



Review

Green concrete: Prospects and challenges

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HIGHLIGHTS

- Green concrete utilizes waste materials as SCM and aggregates in concrete.
- It promotes effective waste management, GHG reduction and resource conservation.
- Benefits: improved strength, workability, durability, pumpability, reduced cracking.
- Benefits: reduction of construction & maintenance costs and increased service life.
- More R & D, standards and large-scale demonstration projects are required.

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ABSTRACT

Utilization of green concrete in construction is increasingly adopted by the construction industry owing to the drawbacks of conventional concrete and the numerous inherent benefits of green concrete. The increasing demand for green concrete has been spurred by demand for high quality concrete products, desire of nations to reduce green-house gas emission, need for conservation of natural resources and limited landfill spaces. Green concrete comes in various forms such as high-volume fly ash concrete, ultra-high performance concrete, geopolymer concrete, lightweight concrete to mention a few. Green concrete offers numerous environmental, technical benefits and economic benefits such as high strength, increased durability, improved workability and pumpability, reduced permeability, controlled bleeding, superior resistance to acid attack, and reduction of plastic shrinkage cracking. These characteristics promotes faster concrete production, reduction of curing waiting time, reduction of construction costs, early project completion, reduction of maintenance costs and increased service life of construction projects. Green concrete promotes sustainable and innovative use of waste materials and unconventional alternative materials in concrete. Suitable standards, more demonstration projects, as well as adequate training, public awareness, cross-disciplinary collaborations and further research and developments are required to promote global adoption of green concrete in large-scale infrastructure projects.

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Nomenclature

SCM	Supplementary cementitious material	NanoA	Nano- Al_2O_3
SF	Silica fume	CNI	Calcium nitrite-based corrosion inhibitor
RHA	Rice husk ash	FA50L	50% Fly ash content
GGBS & GGBFS	Ground granulated blast-furnace slag	HVFAC	High-volume fly ash concrete
WG	Waste glass	HPSCC	High performance self-consolidating concrete
NS	Nano-silica	FA	Fly ash
PPF	Polypropylene fibres	CRT	Cathode ray tube waste glass
BOFS	Basic oxygen furnace slag	GFRP	Glass fibre reinforced polymer
RAC	Recycled aggregate concrete	CS	Compressive strength
FFA	Fine fly ash	SP	Superplasticizer
RHAC	Rice husk ash concrete	w/b	water binder ratio
FAC	Fly ash concrete	w/cm	water-cementitious ratio
FA-HSC	Fly ash-based high strength concrete	w/scm	water-supplementary cementitious materials ratio
SFC	Silica fume concrete	ASR	Alkali silica reaction
UHPC	Ultra-high performance concrete	RPC	Reactive powder concrete
WGC	Waste glass concrete	MK	Metakaolin
GF	Glass fume from waste glass	SiO_2 - <i>Eff</i>	Effective amorphous silica content
C_3S	(tricalcium silicate)	S_{eff}	Effective surface area of SCM
C_2S	(dicalcium silicate)	CN	Carbon nanotube
RHAC	Rice husk ash concrete	HSC	High strength concrete
HCC	Self-consolidating concrete	UHPC	Ultra high strength concrete
HPC	High-performance concrete	LWC	Lightweight concrete
AA	Alternative aggregates	BRAC	Bacterial rice husk ash concrete
OPC	Ordinary Portland cement	CRHA	Rice husk ash from controlled burning
RRHA	Raw rice husk ash		

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