

Design and Development of a Prototype Extruder for Manufacturing of Recycled Plastic Composites

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The use of plastic wastes to develop construction materials such as bricks, interlocks, railway sleepers, paving slabs, and fence columns is a new concept in Sri Lanka as the technology to develop such materials is still not readily available in the country. Thus, there is a need for development of technology to use waste plastic as a strategy of waste management and also to use waste as an alternative construction material through an appropriate recycling process. This study was aimed at designing and developing a prototype extruder for manufacturing of plastic-based composite samples through hot extrusion of waste plastics and re-molding with bulking agents such as sand, sawdust, and metal aggregates. A prototype extruder was designed and fabricated. The major components of the machine include infrared heating elements with precise temperature control circuit, melting and mixing chamber manufactured by steel cylinders, screw piston and extruding nozzle fixed at the end of heating chamber. The extruder was designed to heat and melt shredded plastic waste at 180 °C and then to mix with different bulking agents such as dry sand, dried sawdust and chips stones at different ratios. After 15-20 minutes of heating and mixing, depending on bulking materials, the hot blended composite was discharged into the mold by a screw threaded piston. The molded specimen was cooled to remove from the mold. Throughput of the extruder was 1.2 kg/hr on an average and functional efficiency was 80%. The developed technology can easily be scaled up for commercial production of building materials, having compressive strengths of 3-18.5 MPa at fracture. Even a small scale entrepreneur would be able to produce waste polypropylene or polyethylene-based composites material to replace existing building materials like bricks, tiles, paving blocks, and drainage pipes. Further studies are needed to mechanize the mixing, molding processes and pollution controls of dioxins and furans.

Key words: Composite material, Extruder, Extrusion, Plastic wastes, Waste management