



**MECHANICAL PROPERTIES INVESTIGATION ON VIRGIN AND  
RECYCLED POLYPROPYLENE**

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## ABSTRACT

Polymer blending can be an effective way of reducing large amount of plastic waste as well as a cost-effective method which can be highly beneficial to the manufacturing industries. Polypropylene (PP) is a versatile material that is capable of numerous commercial applications. This study is about the effect of composition between virgin and recycled polypropylene towards their mechanical properties. The effect of blending polypropylene product was investigated whether it can improve the performance of the material without deteriorating its original mechanical properties. Two mechanical testing were conducted according to ASTM D638 for tensile Test and ASTM D790 for flexural test. Fracture surface analysis on the tensile test and flexural test was performed to observe the behavior of the material at fracture. The results from tensile and flexural test reveal that polypropylene products VP75 which consist 75 wt% of virgin polypropylene and 25 wt% of recycled polypropylene were the optimum composition. The results for tensile test also revealed that blending polypropylene at VP75 had positive influence on tensile strength, percent of elongation at break and young modulus. Opposite trends were obtained from flexural test where both flexural strength and bending modulus performed slightly less compared to virgin polypropylene. However, the differences were not that distinct. The SEM results revealed that compressive force and tensile force can instantaneously change the microstructure of PP product which results in the failure of tensile and flexural specimens. Overall, blending virgin and recycled polypropylene together at any composition had no significant effect on the mechanical properties of the material in the comparison with the virgin polypropylene. Therefore, recycled polypropylene can be used in production without the need to sacrifice its mechanical properties which can reduce material costing and help to save the environment by reducing polypropylene waste.

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Project Background**

Polymer blends are capable of providing materials with extended useful properties beyond the range as well as providing material with improved properties in comparison with a single polymer equivalent[1].

Plastics are widely used materials for sustaining society and can be found anywhere during our daily routines. Plastics are commonly a short- lived product for example food packaging and water bottle. They are usually non-renewable raw material such as petroleum. Once it is not needed anymore, it will be discarded and end up in landfilled or incinerated. Plastics are also associated with environmental issues which are a growing concern faced by the society[2]. Therefore, recycling method is an effective waste management technique to overcome the problem. Recycling not only significantly save a remarkable amount of non-renewable resources, it is generally required less energy to recycle polymer rather than producing the same polymer material from virgin material[3].

Injection molding is a well-known manufacturing process for producing plastic parts. Thermoset and thermoplastic polymers can be process to produce parts. Injection molding is a highly desire manufacturing process despite having expensive tooling cost.