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Study and Analyze the Properties of Recycled Plastic Waste and Compare it with Virgin Plastic

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ABSTRACT

Plastic, a widely utilized material globally, poses a significant environmental challenge due to its persistent nature, slow decomposition, and extensive consumption and production rates. Continuous usage may lead to a degradation of its properties, rendering it less functional for its original purpose. Consequently, such plastic is often considered waste and is typically discarded or incinerated. An environmentally viable solution involves repurposing plastic waste, such as recycling it into alternative products with limited functionalities. This study specifically investigates and compares the characteristics of waste polypropylene (PP Waste) and pristine polypropylene (PP Virgin). The findings indicate that polypropylene experiences a reduction in ductility properties and an increase in hardness after use.

Keywords: Plastic waste, recycle, PP Waste, PP Virgin.

1. Introduction

Plastic is one of the most widely used materials in the world, but it causes a major environmental problem due to the difficulty of its decomposition and breakdown in nature [1].To reduce its negative environmental impacts and achieve a more sustainable future, we must adopt an important approach to managing plastic waste, and Plastic recycling is one of these approaches[2]. Plastic recycling is an important environmental solution, as it contributes to reducing plastic waste that ends up in landfills or in the natural environment. The plastic recycling process takes place through a set of steps, and at the end of the process, it is converted into small plastic granules. They are then used in new products such as pipes, synthetic fibers, and other plastic products[3].

2. Experimental

2.1. Sample preparation

In this study, two types of specimens are tested, depending on according to standard ASTM D638-03 and ASTM D790.

- Mechanical tests

Two types of mechanical tests are carried out on the different specimens (Fig 1 and Fig 2):

- Tensile test
- Three-point bending test

Figure 1: Specimens of waste PP

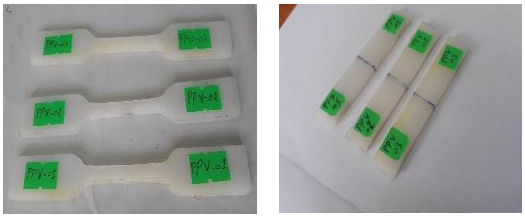

Figure 2: Specimens of virgin PP

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3. Results and Discussion

This section aims to determine the elongation and stress ratios for both tensile and flexural specimens of waste PP and virgin PP. The results of static tests are represented in Fig.3 and Fig.4 respectively. Figure 1 shows typical stress evolutions as a function of the deformation of PP specimens stressed in tension and bending. It is clear from the figures that the strain percentage of virgin PP samples is greater than that of waste PP samples, as the strain percentages of virgin PP ranged between 3.5 and 4.8%, while the strain percentage of waste PP was between 1.4 and 2.5% in the tensile test. On the other hand, we note that the stresses of recycled polypropylene samples are greater than the stresses of virgin PP samples, which indicates that polypropylene has lost some of its ductility properties.

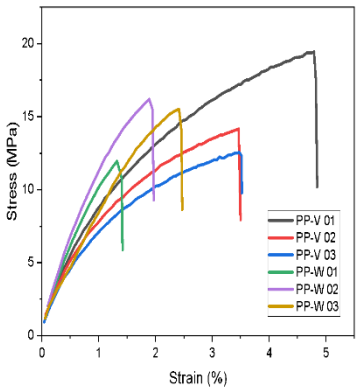

Figure 3: Tensile test

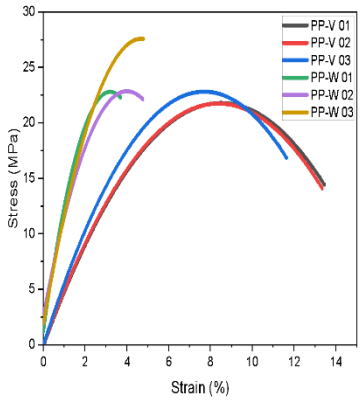

Figure 4: Three-point bending test

4. Conclusions

Plastic recycling has many benefits. It reduces the need to use petroleum raw materials used in the production of new plastics, which contributes to saving natural resources and reducing greenhouse gas emissions. It also reduces environmental pollution resulting from unsafe disposal of plastic, as it eliminates plastic waste and turns it into new valuable products. Through the results obtained through experiments, we have concluded that some changes may occur in the properties of recycled plastic, and this is what enables us to exploit it in different fields as needed.

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