Among many others, biosourced materials are used more and more in building regarding ecological considerations. Indeed the thermal inertia and insulation are both unavoidable important points, which are functions of climatic parameters (temperature, relative humidity). Compared to standard building materials, the biosourced one (hemp concrete) presents a strong hygroscopic behavior due to the vegetal components. Its open porosity is about 70% in volume, and consequently, the thermal properties are very sensitive to the ambient relative humidity. This material is made out of hemp shivs mixed with a lime based binder. It is a lightweight concrete with a low density ($\rho \approx 400 \text{ kg.m}^{-3}$) and a heterogeneous structure that seems to present a “poor” mechanical and acoustical behaviors, but interesting thermal properties. Thus, it becomes successful in the field of construction when it is associated with a timber frame. In the view of fulfilling the actual knowledge on this new material, this work intends to evaluate the thermal properties (conductivity and diffusivity). However as a consequence of this heterogeneity, these properties measured experimentally can be considered as apparent. Well-known experimental characterization techniques are used such as hot-wire, hot-strip, and guarded hot-plate to estimate them and set predictive models. This last point is first done for dry hemp concrete, and the influence of moisture content is then investigated.