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Mix Sustentável

RESUMO DE DISSERTAÇÃO

Accelerated aging by thermal cycling in mixed mortars incorporated from PET waste.

Envelhecimento acelerado por ciclos térmicos em argamassas mistas incorporadas de resíduos de PET.

Envejecimiento acelerado por ciclado térmico en morteros mixtos incorporados a partir de residuos de PET.

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1. INTRODUCTION

Polyethylene terephthalate (PET) is a thermoplastic polymer belonging to the polyester family, widely used in beverage bottles, and other plastic containers (AHMADINIA et al., 2011). Improper disposal, coupled with a lack of effective public policies, contributes to the problem of plastic pollution. However, PET

waste has great potential in the construction sector, and one of the materials that could benefit from its addition and/or replacement is mortar (BELMOKADDEM et al., 2020; SPÓSITO et al., 2020).

This research analyzed the physical and mechanical behavior of mixed coating mortars incorporating PET and subjected to accelerated aging through thermal cycling (Figure 1). The primary objective was to assess the influence of different PET contents (5%, 10%, 15%, and 20% by volume) on the properties of the mortars, both in initial conditions and after three aging cycles.

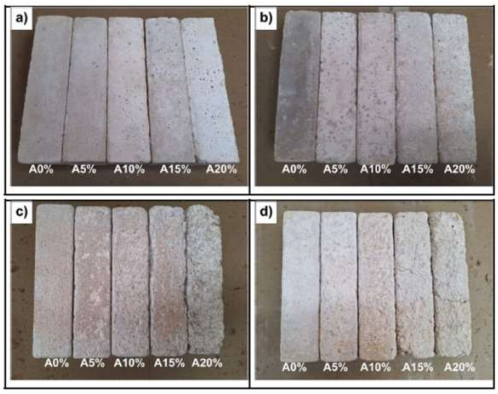

Figure 1: Some test specimens (a) without aging, (b) after the first, (c) after the second and (d) after the third aging cycle.

Source: Authors.

2. METHODOLOGY

Tests were conducted for water retention, consistency index, capillary water absorption, immersion water absorption, water vapor permeability, compressive strength and analysis of scanning electron microscopy (SEM) and ultrasound.

3. RESULTS

PET addition increased capillary and immersion water absorption due to the higher porosity of the cementitious matrix. After the first aging cycle, PET-containing formulations exhibited a linear increase in capillarity, whereas the reference mortar showed a reduction. The 20% PET formulation exhibited the highest capillary absorption coefficient, a trend that intensified in subsequent cycles. Water vapor permeability was higher in PET-containing formulations, demonstrating the relationship between porosity and moisture diffusion. However, progressive aging reduced this permeability, particularly in A15% and A20%, suggesting partial pore network closure due to continuous hydration. SEM analysis revealed pronounced interfacial transition zones (ITZs) in A15%, indicating lower adhesion between materials. Aging also led to increased cracking

and microstructural degradation, compromising the cohesion of the cementitious matrix, especially in A20%. Ultrasound tests confirmed the trend of increased porosity, with up to a 25% reduction in ultrasonic wave velocity in A15% and A20% after three cycles. The consistency index increased with PET addition, improving workability without a defined linear trend. Compressive strength decreased with higher PET content, particularly after aging; however, A15% achieved the best mechanical performance before and after the first thermal cycle. It was concluded that PET incorporation significantly alters mortar properties. Accelerated aging affected the composites differently, with those containing higher PET contents exhibiting greater degradation.

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