

Statement of the problem: The disposal of waste tyres is currently causing serious environmental problems all over the world. It is recorded that about 1 billion waste tyres are generated globally every year with 1.6 billion new tyres produced. In like manner, the amount of construction and demolitions wastes generated is a thing of concern due to increasing demolition of existing infrastructures. It is also estimated that the UK generated 67.8 million tonnes of non-hazardous C&D waste, of which 62.6 million tonnes (92.3%) was recovered. Despite extensive research, recycled aggregates and worn-out automobile tyres are still not fully reused and are thus disposed of in environmentally hazardous ways. Several studies have been carried out on recycled aggregate and rubberized concrete, but very limited studies is conducted on rubber recycled aggregate concrete without any information on durability performance. This study focuses on the strength and durability performance of concrete comprising of recycled aggregates and crumb rubber at different replacement level (5%, 10%, 15% and 20%) for civil engineering applications. The first stage of the study covers the effect of incorporating crumb rubber at different concentration on the compressive strength of the recycled aggregate concrete. The results revealed that the compressive strength of the recycled aggregate concrete can be used for structural applications when 5% of crumb rubber are used to replace recycled aggregates. The 28days compressive strength of the rubberized recycled aggregate concrete with 5% crumb rubber concentration reduces with 21.1% when compared to recycled aggregate concrete without crumb rubber. The second stage of the study assess the durability performance of the recycled aggregate concrete with 5% crumb rubber concentration. The 5% crumb rubber content for durability tests was considered because the ultrasonic pulse velocity tests revealed that the quality of the recycled aggregate concrete is questionable if the concentration of crumb rubber particles is beyond 5%. The durability performance using the surface resistivity test also shows that the chlorine ion penetration of recycled aggregates concrete with 5% crumb rubber replacement is moderate using air dried curing technique. Hence the study suggests the use of rubber recycled aggregate concrete for applications where the exposure condition is not extreme.

Conclusion and significance: The assessment in this study shows the of use of rubber recycled concrete can be utilized in civil engineering construction where strength requirement is not critical. Civil engineering works such as concrete fence walls, road walks, and structural members subject to bending (bottom layer of reinforced concrete beams, concrete slabs, concrete window lintels for example) can use rubber recycled aggregate concrete without compromising performance. This will have a significant impact on the sustainability of construction materials such as aggregates, which

account for up to 75% of concrete volume, as well as the reduction of carbon emissions in the construction industry.

Biography:

Robert Ataria is a researcher with main interest in sustainability of civil engineering construction materials, concrete structures and circular economy in the construction industry. He is currently an ICURe (Innovation to commercialization of University Research) Early Career Researcher at the University of Manchester funded by Innovate UK. He holds a PhD in civil engineering from the University of Manchester as well as an MSc in structural engineering from Surrey University in the United Kingdom.

References:

Yunusa-Kaltungo, Akilu ; Ataria, Robert. / [Health and safety performance in high hazard industries: A feasibility study of the Nigerian cement industry](#). 2019. 23 p.

Robert Ataria / [Two-layer beam: a method to use recycled aggregate concrete in loadbearing members](#). 1st International Conference on Construction Circular Economy, 2019

Zhang, Qinglin ; Wang, Yong ; Bailey, Colin ; Istrate, Oana ; Li, Zheling ; Kinloch, Ian ; Budd, Peter. / [Quantification of gas permeability of epoxy resin composites with graphene nanoplatelets](#). In: Composites Science and Technology. 2019 ; Vol. 184.

Hopkinson, Peter ; Chen, Han-Mei ; Zhou, Kan ; Wang, Yong ; Lam, Dennis. / [Recovery and Re-Use of Structural Products from End of Life Buildings](#). In: [Institution of Civil Engineers](#). Proceedings. Engineering Sustainability. 2019.

Yu, Junlong ; Wang, Yong. / [Punching Shear Behavior and Design of an Innovative Connection from Steel Tubular Column to Flat Concrete Slab](#). In: Journal of Structural Engineering. 2018 ; Vol. 144, No. 9. pp. 1-13.

Organization / University Logo:



The University of Manchester