-access corners, and around frame timbers to ensure that the material is making good contact with the timber. The top of the layer is then patted down firmly with the palm of your gloved hand. No other “tamping” is required, since over compressing the material has unwanted effects. Firstly you are reducing the amount of air trapped in the material (reducing the insulation value of the finished wall). Secondly your wall will be more expensive, as you will have put more material into it. Lastly you are closing up the matrix structure and reducing the size of the thousands of tiny air tunnels running through the finished wall. This restricts air flow and so further extends the drying time, causing delays in the application of finishes.

For this reason we never use “tamping sticks”; we find that people are more sensitive to the amount of compression required when their gloved hand is in contact with the material. Give someone a stick, and they immediately lose touch with the material and the tendency is then to over-compact. We use sticks only to reach inaccessible areas, and teach people to use them as an extension of what they are doing with their hand. Some areas, e.g. where the coverage of hempcrete over a frame timber is not very deep (the minimum is 50mm or 2 inches), may require more compression, to ensure the structural integrity of the finished material. Additionally it is good practice to give extra compression, with the tips of your gloved fingers, along the sides of the void to consolidate the face of the wall. How much compression is needed here is largely a matter of experience, and there is a balance between a wall face which is too “open” - potentially friable and swallowing up too much plaster in the base-coat, increasing the finish costs - and too “closed” - with insufficient air holes, thus reducing the surface area of the material at the face of the wall, slowing the evaporation of excess water out of the wall and extending the drying time.

Move around the building, placing hempcrete in the shuttering as described until it is all full and ready for the next lift. You can fix more shuttering boards to create the next lift, leaving the ones below in place. Once the hempcrete has taken its initial set, boards can be removed, but always keep a board in place below the lift you are currently casting. There is no set “maximum lift” in a day, this depends on the materials you are using, but in practice, unless you are casting a very small shed, you are unlikely to run into trouble as long as you always cast a whole lift before moving up. If you have to stop for the day with shuttering half full, taper the last few mixes down into a gradual slope, so that the next day your first hempcrete is building on top of what is already there. This is better than leaving “vertical day joints” which form a weak spot in the finished material.

When casting spans across windows and doors, cast the whole ‘lintel’ section in one go, extending at least 300mm (12 inches) over the wall on each side, to ensure the integrity of the spanning section. Small section timbers, such as roofing battens, can be cast into the ‘lintel’ hempcrete on either side of the frame to provide extra support to it as it dries. For longer spans, more substantial timbers may be required to provide additional support. At the bottom of openings in the wall (e.g. windows) where the hempcrete stops, cast the hempcrete approximately 25mm (an inch) higher than the eventual desired level, and cut it back afterwards with an old hand saw. This is so that the top layer (always loose and friable when dry) can be cut back to solid hempcrete.



Tipping hempcrete into the shuttering.



# Materials

## After casting

One or two weeks after casting, once the hempcrete has hardened sufficiently (but before it goes too hard!) use a nail float to shape the hempcrete as required, and an old saw to cut back to level at the openings.

Use good drying management to speed up the drying time. The key here is to get as much heat and airflow to the surface of the wall. A “good washing day” is good for hempcrete drying. Organise the site so that materials are not left leaning against the wall or standing in front of it to block light and airflow. Ensure the building is well ventilated and if doors and windows are fitted, make sure these are left open as much as possible. If a wood burner is fitted ensure the door is left open when not in use, to provide passive ventilation of the building. If you are casting at colder times of the year (which is not recommended), heat the building when you are there and, as soon as the heat source is turned off, open all the doors and windows to vent away any moisture that has evaporated into the heated room.

## Finishes

All finishes for a hempcrete wall must be vapour permeable to ensure the continued health of the fabric of the wall, which contains untreated timber and a plant aggregate. The usual finish is a two coat lime plaster, and lime render externally. Clay plasters can be used internally. All paints must be vapour permeable, and lime or clay paints, and limewash are often used. Other finishes include timber or hung tile cladding with a vented air gap, or stone or brick cladding with lime mortars. For a cladded wall, an external, or double, frame design is required so that there is something to tie the cladding back to. A

vented air gap can be used behind the masonry cladding, or the masonry can be constructed first and the hempcrete cast against it, as long as consideration is given to a) the ability of the hempcrete to dry out after casting, and b) the exposure of the wall to driven rain. In situations where the wall is frequently exposed to severe weather a vented cavity is preferable.

Wet finishes can be applied as soon as a dry crust of around 40mm (1 ½ inches) is present below the wall’s surface. Dry means below approximately 23% WME (wood moisture equivalent) as tested with a protimeter (moisture meter) with long probes to get inside the wall. A dry crust indicates that moisture is now leaving the wall as vapour rather than liquid water, and so cannot carry tannins (present in the hemp) through to the surface of the wall. Plastering too early can cause cosmetic staining of the plaster due to these tannins being deposited on the surface. Plastering also closes up the surface of the wall, reducing the surface area for evaporation and slowing the drying of the wall, meaning that it will take longer to reach its optimum thermal performance, so it’s important not to apply wet finishes too early.

## Final thoughts

Cast in situ hempcrete is a low tech, sustainable and very enjoyable material with which to build. It offers a flexible construction method, suitable for all types of construction (with the exception of underground or underwater applications!). Hempcrete is truly zero carbon, since it acts as a carbon sink for the lifetime of the building. Tom Woolley is correct in saying that once people have experienced this

way of building, they rarely go back to using any other method.

The main drawback is the drying time on site, which as described above can be extended considerably by weather conditions, sloppy practices and contractor error, and so for larger builds pre-cast hempcrete blocks or panels are probably more suitable options. Contractor technique on site can also have an effect on the thermal performance of the finished hempcrete, so it’s important for those building with hempcrete to understand the issues involved to ensure a successful and smoothly run project.

Currently, due to supply-demand issues and the consequent price of binder materials, the cost of building with hempcrete (in the UK at least) is broadly the same as the equivalent brick and block construction with a high spec insulation. However, hempcrete - while “light work” - is a pretty labour intensive way of building, and due to the low-tech, hands-on method it is very easy for self-builders to do much, if not all, of the work themselves, dramatically reducing costs.



Using a nail float to soften a hempcrete corner 10 days after casting.



The effect of plastering too early; tanin stains on the plaster.

# Materials



Although currently in its infancy due to the developing supply chain for industrial hemp and certified binder materials, this is a method which can, and will, increasingly be used around the world to provide low impact homes and take us towards a serious reduction in carbon emissions associated with the built environment.

◀ New build hempcrete housing in Swindon, UK (built by Haboakus).

Hung tile cladding on a hempcrete gable.

A self-built hempcrete house, combining timber cladding and lime render finishes.



The issues and methods outlined above are discussed in more detail in William Stanwix and Alex Sparrow’s forthcoming book *The Hempcrete Book: Designing and building with hemp-lime*. The book is in three parts: a discussion of the underlying principles of hempcrete building; a full practical construction manual; and a section on detailing and wider design considerations for architects and other building designers.

The publication dates are 9th October (UK) and 1st November (USA). More information can be found at <http://www.greenbooks.co.uk/the-hempcrete-book>

Hemp-LimeConstruct can be contacted through their website at [www.ukhempcrete.com](http://www.ukhempcrete.com), or via twitter: @UKHempcrete and @hempcretebook.

A video showing hempcrete being mixed in a drum mixer is available at: <http://www.youtube.com/watch?v=wIFupaK-rvM>

See also:

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Woolley, T. (2006) Natural Building: A guide to materials and techniques. The Crowood Press: Marlborough

