

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 BACKGROUND OF STUDY**

Polymers, or also known as plastics, are a major class of materials and possess a very wide range of mechanical, physical, chemical, and optical properties. Unlike metals, polymers generally are characterized by a lower density, strength, elastic modulus, thermal and electrical conductivity, and cost. Also, by a higher strength-to-weight ratio, higher resistance to corrosion, higher thermal expansion, wider choice of colors and transparencies; and by a greater ease of manufacture into complex shapes. Hence, plastics are been used mostly in agriculture, appliances, clothing, construction and numerous other fields which required their existence.

The most common polymer that has been used for industrial and commercial products nowadays is High-Density Polyethylene (HDPE). HDPE is one of basic types under Polyethylene (PE) polymer. It is a thermoplastic polymer; means that it can be melted to a liquid and remolded it to a solid state. It is tough, relatively inexpensive and has excellent process ability. It is used in numerous applications ranging from plastic grocery bags to heavy duty plastics containers. Moreover, HDPE also widely been used in construction industry for producing pipes and as insulator in electrical appliances.

Due to the advantages of HDPE plastics, during the last decade their use has increased greatly, both in areas of applications and in actual quantities employed. However, improper and uncontrolled plastics production and consumption causes wastes, which eventually causes loss to certain companies and also lead to pollution to

environment. In addition, because HDPE plastics are composed of organic compounds, their main disadvantage is that their decay process takes a very long time. As it is impossible to avoid plastic consumption, which parallel with the development of new technology, realistic solution have to be searched for the problems arising from the growing use of plastics, especially HDPE plastics. That is, recycling methods and ways of evaluating these recycled materials must be found.

For this purpose, a study on determining the effect of recycled HDPE mixing ratio on the tensile strength of HDPE polymer is carried out in order to reduce the HDPE wastes problem. Besides that, this research will present which the mixing ratio of recycled and pure HDPE that are likely improving in tensile strength, by comparing to the tensile strength of pure HDPE and eventually will be selected as the optimum percentage of mixing ratio at the end of the experiment.

## **1.2 PROBLEM STATEMENT**

The worldwide production of plastics is approximately 100 million tonnes per annum [1], resulting in a significant proportion in municipal solid waste (MSW). Municipal solid waste is all types of solid waste generated by households and commercial establishments, and collected usually by local government bodies. According to a statistics, waste plastics account for 11.8% of the 246 million tonnes of MSW generated in Unites States for year 2005 [2]. Attempts have been made to recycle the post-consumer plastics in order to reduce the environmental impact and consumption of HDPE virgin plastics. However, the mechanical properties of recycled HDPE still not widely explored in open literature as there are not much input on the properties. Thus, study on the mechanical properties of the HDPE recycled product, especially tensile strength is necessary.

It is known that the mechanical properties of original materials are different from those of the corresponding recycled materials. However, it is possible to find an optimum point which can be determined by experimentation. Hence, the purpose of this project is to study the effect of recycled HDPE mixed with original HDPE materials in

various proportions on their new tensile strengths. The mixture with the highest tensile strength will be considered as the best percentage.

### **1.3 PROJECT OBJECTIVES**

There are two objectives that need to be achieved from this project, which are:

- i. To design dog-bone shape mould by using AutoCAD software and produce the real mould for this research purpose.
- ii. To study the effect of mixing of recycled HDPE and pure HDPE according to determined percentage.
- iii. To determine the best percentage of mixed pure and recycled HDPE materials by selecting the mixture with the highest tensile strength.

### **1.4 SCOPES OF THE PROJECT**

The scope of this project is to design a mould that have a dog-bone shape, which is the form of testing specimen following ASTM D 638 [3] by using AutoCAD software and then produced the real mould by machining operations for research purpose. Next, using the virgin high density polyethylene (HDPE), and mixed with recycled HDPE according to the determined percentage from each of them. After that, tensile tests were done to examine the tensile strength of these mixtures. The tensile test results of each proportion were tabulated. The mixture with the highest tensile strength was selected as the best percentage. The location of this research was conducted laboratory of Faculty of Manufacturing Engineering and Faculty of Mechanical Engineering.