World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:18, No:06, 2024

The Effect of Agricultural Waste as a Filler in Fibre Cement Board Reinforced with Natural Cellulosic Fibres

Authors : Anuoluwapo S. Taiwo, David S. Ayre, Morteza Khorami, Sameer S. Rahatekar

Abstract : This investigation aims to characterize the effect of Corn Cob (CC), an agricultural waste, for potential use as a filler material, reducing cement in natural fibre-reinforced cement composite boards used for building applications in low-cost housing estates in developing countries. The corn cob, an agro-waste, is readily and abundantly available in many West African States. However, this agricultural waste product has not been put to any effective use. Hence, the objective of the current research is to convert this massive agro-waste resource into a potential material for use as partial cement replacement in fibre-cement board production. Kraft pulp fibre-reinforced cement composite boards were developed with the incorporation of the corn cob at a varying percentage of 1 - 4 wt.% as partial cement replacement using a laboratory-simulated Hatschek process. The mechanical properties of the developed cement boards were characterized through a three-point bending test, while the fractured morphology of the cement boards was examined through a scanning electron microscope (SEM). Results revealed that the flexural strength of the composite board improved significantly with an optimum enhancement of 40% when compared to the reference sample without corn cob replacement; however, the flexural behaviour (toughness) of the composite board was slightly affected by the addition of the corn cob. SEM observation of the fractured surfaces revealed good bonding at the fibre-matrix interface as well as a ductile-to-brittle fracture mechanism. Overall, the composite board incorporated with 2 wt.% corn cob replacement for cement had the optimum properties, which satisfied the minimum requirements of relevant standards for fibre cement flat sheets.

Keywords : agricultural waste, building applications, fibre-cement board, kraft pulp fibre, sustainability
Conference Title : ICCMST 2024 : International Conference on Composite Materials Science and Technology
Conference Location : Montreal, Canada
Conference Dates : June 13-14, 2024