DIGITAL IMAGE PROCESSING WITH MATLAB TO ANALYZE THE USE OF PLASTICS IN CONCRETE

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Introduction

- Plastic waste occupies a substantial portion of our landfills and pollute our waters, hence there is an increasing desire to recycle and reuse plastics to mitigate their environmental and health impacts.
- Plastic waste can be used to replace sand in concrete. The used plastic is ground down to small pieces and added to concrete and its compressive strength is measured.
- This research quantifies the distribution of plastic particles in concrete using digital images of sample surfaces with MatLab which can then be related to its compressive strength.
- Image processing software provides a nondestructive method to analyze the size distribution of the plastics as well as quantify the overall area percentages of ground plastic fragments appearing within a binary image of a concrete sample.

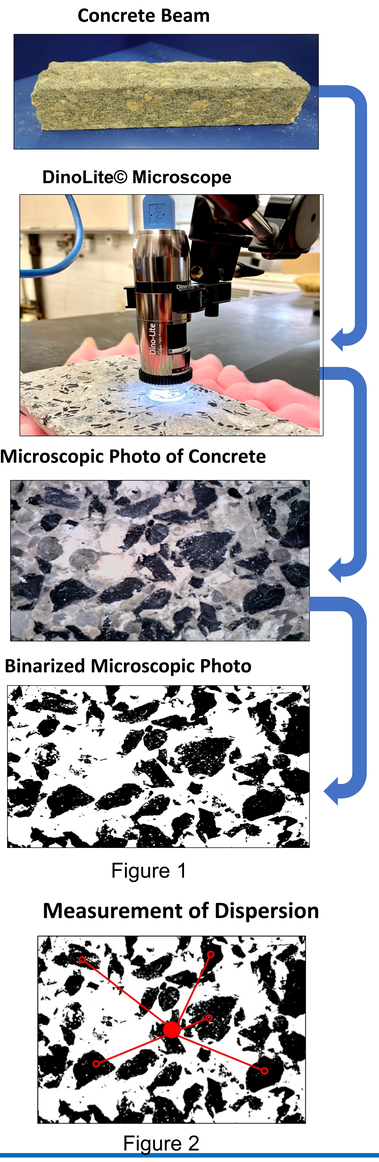

Figure 1

Figure 2

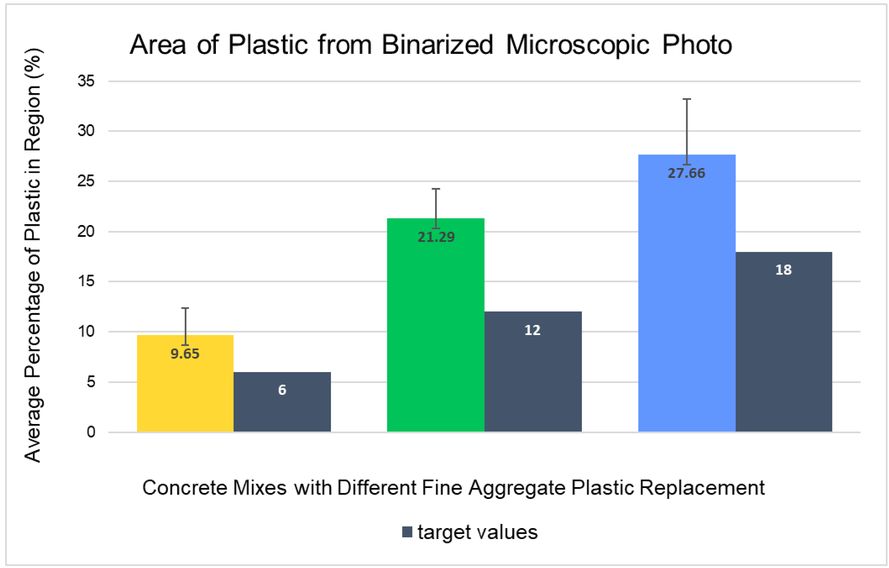

Figure 3

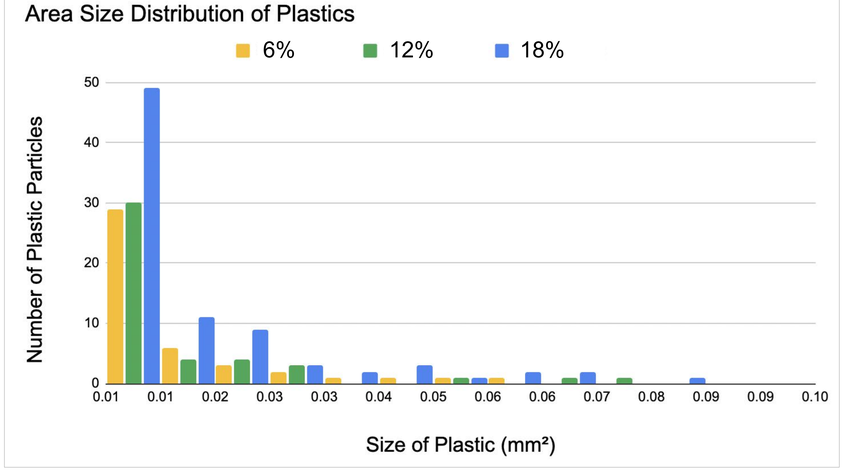

Figure 4

Conclusion and Future Work

- There is a positive correlation between the amount of plastic in the concrete and the area percent of plastic in the binary image. The additional dark aggregate that appears in the binary images contribute to the overestimation of area percent of plastic
- There are more finer particles that appear in the 18% concrete mix which is most likely due to the grinding of the plastic.
- There were limitations when calculating the dispersion of the plastic. In the binary image other aggregate like gravel are a part of the white area and the plastics appear to be more clustered together. Future samples need to be collected with just the plastic and cement mixture.
- Future studies consist of examining the dispersion and the bonding of the plastic, and observing the impact these features have on the quality of the concrete.

Figure 5

Methodology

- A DinoLite© microscope was used to capture photos of various regions of the surface of concrete beams, each ranging in the amount of plastic, as shown in Fig. 5, that was replacing the fine aggregate sand to produce mixes with 6%, 12% and 18% plastic.
- Photographs were processed in MatLab and were converted to grayscale images and then binarized, as shown in Fig. 1.
- The area of the black, which depicted the area of plastic, was calculated using MatLab, results shown in Fig. 3.
- The size distribution of the plastics were then also calculated in MatLab, results shown in Fig. 4.
- An additional feature of the plastic that was examined was how uniformly mixed the plastics were within the concrete, and defined as the distance between the centroid of a plastic particle and the center of the photo, as shown in Fig. 2.

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