HEMP COMPOST WALLS AND INSULATIONS.

IS IT:

- [X] *Product*
- [ ] *Technology*
- [ ] *Equipment*

APPLICABLE FOR:

- [X] *Restoration*
- [X] *Rehabilitation*
- [X] *New Construction*

APPLICABLE ON:

- [ ] *1. Foundations and underground structures*
- [ ] *2. Vertical structures*
- [ ] *3. Horizontal structures and vertical connections*
- [X] *4. Roof and terraces*
- [X] *5. Façade and building envelope*
- [X] *6. Finishes and completion elements*
- [ ] *7. Integrated services*
- [ ] *8. General strategies for building recovery*

Related companies: *Hemp Eco Systems*

DESCRIPTION

HempLime consists of hemp-hurds, hydrated lime, *HESplus* and water (patented). The combination of these 100% natural raw materials produce a long lasting, lightweight, fire resistant, thermal and humidity regulating, rot and pest resistant, carbon negative building material which improves the indoor climate for all inhabitants.

WHY TO USE

Thermal Regulator: *HempLime* is an excellent thermal regulator due to the high porosity, the breathing abilities, and the seamless application.

Humidity Regulator: Both lime and hemp hurds take up indoor humidity which results in a comfortable living environment with no need of indoor mechanical ventilation.

Resilient to moisture damage: HempLime capability absorbing and realising moisture to any kind of water related damages.

CO2 Absorbent: Hydrated lime carbonates and absorbs CO2 in the presence of humidity. The humidity regulating performance of the hemp assures a constant humidity feed to the lime.

Acoustic Insulation: The porosity ensures good sound absorption properties from the outside and produces a pleasant indoor soundscape.

Rot and Pest Resistant: HempLime does not rot due to its high silica content and porosity. The alkalinity of the lime repulses bacteria fungi and rodent.

Other benefits:

- Hydrated lime can be sourced locally in many regions leading to lower cost of materials and transport by avoiding the need to import heavy pre-mixed binders.
- Hydrated lime has lower carbon emissions than hydraulic lime and cement.
- Hydrated lime allows HES-mix to be more porous therefore lighter and more insulating.
- Hydrated lime allows HES-mix to have exceptional moisture/humidity regulating properties.
- Continuous carbonation (CO2 absorbing) effect of hydrated lime allows hydrated lime to complete the lime cycle turning back to limestone.
- No cement or toxic materials used, ensuring a breathing product good for health and alkaline indoor climate.

HOW TO USE AND APPLY

HempLime is used for walls, roof and floor construction and insulation.

For walls, HempLime is packed into formwork, which is usually erected around a timber frame. When the wall formwork has been filled, the formwork can be lifted immediately and the HempLime will start its drying and curing process.

For floor and roof, HempLime can be placed directly onto gravel floors or placed on top of netting in between roof rafter or floor joists for insulation.

TECHNICAL CHARACTERISTICS

Hemp Hurds: Inner ‘woody’ core of the hemp plant, contains high silica content and lodges microscopic voids. Produced with retting stalks followed by processing and dedusting.

Hydrated lime (93-98% pure): An alkaline material occurring abundantly in nature, as limestone. Does not set in the presence of water. Produced with Calcium Hydroxide in powder form, made by heating limestone to around 800°C turning it into Calcium Oxide then adding water which turns it into Calcium Hydroxide.

HES-plus minerals: A blend of natural minerals which allows hydrated lime to cure faster without losing its CO2 absorption properties. Produced with naturally occurring minerals which may have been crushed from stone, blended by hand.

Water: clean/potable water from local natural or municipal source.

General:

Apparent density (kg/m3): <300; Source: HES; Target density for HES-mix = 240 kg/m3

Dry total Porosity: 72%; Source: BESRAC; Wall infill, hand compacted.

Hazardous substances: None; Source: HES

Thermal/Moisture Performance:

Thermal conductivity (Lambda)(W/m.k): 0.048; Source: VGTU.

Thermal effusively (j/m2.k.s2): very low; Source: Evrard, 2008; Similar to wood, depends on relative humidity.

Thermal diffusivity (m2/s): very low; Source: Evrard, 2008; Similar to wood, depends on relative humidity.

Specific heat capacity c (j/kg.K): 1560, Source: BESRAC.

Thermal capacity (kj/m3.K) for 1m3 INERTIA: 750 to 900; Source: Evrard, 2008; 25mm wall, At=20°, 24h.

Heat flow capacity (W/m2) (t-24h): 187; Source: Evrard, 2008; Probably lower, depending on mixing proportions.

Dampening Temp, variation (h): 98.5%; Source: Evrard, 2008.

Steam diffusion resistance: 3.6 to 4.8; Source: BESRAC.

Humidity storage capacity (%): 11; Source: Rode et al, 2003.

Swelling and Shrinkage: None; Source: HES.

Acoustics:

Global reduction acoustic index (Ra)(dBA): 52 dBa; Source: BESRAC; Havernhill housing test, density 550kg/m3. HES-mix probably lower.

Sound absorption coefficient: 0.3 to 0.9; Source: BESRAC; Spread results.

Energy and CO2:

GWP (Global warming potential) (kg CO2eq/m3): -108.

Embodied energy (MJ/m3): very low.

Recycling (waste sent to disposal): None; Source: HES; Fully biodegradable.

Mechanical Parameters:

Comprehensive strength (N/mm2): 0.4 to 1.2

Tensile Strength (N/mm2): 0.08 to 0.25

Bending Strength (N/mm2): 0.3 to 0.4

Fire Parameters:

Resistance to fire: 105; Source: CSTB report, 2005; 300mm Chanvriblock.

Reaction to fire: (B s1, d0); Source: MEKA; Bio-composite material receives class B, VGTU declared HES-mix as A2.

RECOMMENDATIONS AND OTHER INFORMATION

Casa Coca, Barcelona, Spain. See figures 8, 9, 10

EXAMPLES

http://www.hempecosystems.org/reference-list

https://www.youtube.com/watch?v=gg17npoP0uk

P. Álvarez Naval. Catálogo de puentes térmicos de tipologías constructivas residenciales desde principios del s. XX hasta la actualidad. Propuestas de mejora con materiales ecológicos (2019) Trabajo final de grado en Fundamentos de la Arquitectura, Universidad Politécnica de Valencia. http://hdl.handle.net/10251/135154

M.D. Heidari, M. Lawrence, P. Blanchet, B. Amor. Regionalised Life Cycle Assessment of Bio-Based Materials in Construction; the Case of Hemp Shiv Treated with Sol-Gel Coatings (2019) *Materials*, https://doi.org/10.3390/ma12182987

A. Santoni, P. Bonfiglio, P. Fausti, C. Marescotti, V. Mazanti, F. Molica, F. Pompoli. Improving the sound absorption performance of sustainable thermal insulation materials: Natural hemp fibres (2020) *Applied Acoustics*, vol. 150, https://doi.org/10.1016/j.apacoust.2019.02.022

REFERENCES / SOURCES AND LITERATURE

http://www.hempecosystems.org/hemplime

http://www.hempecosystems.org/materials-and-equipment

http://www.hempecosystems.org/certifications-and-tests

https://www.biofib.com/files/es/BIOFIB-Catalogo.pdf

https://diario420.es/aislamiento-de-canamo-contribuye-a-reduccion-de-co2/

WEBSITE OF THE COMPANY

http://www.hempecosystems.org/

IMAGES AND CAPTIONS

Fig.1: Hemp Mini House “grand edition”: The first fully permitted hemp house (A guest cottage) in Mendocino County, Hopland, California, USA. Build in 2009, with repurposed oak beams and trusses, a footprint of 420 sq.ft., and a total floor area of 650 sq.ft. ©https://www.hempecosystems.org/references-1/Hemp-Mini-House-%22grand-edition%22

Fig.2: Formwork process and curation process of HempLime. ©https://www.hempecosystems.org

Fig.3: Detail of application on floor. ©https://www.hempecosystems.org

Fig.4: Detail of application on wall. ©https://www.hempecosystems.org

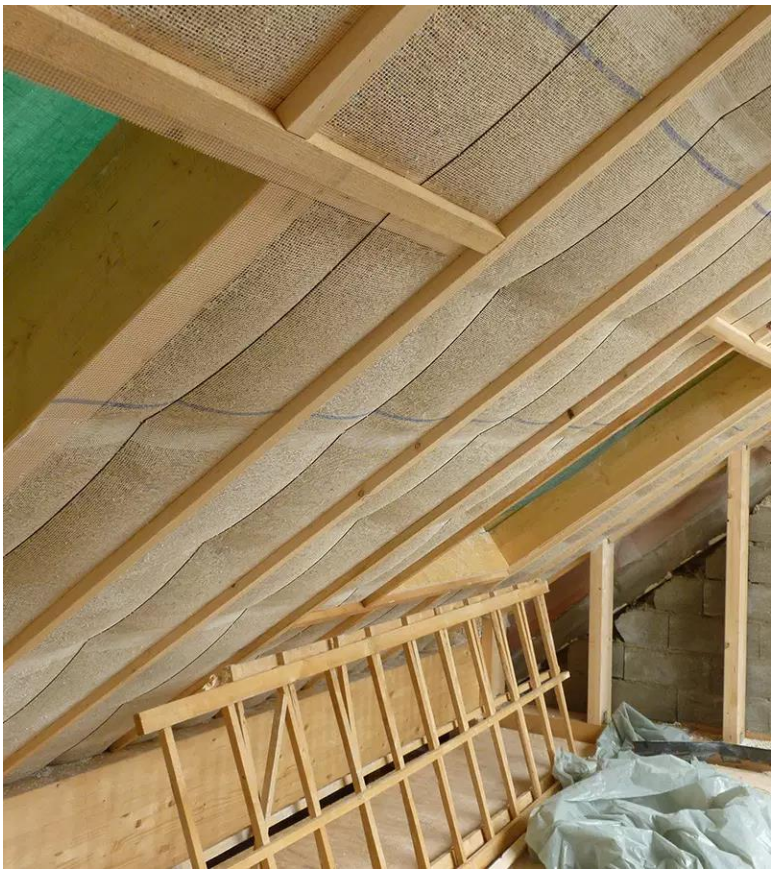

Fig.5: Detail of application on roof. ©https://www.hempecosystems.org

Fig.6: Detail of HES-wall lime paste. ©https://www.hempecosystems.org

Fig.7: Detail of HES-finish breathable plaster (left). ©https://www.hempecosystems.org

Fig.8: 2 HES-finish breathable plaster samples in Casa Coca. © Belén Onecha

Fig.9: Detail of a HES-finish breathable plaster sample in Casa Coca. © Belén Onecha

Fig.10: HES-finish breathable plaster coating in Casa Coca. © Belén Onecha