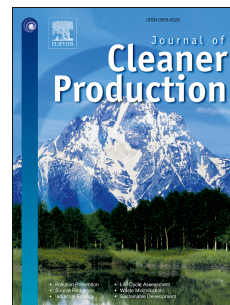


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Supplementary cementitious materials to mitigate greenhouse gas emissions from concrete: can there be too much of a good thing?

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

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9 **Word Count:** 8763

10 **Abstract:** Among the many possible strategies for reducing anthropogenic greenhouse gas (GHG)
11 emissions is reduction of emissions associated with the production of concrete, which is responsible for
12 8-9% of global emissions. Using supplementary cementitious materials (SCMs) in concrete to offset
13 demand for clinker in cement is a commonly proposed method to cut GHG emissions from concrete
14 production. The most commonly used SCMs are industrial byproducts, such as fly ash and ground
15 granulated blast furnace slag, but the extent to which these SCMs should be used in individual concrete
16 mixtures is not well examined. This research examines the contribution of fly ash and ground granulated
17 blast furnace slag, common SCMs, to material properties, the role of allocation in the assessment of
18 environmental impacts, and the impacts of transportation. Quantitative assessments are developed using
19 environmental impact assessments and comparisons are drawn based on changes in GHG emissions for
20 concrete production. The findings of this research show that these three factors can outweigh benefits
21 associated with use of SCMs: depending on SCM type and use of allocation or changes in
22 transportation, high levels of SCM replacement do not consistently result in lower GHG emissions for
23 the production of concrete. Limited supplies of these popular byproduct SCMs amplifies concerns about
24 increasing the rates at which they are used. Within the limitations of this study, this work shows greater
25 efficient use of SCMs should be implemented.

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28 **Keywords:** Cementitious materials; Greenhouse gas emissions; Fly ash; Blast furnace slag; Co-product
29 allocation; Material efficiency
30

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