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EDITED AND REVIEWED BY
John L. Provis,
The University of Sheffield,
United Kingdom

*CORRESPONDENCE
Li Li,
drlili@vip.163.com
Mehran Khan,
Drmehrankhan@outlook.com

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Editorial: Sustainable fiber reinforced cementitious composites for construction and building materials

Li Li[1,2]*, Mehran Khan[3]*, Xi Jiang[4], Pshtiwan Shakor[5] and Yangyang Zhang[6]

[1]Shaanxi Key Laboratory of Safety and Durability of Concrete Structures, Xijing University, Xi'an, China, [2]College of Water Resources and Architectural Engineering, Northwest A&F University, Yangling, China, [3]School of Civil Engineering, University College Dublin, Dublin, Ireland, [4]Department of Civil and Environmental Engineering, University of Tennessee, Knoxville, TN, United States, [5]Technical College of Engineering, Sulaimani Polytechnic University, Sulaymaniyah, Iraq, [6]State Key Laboratory of Metastable Materials Science and Technology, Yanshan University, Qinhuangdao, China

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Editorial on the Research Topic
Sustainable fiber reinforced cementitious composites for construction and building materials

Sustainable composites reinforced with fibers have gained significant attention in the construction sector, owing to their remarkable strength, long-lasting properties, and positive environmental impact. This editorial presents a summary of recent scientific papers focusing on diverse facets of sustainable composites.

Progress in the realm of ultra-high-performance concrete (UHPC) technology has led to notable enhancements in its characteristics, including exceptional compressive and tensile strength, ductility, and durability (Alkadhim et al.). Nevertheless, there are still hurdles to overcome concerning the cost-effectiveness and sustainability of UHPC when incorporating steel fibers. Sustainable fibrous high-strength concrete (SFHSC) demonstrates promise as a material, although additional research is necessary to understand the impact of thermal cycles on its engineering properties and long-term durability (Hakeem et al.).

The utilization of machine learning algorithms in construction materials research is on the rise (Qian et al.). Khan et al. have demonstrated that these algorithms have the capability to effectively forecast the ultrasonic pulse velocity of hybrid fiber-reinforced concrete that has been modified with nano-silica. Moreover, they can be employed to assess the performance of high-strength concrete in challenging environments (Chen et al.).

The application of scientometric analysis offers valuable insights into the patterns and advancements within a specific research domain. A recent study conducted by Mohamad Moasas et al. examining mineral fiber reinforced concrete (MFRC) revealed a consistent growth in research activities related to this field over the last decade. Nevertheless, further research is warranted to enhance the durability and sustainability aspects of MFRC.

In the context of environmental sustainability, the significance of recycling plastic waste is steadily rising. A recent research study by Qaidi et al. delved into the application of recycled polyethylene terephthalate (PET) plastic waste as a substitute for sand in high-strength concrete. The findings revealed that this substitution positively impacted the mechanical and durability properties of the concrete. Likewise Nikhade et al. (2023) have explored the viability of sugar cane bagasse ash (SCBA) as an environmentally friendly substitute for conventional concrete materials. SCBA is a by-product of the sugar cane industry and shows promise as a sustainable alternative. In recent studies, the performance of a composite geomaterial incorporating SCBA has been examined under compressive and flexural loading conditions. The research findings indicated notable enhancements in the mechanical properties of the composite material.

Concrete structures are often reinforced using carbon fiber reinforced polymer (CFRP), a widely adopted fiber material. Current research efforts are concentrated on constructing models specific to CFRP-confined concrete-filled steel columns featuring elliptical cross-sections (Isleem et al.). The aim is to enhance the precision of predicting the structural behavior under diverse loading conditions for such columns. Ahmad et al. have explored bio-deposition techniques as a potential method for integrating recycled aggregates into concrete structures. The findings have shown promise in enhancing the strength and durability of concrete made with recycled aggregates.

Ternary hybrid fibers have emerged as a promising substitute for conventional fiber materials in reinforcing concrete structures. Abed et al. have demonstrated that the inclusion of ternary hybrid fibers resulted in notable improvements in both the strength and ductility of ultrahigh strength concrete. In grouting materials, the use of mineral admixtures is widespread to augment their strength and durability. Current research endeavors have focused on examining the influence of various mineral admixtures on the operational and mechanical characteristics of grouting materials (Shen et al.).

In summary, the articles addressed in this editorial underscore the necessity for continued research in multiple areas. These include the exploration of sustainable alternatives to conventional materials, the enhancement of durability in sustainable composites under challenging circumstances, the optimization of recycled material utilization, and the improvement of cost-effectiveness and sustainability in material practices. Applying machine learning algorithms and employing scientometric analysis can yield valuable insights into the aforementioned research domains. Promising alternatives to traditional materials include recycling plastic waste and utilizing by-products like sugar cane bagasse ash. Furthermore, innovative methodologies like bio-deposition and the utilization of ternary hybrid fibers demonstrate promising potential for enhancing the strength and durability of sustainable composites. Ultimately, persistent research and development within this realm have the capacity to yield more resilient and sustainable structures that positively impact both the environment and society.

Author contributions

Conceptualization, methodology, investigation, formal analysis, writing—original draft, writing—review and editing, supervision, funding acquisition, LL; methodology, investigation, formal anal-ysis, writing—original draft, writing—review and editing, supervision. MK; resources, XJ; resources. PS; resources, YZ. All authors contributed to the article and approved the submitted version.

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