Use of Plastic as a Replacement of Fine Aggregates in Concrete Admixtures
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ABSTRACT
Current legislation established that 35% of plastic waste must be recycled on the island. These materials damage the environment since they have no biodegradable properties. This research studied the feasibility of using type 5 shredded plastic, currently not recycled in PR, as a replacement of fine aggregate in concrete admixtures, in order to provide a recycling alternative that may to reduce their disposal. A normal resistance admixture was designed as a control sample, and several admixtures replacing 0% to 30% by volume of fine aggregate were developed. The samples were cured and tested in compression at different ages in accordance with the American Society for Testing and Materials (ASTM). The results showed that shredded plastic type 5 could be a suitable replacement for part of the fine aggregate in concrete admixtures, since the resistance obtained was similar or better than the control sample.

INTRODUCTION
This project will focus on making concrete admixtures replacing fine aggregates with plastic (preferable number 3 to 7, currently not recycled in Puerto Rico) in order to contribute to the reduction of plastics as a solid waste that ends up in landfills. By reducing the disposal of this material, one may contribute not only to the reduction of the impact of the plastic on landfills, but also to the reduction of the impact that plastic carried out from landfills has in the interment, wildlife, and domestic animals.

OBJECTIVE
The objective of this project is to study the effect of replacing fine aggregate by threaded plastics in concrete admixtures in the mechanical and physical properties of the hardened concrete in order to assess if the obtained product is a viable construction material.

METHODOLOGY
The methodology that was used for this research was divided into eight phases:
I. Study and practice of material testing procedures according to ASTM.
II. Shredded plastic material procurement.
III. Cement characterization, fine aggregate, coarse aggregate and crushed plastic. The following image will present the grain distribution analysis.
IV. Control the mix design and calculation of the required volume of components.
V. Modified additive design, replacing 5% to 30% of the fine aggregate with crushed plastic by volume.
VI. Additives and sample preparation (figure 3).
VII. Cured (figure 4).
VIII. Test: compression test of 3 cylinders per additive (7 days, 14 days, 21 days and 28 days; 12 per additive) (figure 5 & figure 6).

ANALYSIS & RESULTS
The chart summarizing the results of the experiments shows the following:
- Admixtures with shredded plastic exhibit a resistance comparable to the control admixture, without plastic.
- The greater the substitution of fine aggregates, the lower the resistance in the concrete.
- The results of 5% to 25% of the plastic replacement obtained larger resistance than the control sample.

CONCLUSION
The results demonstrate that, in term of resistance, the use of shredded plastic type 5 as a replacement of fine aggregate in concrete admixtures, up to a 25% replacement by volume, could result in a concrete admixture of adequate resistance for normal construction. These results indicate that a deeper study of the use of plastics in concrete admixtures is extremely advised.

RECOMMENDATIONS
As the results showed the feasibility of using shredded plastic as replacement of fine aggregate, to continue an deepen the research is advisable. Recommended avenues are:
- Widen the range of replacement %.
- Perform other test aside compression (i.e. tension and permeability).
- Use other type of shredded plastics.
- Obtain the plastic in advance, so the quantity of admixtures made simultaneously is reduced and more manageable.

REFERENCES

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