Durability of Mortars Packaged with Production Waste of Autoclaved Aerated Concrete

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1 Introduction

The building sector is responsible for the introduction of about 40% of the waste in the environment (60 Mtons per year in Italy), with serious consequences for our future. Therefore, the statistics of the last few years have induced many researchers and many companies to investigate more sustainable products and technologies. Among these strategies, the re-use of waste materials has been widely encouraged. It is generally preferable to use building materials production waste due to their controlled chemical composition, rather than Construction and Demolitions Waste. Many solutions have been proposed in the field of mortars for which the use of waste products such as ceramic materials, polystyrene, clay, concrete, has been tried out (Restuccia et al., 2016; Nepomuceno et al., 2018; Dang et al., 2019). The results have often been encouraging, especially for masonry mortars. Nevertheless, very few attempts have been made to place this type of products on the market. Moreover, the “younger” building materials such as Autoclaved Aerated Concrete have not been fully investigated in their potential use as recycled aggregates. The goal of this research was to evaluate the characteristics of mortars packaged with different percentages of production waste of Autoclaved Aerated Concrete components as aggregates, in order to evaluate the influence of these recycled aggregates on the hard state properties of mortars and to assess the possible use of the tested conglomerates as masonry mortars or as plasters. Therefore, a reference mortar with hydraulic lime and sand was tested and compared with four groups of mortars with both natural and recycled aggregates. The natural sand was gradually replaced with 12.5-25-37.5 and 50 AAC percentage by mass. The first campaign included tests for determining apparent and bulk density, porosity and water adsorption, flexural and compressive resistance, adhesive strength to three different substrates, resistance to carbonation. The results show the influence of AAC percentage over all the tested properties. The porosity and the water adsorption increased along with the AAC mass, whereas the density, the adhesive, the compressive and the flexural strength decreased as AAC percentage grew. Finally, on the first-step measure the carbonation depth of highest porous mortar was twice as high as the reference one. Figure 1 plots the compressive and the
flexural strength on y-axis and the AAC mass of each group of mortars on x-axis. Figure 2 plots the porosity and the water adsorption on y-axis and the AAC mass of each group of mortars on x-axis. The packaged mortars generally exhibited a good mechanical and resistance to carbonation behavior with some limitations for the 50% recycled aggregates mortar, concerning their use as masonry mortars. Conversely, these highest-AAC mortars could be adequate for thermal purposes.

![Figure 1](image1.png)

**Figure 1.** Compressive and flexural strength of tested mortars versus AAC mass.

![Figure 2](image2.png)

**Figure 2.** Porosity and water adsorption of tested mortars versus AAC mass.

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