

Fig. 15 shows effect of varying 10% isotherm curves or exactly the term θ_s in the equation 13 for the sorption and desorption curves. It can be seen that as isotherm curves are higher, material moisture content tends to increase at the same relative humidity level and thus moisture uptake will increase. Increasing θ_s 10%, increases moisture uptake 4.7% and decreasing it 10% decreases moisture content 5%. For both cases rejected moisture mass during desorption is about 2.5 different than reference case.

So we notice that the main parameters affecting moisture uptake or rejection are hysteresis phenomenon, isotherm curve, material exposed surface, vapour permeability finally material thickness.

VII. CONCLUSION

In this paper, we investigated experimentally and numerically the hydric behaviour of a mixture of hemp and lime (hemp concrete) under periodical static step change of air relative humidity. Compared to gypsum and brick, our results suggest that hemp concrete has a higher moisture buffering capacity. In parallel a numerical model using the simulation environment SPARK showed the importance of taking into account sorption isotherm hysteresis in order to predict material dynamical behaviour. A parametrical study has shown that the most important parameters affecting moisture uptake and rejection are hysteresis phenomenon, material sorption curves, its air exposed surface and vapour permeability. These results are actually completed with experimental data for longer periods.

NOMENCLATURE

| Symbol | Definition | Unit |
|----------------|---|---|
| C | Specific heat | $\text{J kg}^{-1} \cdot \text{K}^{-1}$ |
| C_0 | Specific heat of dry material | $\text{J kg}^{-1} \cdot \text{K}^{-1}$ |
| C_1 | Specific heat of water | $\text{J kg}^{-1} \cdot \text{K}^{-1}$ |
| D_T | Mass transport coefficient associated to a temperature gradient | $\text{m}^2 \cdot \text{s}^{-1} \cdot \text{°C}^{-1}$ |
| $D_{T,v}$ | Vapor transport coefficient associated to a temperature gradient | $\text{m}^2 \cdot \text{s}^{-1} \cdot \text{°C}^{-1}$ |
| D_θ | Mass transport coefficient associated to a moisture content gradient | $\text{m}^2 \cdot \text{s}^{-1}$ |
| $D_{\theta,v}$ | Vapor transport coefficient associated to a moisture content gradient | $\text{m}^2 \cdot \text{s}^{-1}$ |
| d | Moisture penetration depth | m |
| G | Gravity acceleration | $\text{m}^2 \cdot \text{s}^{-1}$ |
| h_M | Mass transfer convection coefficient | $\text{kg} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$ |
| h_T | Heat transfer convection coefficient | $\text{W} \cdot \text{K}^{-1} \cdot \text{m}^{-2}$ |
| L_v | Heat of vaporization | $\text{J} \cdot \text{kg}^{-1}$ |
| T | Temperature | °C |
| t | Time | s |
| α | Solar radiation absorption coefficient | |
| θ | Moisture content | $\text{m}^3 \cdot \text{m}^{-3}$ |
| λ | Thermal conductivity | $\text{W} \cdot \text{m}^{-2} \cdot \text{K}^{-1}$ |
| ρ_0 | Mass density of dry material | $\text{kg} \cdot \text{m}^{-3}$ |
| ρ_l | Mass density of water | $\text{kg} \cdot \text{m}^{-3}$ |
| ρ_v | Mass density of vapor water | $\text{kg} \cdot \text{m}^{-3}$ |

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