

Utilization of recycled plastic waste in construction materials and its environmental impacts

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Recycling plastic waste into construction materials is a promising solution for plastic waste deemed “unrecyclable” by traditional recycling measures. The production and use of plastic blocks as an alternative building material has gained attention with several countries in the global South producing. In collaboration with BluDae, an organization focused on transforming plastic waste into quality building materials, we are investigating the impact of plastic waste composition and other additives on the strength and environmental fate of the blocks. Plastic blocks were manufactured using plastic waste collected from the environment (e.g., beaches), crushed glass, and river sand. This study included two batches of blocks obtained from functional manufacturing factories. The first batch was obtained from Coimbatore, India and included three compositions, containing various amounts of multi-layered plastic, polypropylene, and sand. The second batch was obtained from Dili, Timor-Leste includes samples with four known compositions containing varying percentages of recycled polyethylene-terephthalate, high-density polyethylene, low-density polyethylene, glass, and sand. The compressive strengths of the blocks were tested in accordance with ASTM C109, a standard test method for compressive strength. The composition of the blocks was characterized using Fourier-Transform Infrared Spectroscopy (FTIR). Leaching tests are underway to determine the release of harmful substances from the blocks. Results from the compressive strength tests of the blocks from India found average strengths of $29.70 \pm 1.09 \text{ N/mm}^2$, $26.54 \pm 0.33 \text{ N/mm}^2$, and $27.65 \pm 0.64 \text{ N/mm}^2$ for the three compositions. FTIR analysis found all samples contained polyethylene and polypropylene, but polymer ratios are unknown. Further examination of the compressive strength and composition will identify if a correlation between the two parameters exists. Also, environmental impacts associated with each block composition will be identified. Determining the impacts of polymer composition on strength and environmental impact will enable manufacturing facilities to enhance the functionality of the blocks and reduce environmental impacts.