

Development of Novel Composite Material for Roofing Tiles by Mineral Based Industrial Waste and Waste Plastic

W. M. L. I. Dilshan, H. P. T. S. Hewathilake*

Department of Applied Earth Sciences, Uva Wellassa University, Badulla, Sri Lanka

Several research studies related to the construction sector look forward for the utilization of waste as promising construction materials. This trend has instanced by the depleting natural aggregates and increasing their demand. Therefore, this research aims to introduce a novel composite material for roofing tile, based on Fly Ash (FA), Sand, Tile Waste (TW) and chemically unmodified Polyethylene Terephthalate (PET) waste plastic. Initially, X-Ray Diffraction (XRD) phase analysis and moisture content analysis have conducted for the collected samples. Sample blocks with different combinations under three different samples series have prepared by using 7.0 cm × 5.0 cm × 1.5 cm size mold. All the raw materials were thoroughly mixed with molten PET and added to mold. Physio-mechanical characteristics were conducted by Water Absorption (WA) test and Compressive Strength (CS) test. Prior to the composite preparation moisture content of each raw material has analyzed and maintain below 7%. XRD analysis of sand, TW and FA have confirmed the major phase is crystalline silica. WA of each composite was compared with the clay roofing tile specimen which has the WA of 10.68%. However, all the prepared composites have the WA below 1% since each having 35% PET. Further, variation of the sand amount has the high impact of WA, since it is increased when sand content increased above 30%. CS analysis has shown that the minimum CS, 17.0 MPa of the composite is higher than the CS, 15.3 MPa of reference clay roof tile. Further, in each series, if the raw material content is increased more than 22.5%, CS was decreased. Therefore, to achieve low WA and high CS, the amount of Sand, FA and TW should be equal or below 22.5 %. Hence, all the combinations are complied with aforesaid weight ratios are suitable for the roof tile production but utilizing the composition with lower sand amount will be more cost effective thus both fly and tile waste are rejected waste materials.

Keywords: PET plastic, Composite material, Compressive strength, Water absorption