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Construction Composites of Recycled PVC and Recycled Polyolefins

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Executive Summary

Polyvinyl chloride (PVC) is a common thermoplastic that can be manufactured for outdoor construction applications. However, recycled polyvinyl chloride (rPVC) has limited supply because how difficult PVC is to recycle. Nevertheless, polymers can be blended to improve polymer characteristics, reduce cost, and incorporate other recycled polymers. Polyolefins (POs), specifically polyethylene (PE) and polypropylene (PP), have been blended with PVC to enhance processibility and supply chain economics. Compatibilizers, such as chlorinated polyethylene (cPE), can be added to boost or enable the compatibility of POs and PVC, since the polymers are immiscible.[1] The following study explores if recycled polyolefins (rPOs) can be incorporated in PVC to use as construction materials to lower costs and improve performance through increasing the adhesion strength of blends consisting of cPE and PO with PVC.

For the project, trilayer and bilayer laminates were formed from virgin material or blends, and adhesion was quantified through a T-peel test. The modes of failure for the samples were investigated using scanning electric microscopy (SEM) imaging. The processing conditions of blends wherein the laminates failed by cohesive failure was identified. Additional work could include measuring flexural and impact strengths of the blended materials.

Overall, the project determined some parameters that could lead to increased plastic recycling and enhanced material properties. One of the difficulties in recycling plastics is pigment. Pigmented plastics are not normally used because they might not be able to achieve the end product's color.[2] Because the rPO blends being used are in the inner, nonvisible layer of the composite, pigmented rPOs can be utilized.

My honors project has added onto my undergraduate experience and knowledge in a variety of ways. I learned new processing and characterization techniques, how to operate testing

equipment, and accurately measure material properties. Additionally, I learned how to modify an approach to achieve desired engineering properties.

References

1. Eastwood, E.A.; Dadmun M.D. Compatibilization of Poly(Vinyl Chloride) and Polyolefin Elastomer Blends with Multiblock/blocky Chlorinated Polyethylenes. *Polymer* **2002**, *43*, 6707.
2. Milbrandt, A.; Coney, K; Badgett, A,; Beckham, G. T. Quantification and Evaluation of Plastic Waste in the United States. *Resources, Conserv. And Recycling* **2022**, *183*, 106363.