Title: Synthesis of eco-friendly alkali-activated materials based on incineration by-products and cigarette filters: A Novel Approach to Address Cigarette Pollution

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Abstract: Using waste as a raw material for the synthesis of construction materials is gaining increasing attention due to the declining availability of natural resources. This research seeks to assess the impact of using cellulose acetate microfibers (CAMs) derived from discarded cigarettes as a reinforcement for alkali-activated materials (AAMs). In this context, seven blends were elaborated with the addition of various percentages of CAMs (0%, 0.2%, 0.4%, 0.6%, 0.8%, 1%, and 1.5%) per dry mass of fly ash, and using an alkaline solution composed of Na_2SiO_3 and 10 M NaOH solution. Then the physico-mechanical, thermal, and environmental properties of these composites were evaluated. The experimental results indicated that the addition of CAMs led to lighter composites, which decreased compressive strength, P-wave velocity, and density, while slightly increasing flexural strength, porosity, and water absorption. Moreover, a slight enhancement in thermal insulation capacity was observed (up to ~9.28%). The microstructural analyses, encompassing XRD, FT-IR, and SEM/EDX examinations, revealed the formation of geopolymeric gels N-A-S-H and C-A-S-H in all specimens. The Toxicity Characteristic Leaching Procedure indicated that the released contaminants were within the regulatory limits, as well as the binder exhibited a remarkable decrease in carbon dioxide emissions and energy demand by 77.23% and 57.92% in comparison to cement. Thus, the prepared materials are viewed as a more environmentally responsible choice for reducing greenhouse gas emissions while avoiding potential toxicity issues.

Keywords: iAlkali-activated materials (AAMs) Cellulose acetate microfibers (CAMs) Cigarette waste recycling Fly ash composites Sustainable construction materials

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