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Hempcrete Buildings: Environmental Sustainability and Durability of Two Case-Studies in North and South Italy

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1 Introduction

In the framework of Circular Economy policies aimed at reducing the consumption of raw materials, shives, as an agricultural by-product of hemp cultivation, have gained a renovated life in the construction sector. Its excellent thermal insulating properties permitted the development of new building materials to be used in various executive technologies. When shives are mixed with a mineral binder such as lime or cement, the mixture is usually referred to as hempcrete. In Italy, the use of hempcrete and the development of new production chains and implementation techniques dates back only to about the last decade, while other European countries have more long-lasting experiences (90s). In order to assess the potential benefits of hempcrete in the construction sector, its environmental performances were evaluated using the LCA methodology, by comparing four non-loadbearing representative walls, one made with hempcrete blocks and the others with more "traditional" materials. This research constitutes a solid basis for the development of future guidelines and/or regulations at national and international level in order to guarantee the maximum diffusion of this type of product. Then, a study has been carried out regarding the functionality of hempcrete blocks in masonry, layered with finishing plaster made of fine hemp shives, to evaluate the in-situ hygrothermal building performance. In particular, measurement methods were developed and analysis were carried out on two houses, one in northern Italy and one in southern Italy, and precisely in Sicily, focusing the study on the performances of the walls subjected to warm Mediterranean climates. Indeed, the literature on masonry behavior in hot Mediterranean climates is much scarcer than in cold climates.

2 Conclusions

This study shows the promising performances of hempcrete blocks both in terms of environmental sustainability and hygrothermal properties. The preliminary environmental assessment through LCA is highly encouraging and seems to confirm what has been already demonstrated in the recent literature, *i.e.* that the use of hempcrete blocks has a beneficial effect on relevant impact categories. Furthermore, some of the advantages of the hempcrete are not clearly evidenced in the first life cycle stages of a building, in terms of energy saving and recyclability at the end-of-life.

The first evaluation of the hygrothermal performances of hempcrete blocks in the Sicilian climate is positive. The indoor temperature and humidity were almost constant during the analysis period without the utilization of ventilation, air-conditioning systems or air exchange. Further measurement in situ will allow to understand the evolution of the material performances in time. Thus, the durability of hempcrete will be evaluated together with the possibility to install it in place of traditional materials, especially when sudden climatic variations occur, or higher humidity and continuous rain conditions verify.

Moreover, the availability of residential houses for in situ measurements will allow the evaluation of energetic behaviour of the buildings and the evaluation of the environmental performances of the material when applied in construction works. Also, the effects on the indoor comfort will be investigated i.e. humidity and temperature of the internal spaces will be measured.

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