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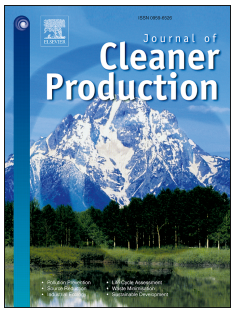

Supplementary cementitious materials to mitigate greenhouse gas emissions from concrete: can there be too much of a good thing?

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Supplementary cementitious materials to mitigate greenhouse gas emissions from concrete: can there be too much of a good thing?

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Abstract: Among the many possible strategies for reducing anthropogenic greenhouse gas (GHG) emissions is reduction of emissions associated with the production of concrete, which is responsible for 8-9% of global emissions. Using supplementary cementitious materials (SCMs) in concrete to offset demand for clinker in cement is a commonly proposed method to cut GHG emissions from concrete production. The most commonly used SCMs are industrial byproducts, such as fly ash and ground granulated blast furnace slag, but the extent to which these SCMs should be used in individual concrete mixtures is not well examined. This research examines the contribution of fly ash and ground granulated blast furnace slag, common SCMs, to material properties, the role of allocation in the assessment of environmental impacts, and the impacts of transportation. Quantitative assessments are developed using environmental impact assessments and comparisons are drawn based on changes in GHG emissions for concrete production. The findings of this research show that these three factors can outweigh benefits associated with use of SCMs: depending on SCM type and use of allocation or changes in transportation, high levels of SCM replacement do not consistently result in lower GHG emissions for the production of concrete. Limited supplies of these popular byproduct SCMs amplifies concerns about increasing the rates at which they are used. Within the limitations of this study, this work shows greater efficient use of SCMs should be implemented.

Keywords: Cementitious materials; Greenhouse gas emissions; Fly ash; Blast furnace slag; Co-product allocation; Material efficiency