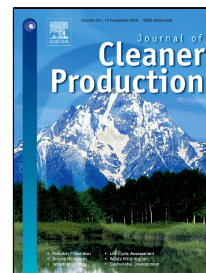


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Utilization of flue gas desulfurization gypsum as an activation agent for high-volume slag concrete

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Abstract: Production of cement has been resources and energy intensive, leaving massive carbon footprint. The use of slag as an admixture reduces **CO₂ intensity of concrete production** by replacing a fraction of cement clinker with industrial solid waste. However, concrete with high volume of slag addition suffers **loss in early-age strength, slow hydration** and large drying shrinkage. To address this issue, **flue gas desulfurization** gypsum was added as an activation agent for slag in the present work. The effects of **flue gas desulfurization** gypsum addition on compressive strength, elastic modulus, resistance to carbonation, chloride ion diffusion and drying shrinkage were examined. XRD and SEM analyses were conducted to investigate the hydration products and microscopic structure. The results show that the early-age (3 d and 7 d) compressive strength of concrete increases with increasing gypsum content, reaching an optimum at 5 wt.% gypsum content. **Flue gas desulfurization** gypsum addition does not affect the correlation between the elastic modulus of concrete, nor does it affect concrete resistance to chloride ion diffusion, though slight improvement in carbonation resistance is observed. Reduction in drying shrinkage is evident when the gypsum is added. XRD and SEM analyses indicate that formation of ettringite (AFt) is strongly promoted by the gypsum addition, which suggests a likely reason for the improved early-age strength and reduced drying shrinkage. **With flue gas desulfurization gypsum addition, as much as 55% reduction in CO₂ intensity of concrete production can be achieved with no loss in concrete strength.** The synergetic use of **flue gas desulfurization gypsum and slag makes concrete production much cleaner while turning both types of industrial solid wastes into valuable resources.**

Keywords: Slag concrete, **flue gas desulfurization** gypsum, activation agent, early-age strength

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