Effect Of 3D-Printed Fibers On Concrete

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Nowadays one of the most important parameters in construction is the sustainability due to different economic and energy efficient problems [1]. It is widely known that concrete has a very high compressive strength. However, resisting tensile loads is one of its weakest aspects. The addition of fibers as reinforcement, has proven to be very efficient throughout time [2]. Therefore, this research is trying to combine these two factors, sustainable materials to reinforce concrete through a viable approach. Specifically, the research considers the effect of 3d-printed fibers using recycled polymeric material on the mechanical properties of concrete. The selected polymers are Polylactic Acid (PLA) and Acrylonitrile Styrene Acrylate (ASA). Two different shapes of fibers designed and printed for this purpose intending to achieve a good adhesion in the mixture. The one is a cyclic fiber 2cm diameter, and the other one is a straight 3cm long as they depicted in figure 1. Five different concretes were laboratory produced and cylindrical specimens were formed. The influence of fibers was examined through tensile and compressive strength of the specimens at 7 and 28 days based on BS EN 12390-6:2009. The results shown that polymer fibers addition in concrete contributed positively to enhancing the mechanical properties of the material, especially the ASA and PLA cyclic fibers. They were found to be more effective than straight fibers in the concrete samples, so the shape of the fiber played an important role in the behavior of the specimen. Considering the polymer material, ASA seems to be more effective than PLA in both shapes of fibers.

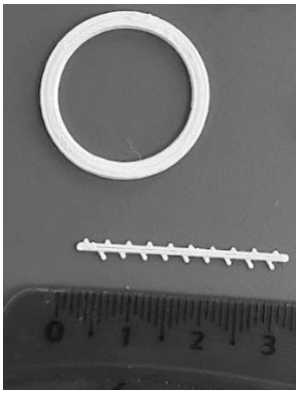

Figure 1: Fibers

1. Andrew, R.M.: Global CO2 emissions from cement production, 1928–2018, **2019**, Earth Syst. Sci. Data, 11, 1675–1710, https://doi.org/10.5194/essd-11-1675-2019
2. Khan, M. S., Fuzail Hashmi, A., Shariq, M., & Ibrahim, S. M. Effects of incorporating fibres on mechanical properties of fibre-reinforced concrete: A review. **2023**, Materials Today: Proceedings, S2214785323027190. https://doi.org/10.1016/j.matpr.2023.05.106