Environmental Engineering and Management Journal

February 2025, Vol. 24, No. 2, 243-254
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu
http://doi.org/10.30638/eemj.2025.019

"Gheorghe Asachi" Technical University of Iasi, Romania

STUDYING THE EFFECTS OF INCORPORATING POLYMERIC RESIDUE IN SELF-COMPACTING MORTARS

Ana Clara Monteiro de Siqueira[1], Isabella Leão Ceccarelli[1], Maria Auxiliadora de Barros Martins[2], Lucas Ramon Roque da Silva[2], Michel Henry Bacelar de Souza[2*], Vander Alkmin dos Santos Ribeiro[1], Paulo Cesar Gonçalves[1], Mirian de Lourdes Noronha Motta Melo[2], Valquíria Claret dos Santos[1]

[1]Institute of Natural Resources, Unifei-Federal University of Itajubá, Av. BPS, 1303, Cep-37500 903, Itajubá, MG, Brazil
[2]Institute of Mechanical Engineering, Unifei-Federal University of Itajubá, Av. BPS, 1303, Cep-37500 903, Itajubá, MG, Brazil

Abstract

The construction industry faces a growing challenge of balancing material demands with environmental responsibility. Natural sand extraction disrupts ecosystems and depletes a finite resource. This study investigates the potential of incorporating polyurethane (PU) residue, a common construction waste material, as a partial replacement for natural sand in self-compacting mortar (SCM). By reusing waste in concrete production, this research contributes to sustainable construction practices and reduced environmental impact. The objective of this work was to study the behavior of the incorporation of polyurethane residue (PU) in self-compacting mortar (SCM) in substitution of natural sand in the proportions of 2%, 4%, 6%, 8% and 10% by weight. Tests were carried out in fresh and hardened mortar. The SCM maintained its characteristics with additions of up to 8% in fresh state. Compressive strength decreased significantly in relation to the control mixture. For splitting tensile strength, all mixtures showed very similar results to the reference material. The dynamic modulus of elasticity showed progressive reductions from 4% of replacements. Scanning Electron Microscopy (SEM) analyses revealed that the material exhibited sand-like characteristics, while Energy Dispersive Spectroscopy (EDS) did not detect any elements that could negatively impact the SCM. The authors conclude that it is possible to produce SCM with the addition of PU up to 8% by mass, replacing the fine aggregate.

Key words: polyurethane, refrigerators, self-compacting mortar, waste

Received: February, 2023; Revised final: May, 2024; Accepted: July, 2024; Published in final edited form: February, 2025

[*] Author to whom all correspondence should be addressed: e-mail: michelhenry@unifei.edu.br; Phone: +55(35)36291224; Fax: +55(35)36291265