Effect of spent filtering earths addition in rice husk ash geopolymers

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Geopolymers or alkali activated materials (AAM's) are considered an environmentally friendly alternative to Portland cement, which is responsible for about 5 % of all fossil fuel CO_2 emissions (Andrew, 2018). Geopolymers can be synthetized from different aluminosilicates-containing materials such as clays, slags and ashes among other. This study is focused on the use of Rice Husk Ash (RHA) as precursor in the manufacture of geopolymers.

RHA is a widely produced waste in some regions and an excellent source of amorphous silica but its alumina content is extremely low so many studies have evaluated the potential of mixtures with other raw materials, including slags (Zhu et al. 2021), other fly ash (Fernando et al. 2021), metakaolin (Liang, 2019) and other.

The innovation of this research is studying the use of spent filtering earths as source of aluminosilicates to complement the RHA precursor, which allows to enhance the process of alkali activation. Filtering earths are commonly used in the agri-food industry and when no longer can be used, become a nearly useless waste. However, with a silica content of 83.9 % and alumina content of 5.7 wt %, spent filtering earths (SFE) represent a potential additive to RHA in the manufacture of geopolymers.

Samples were prepared by mixing the solid material with alkali activating solution and pouring into moulds of 60x10x10 mm. Alkali solution contains 65 wt % of sodium silicate solution Panreac (29.2% SiO_2; 8.9% Na_2O and 61.9% H_2O) and 35 wt % of NaOH 6 M solution. Solid precursors were created by replacing percentages of RHA with SFE in amounts from 10 up to 40 wt %. The amount of solution used was set for every mixture to keep an adequate workability in the paste. Prototypes were kept at ambient room until the age of testing (7 and 28 days).

The data indicate that the incorporation of spent filtering earths in the mixture, produce an improvement of the mechanical properties, flexural and compressive strength, due to the formation of more geopolymer gel and presumably due to the incorporation of the alumina necessary during the process of alkali activation. The compressive strength is increased from 23.7 MPa for the control geopolymers to 30.4 MPa with the addition of 40 wt% SFE. Therefore, this preliminary study confirms the use of these by-products or industrial wastes for the manufacture of geopolymers to bring us closer to a circular economy.

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