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Experimental Investigation to Evaluate the Mechanical Behaviour of Concrete Containing Waste Tire Steel Fibres

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Abstract

Although numerous research studies are available to identify the effect of adding waste tire rubber in concrete, the studies related to Waste Tire Steel Fibre (WTSF) are limited. Moreover, waste tire rubber aggregate is usually produced by extracting rubber particles whilst removing steel fibres as waste material. Consequently, it is vital to recognize an effective way to recycle the WTSF without putting further burdens on the environment. Hence, the possibility of utilizing WTSF instead of Commercial Steel Fibres (CSF) in Steel Fibre-Reinforced Concrete (SFRC) is currently being investigated as a sustainable method, which converts low-cost waste material into a value-added market product. However, variations in the geometrical properties of WTSF compared to CSF influence the properties of concrete. In addition, the presence of contradicting results in previous studies further reveals the requirement of conducting a detailed investigation for evaluating the authentic properties of SFRC containing WTSF. Consequently, the properties of waste tire SFRC were evaluated by utilizing WTSF collected from a shredding and pyrolysis mechanism in this research. The experimental results showed that adding WTSF up to a certain percentage (≤ 1% volume of concrete) increased the compressive and flexural strength of SFRC by nearly 25% and 40% due to the crack-bridging effect of fibres. Moreover, WTSF collected from the shredding mechanism showed better results than pyrolysis WTSF. Especially, it was observed that concrete containing WTSF gradually failed with an increasing load instead of sudden failure, which generally exhibits in the control specimen without fibre. However, it was observed that increasing steel content significantly reduced the workability due to the segregation and inconsistency, but which can be controlled by adding chemical admixtures. Consequently, the use of WTSF in concrete evidenced promising results, but further investigations are required for cognizing the behaviour under dynamic and static loading conditions before introducing it to the industry.

Keywords*:* *Compressive Strength, Flexural Strength, Recycling, Steel Fibre-reinforced Concrete, Waste Tire Steel Fibre.*

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