Red tomato waste in metakaolin-based geopolymers: a sustainable recycling

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Abstract.
The strong need to reduce waste disposal and pollution has led to an increase in the development of sustainable waste-based materials [1]. One of the latest goals to be reached is the reduction in the use of Portland cement, a common construction material, whose production and use are related to strong water and energy consumption, as well as to a high CO_2 release that contributes to greenhouse gas emissions and global warming. Geopolymers, or amorphous aluminosilicate polymers, are known as suitable and sustainable candidates for Portland cement substitution [2]. Geopolymers can be synthesized in an alkaline environment by using several precursors [3]. In this study, metakaolin-based geopolymers have been synthesized at different curing temperatures (25°C, 40°C and 60°C) and the effect of the addition of 10 wt.% of red tomato waste has been investigated. The synthesized geopolymers were characterized in terms of Fourier-Transform Infrared spectroscopy (FTIR), integrity test, chemical oxygen demand (COD), and antimicrobial activity. The analyses were carried out at different ageing times. FTIR analysis revealed that both the curing temperature and the organic matter do not interfere with geopolymerization reactions. Even though the integrity tests suggested that the samples were macroscopically well-hardened, the presence of yellow colour in integrity test water leachates underlined the release of some organic molecules. However, COD analyses carried on up to 9 days, revealed that none of the samples were able to release organic compounds after 4 days of ageing. Eventually, all the samples showed antimicrobial activity against both Gram-positive and -negative strains.

References.
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