CHAPTER I

INTRODUCTION

1.1 Introduction

The accumulation of solid waste has become a major issue in recent years because the decreasing number and space of landfills. Much attention is being given all over the world to the impact of plastics on the environment and upon their disposal [1].

Approaches to plastics recycling mainly include three recycling options: (1) mechanical or material recycling; for example, direct reuse without polymer modification; (2) chemical recycling; for example, depolymerization and reuse of monomers; and (3) energy recovery; for example, use of calorific value of polymer wastes. In recent years, it has been accepted that material recycling is the most efficient and reliable method of dealing with plastic waste. Among the material recycling technologies that have already been developed, the remelting technique; that is, reprocessing in the melt phase, remains the most effective, popular, economical and easily applicable method. Nevertheless, this technology often leads to degraded products of inferior value, because plastics, as organic materials, are subjected to undesirable chemical reactions during their previous processing steps and service life, mainly caused by oxidation and photo-oxidation. These chemical reactions lead to irreversible changes in the polymer structure, affecting the physical properties and the quality of the polymer. On one hand, during their service life, plastics suffer from natural aging from the influence of temperature, air, light, and weathering, leading to degradation of their visual and mechanical

properties. On the other hand, during processing, plastics undergo preliminary molecular damage, such as chain scission, crosslinking, or formation of double bonds [2].

In particular, extrusion is one of the most damaging procedures to which a polymer could be subjected. The shear forces together with the high processing temperatures lead to mechanical scission of the polymer chain, which produces highly reactive macroradicals at the end of the chain. In the presence of small amounts of oxygen, these radicals cannot recombine, but form peroxyl radicals and hydroperoxides. These chemical reactions lead to molecular weight degradation, and the plastic becomes unsuitable for its original use [2].

Since, high-density polyethylene (HDPE) is one of the most widely produced polymers in the world. We thus shall make use of good properties HDPE to blend with the low-density polyethylene (LDPE) family for producing recycled polyethylene products. To be more specific blown HDPE films shall be produced using the virgin HDPE resins blended with recycled polyethylenes. The effects of virgin HDPE/recycled polyethylene compositions on mechanical properties, morphological changes and rheological behavior properties shall be investigated.

1.2 Objective

The main purpose of this study is focused on the blending technique of various recycled polyethylene resins with the virgin HDPE resin. A spectrum of blending ratios are to be made, and dependence of their physical, mechanical, and rheological properties on blend ratios of the blown films is studied.

1.3 Scope of the Research

The scope of this research work to be carried out was the following:

1. Survey of literature and know how of processing machine operation.
2. Preparation of blown film by blending virgin HDPE with recycled polyethylenes at various HDPE/PE ratio using the dry blending technique by high-speed film blowing machine.
3. Preparation of resins and blending the films by blending the virgin HDPE with the recycled polyethylenes at various ratios using single screw extruder.
4. Investigation of the film properties in terms of mechanical properties according to ASTM 638, and morphology using the techniques of TEM or SEM.
5. Analysis of the blended resin for the rheological properties using a capillary rheometer and a melt flow indexer.
6. Evaluation of the thermal properties of the blended resin using Dynamic Mechanical Analysis (DMA), and Differential Scanning Calorimetry (DSC).
7. Summarizing the results.