ENVIRONMENTAL ANALYSIS OF AN URBAN FLOORING MADE WITH INDUSTRIAL WASTE

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1. INTRODUCTION AND OBJECTIVES

When developing a new product, it must be ensured that its environmental performance is equal to or better than the products with the same functionality that already exist. In order to verify that this condition is met, a comprehensive study must be carried out to verify all the stages of the life cycle and to verify that the improvements introduced at some stage of the product life cycle, do not result in environmental impacts in other stages, in other geographic areas or in other environmental vectors.

The present study shows the results obtained in the environmental evaluation of a porcelain stoneware tile with a new composition to be used as an urban flooring and the comparison with other floorings of different nature.

This ceramic tile has a fixing background composed of 100% recycled material and glaze and engobe by 15%, in addition, a new process has been designed for the preparation of fixing background raw materials that allows for the recycling of all ceramic waste with lower water and energy consumption.

This study has been developed within the framework of the LIFECERAM project (www.lifeceram.eu), funded by the European Commission-LIFE Program (LIFE12 ENV/ES/000230).

2. METHODOLOGY

A Life Cycle Analysis study (hereinafter LCA) has been carried out to environmentally evaluate the new tile. The LCA is a methodology for evaluating environmental impacts associated with the life cycle of a product, process or activity by identifying and quantifying the material and energy inputs and outputs.

While carrying out the LCA on LIFECERAM ceramic tiles the recommendations and requirements of the international ISO 14040-44: 2006 standards, as well as the European standard EN 15804: 2012 that includes the Basic Category Rules for construction products have been followed.

The direct data*(foreground data*) have mostly been provided by the project partners involved in the development of the tile. The indirect data (*background data*) have been taken from the PE International, Thinkstep and ELCD commercial databases. Subsequently, these data have been modelled with the GaBi 6 ACV program.

The environmental impacts and the methods applied for the evaluation are those recommended by the ILCD and those considered in the work of the CEN 350 committee on the sustainability in construction. Specifically, they are the *global warming potentials -GWP, (kg de CO_2 equiv.), acidification-AP (kg de SO_2 equiv.), eutrophication-EP (kg de PO_4^{-3} equiv.), ozone layer depletion-ODP (kg de CFC-11 equiv.), photochemical ozone formation-POCP (kg de C_2H_4 equiv.), depletion of abiotic natural resources of fossil origin-ADP fossil (MJ) and of non-fossil origin-ADPelements (kg de Sb equiv.).*

Once the environmental impacts associated with the LIFECERAM tiles were quantified, comparisons were made with environmental information on urban floorings of a different type under the same scenarios, hypotheses and limitations, using the SOLCONCER project as a basis (http://solconcer.es/)

The environmental information on urban floorings was obtained from an exhaustive search of related Environmental Product Declarations and publications. In order to obtain representative values for each type of flooring, a methodology was developed (see Figure 1.) where the criteria that the DAPs must have are taken into account so that they are comparable according to the EN 15804 standard

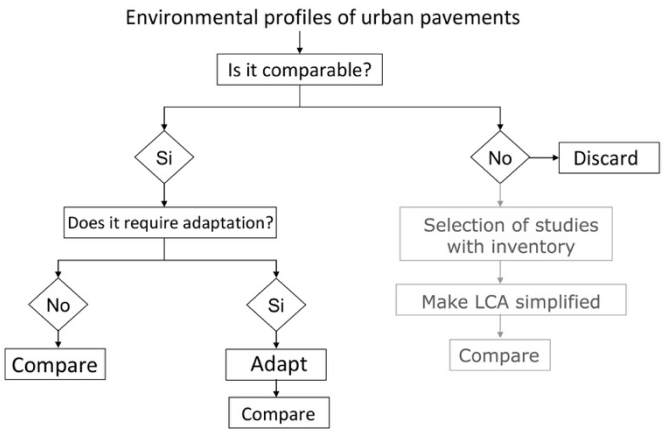

Figure 1. *Methodology followed in the selection and comparison of environmental information.*

3. RESULTS

By carrying out an ACV study of the LIFECERAM tiles, the environmental loads associated with this new product could be quantified with a range from cradle to grave, the results of which are presented in Figure **Figure 2.**.

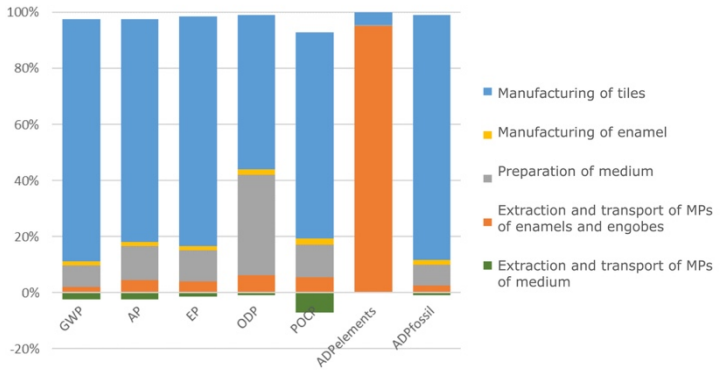

Figure 2. *Relative environmental impacts for the manufacture of ^{1m2} LIFECERAM ceramic tile.*

The methodology was applied to compare DAPs and the appropriate adjustments of the selected documents that best represent the environmental behaviour of the floorings to be studied were made, and average environmental values were obtained, which can be considered representative of each urban ground covering to be studied.

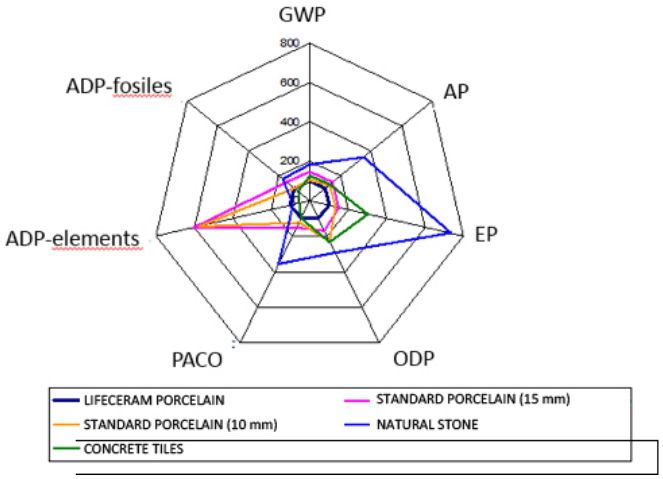

Figure 3. *Environmental impacts of the product stage of the urban floorings compared. Relative values*

It can be seen that the new LIFECERAM tile is better in every impact category in all floorings except two:

- Concrete tiles generate a potential of fossil origin abiotic resources (ADP-Fossil) lower than LIFECERAM due to the lower energy consumption that these tiles require
- The concrete and natural stone tiles have a potential of abiotic resources of non-fossil origin (ADP-Elements) lower than LIFECERAM due to the absence of glazes

In order to facilitate comparison, the set of environmental indicators has been reduced to a single value, through the application of Normalisation Factors (CML2001 - Apr.2015, EU25 +3). The results obtained are shown in Figure 4.

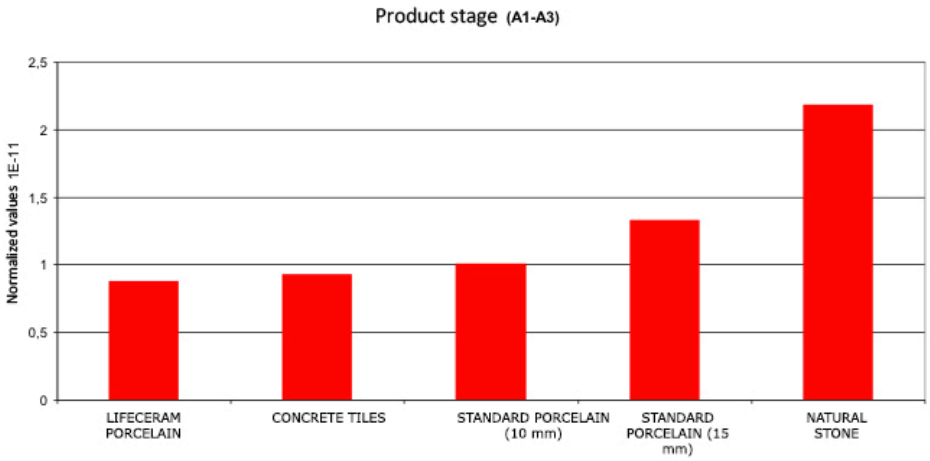

Figure 4. *Comparison of the normalised environmental impact of the urban floorings studied.*

4. REFERENCES

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