

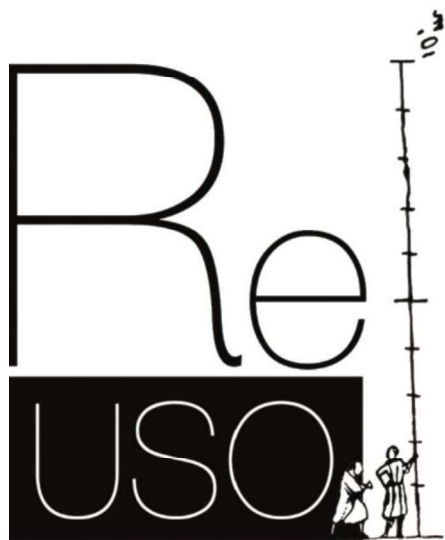


Documentation, Restoration and Reuse of Heritage

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BOOK OF EXTENDED ABSTRACTS





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Review on the application of ceramic residues in mortars

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Abstract: Concern with the destination of the residues generated in several sectors has caused an increase in the amount of research related to the reuse of these materials for the creation of new products. In this context, the present work aims to present the most updated information about the use of ceramic waste for mortar production. A literature review was conducted using the collection published on the online platform Science Direct of works carried out since 2019, which bring knowledge related to the keywords: ceramic wastes and mortar (in Portuguese, ceramic wastes, and mortar, respectively). The results found in the research confirm the technical feasibility of using waste in mortars, because some characteristics obtained in the mixture indicate the possibility of applying this product in various activities in civil construction. Among the main problems still observed when reviewing the contents, one notices the small amount of work that directly addresses the positive environmental impact generated by this type of reuse of ceramic waste.

Keywords: review, waste, ceramic residues, mortars

1. Introduction

The objective of this work is to provide the most updated information about the use of ceramic waste for mortar production. In this context, there was a focus on the publications provided by the "Science Direct" platform and the main information and conclusions obtained by previous research, including other bibliographic reviews, experimental research and case studies, were observed.

2. Materials and methods

The literature review allows for an overview of existing sources (or part of it) on a specific topic to be provided, including the analysis and presentation of the material in an organized manner, obtaining important considerations about previous research (Wee and Banister 2016). In this case, the steps for the development of the proposed review, are described below.

The Science Direct Platform was used in its advanced search function. The subjects and keywords used in the search were "ceramic waste" and "mortar" (both singular and plural). There was a temporal delimitation of articles published in the last five years, that is, since 2019.

The results, with the filter applied, were 58 articles in the English language. Some of the papers were rejected due to the following reasons:

- I. They did not deal with the study of mortars as a central focus.
- II. They only observed ceramic residues generated during the polishing process in the production of ceramics.
- III. Study other types of non-ceramic materials.

After applying the exclusion criteria, 42 articles were reviewed. Among these, there are review materials, case studies, and especially, technical test reports that report on the behaviour of mortars with the addition of ceramic waste (including, in some cases, other types of waste, fibers, and/or aggregates) for application in the most diverse functions of civil construction.

4. Final remarks

Ceramic residues can be applied in the mortar matrix in various functions (aggregates, cement substitutes, fillers) and associated with other types of materials and/or waste. There is also the possibility of reinforcing the mortars with the use of fibers, composed of different materials, which can improve the performance regarding cracking and shrinkage.

In most cases, it is necessary to process the waste before it is used in mortars, because the sources of collection are varied: ceramic and tile production companies, construction and demolition companies, or incinerated rejects in the form of ashes. The ceramic materials can be separated, ground, crushed and screened so that the appropriate granulometry can be reached and inserted into the mortar or cement mixtures.

The use of aggregates reduces the use of natural materials, such as sand. Despite some results attesting to a poor mechanical behaviour, when compared to natural aggregate, mortars can still be applied in finishing functions and there are other gains associated with durability and resistance to polishing that can be advantageous in specific situations.

In the partial replacement of Portland cement, the main gain is the reduction in cost and environmental impact caused by the industrial production of this binder. Ceramic waste has a different composition from cement, and thus, changes are promoted in the chemical processes related to hydration and hardening of the mortar.

The reviewed works demonstrate that the trend to substitute "traditional" materials in mortar production is a reality. And this solution can be widely employed when it comes to the production of mortars and cement with the insertion of ceramic waste (and other types). The studied properties of this material, besides the reduction of environmental impact that it promotes, attest that it is possible to use this type of mortar in several applications in constructions.

Examining the literature available since 2018 in the researched repository, it is possible to notice fields where there is more need for deepening to better understand mortars with ceramic waste addition. Notably, one can list: studies on the environmental and financial consequences of these mortars, analyses of possible real situations where there was the application (as an example, of case studies of constructions), and appreciations on the financial cost involved in this production process of mortars and concretes considered more sustainable.

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