CHAPTER I

INTRODUCTION

1.1 General Introduction

Nowadays the automobile industry has adopted using many kinds of plastics because of the advantages of their mechanical properties such as durability, flexibility, toughness, long life and light weight as compared to metal, there being and less cost when recycling. The largest user of polyethylene is the packaging industry, but the automobile industry requires more mechanical properties **[1]**. However, polyethylene can be blended with other polyolefins, by miscibility between polymers, to improve their mechanical properties. Generally, polyethylene was produced by the free radical polymerization of ethylene using oxygen or peroxide as the initiator and this is referred to as low-density polyethylene (LDPE) **[2]**. In 1953 Dr.Karl Ziegler invented a process for producing polyethylene using as catalyst titanium tetrachloride and triethylaluminium. The product is called high density polyethylene (HDPE), and linear low density polyethylene (LLDPE) was developed using the gas phase technology. Metallocene catalyst technology has recently gained considerable attention in the polyolefin industry. There are plastic films made of an HDPE/MLLDPE blend commercially available today. Their evolution was driven by market needs on the one hand and by advances in technology on the other. In the blown film industry, it was produced by blending high density polyethylene (HDPE) with metallocene linear low density polyethylene (MLLDPE). These metallocene features manifest themselves as a number of advantageous properties e.g., excellent film impact, good toughness, etc. More recent studies concerned with HDPE and MLLDPE have tended to focus on packaging film (film of various gauges ranging from 0.025-0.075 mm.), to get a

broader idea, it is thus interesting to investigate the improvement of the properties of industrial sheet (sheet of various gauges ranging from 2.0-25 mm.) by blending HDPE with MLLDPE for sheet extrusion.

As we already know, the MLLDPE/HDPE blends had been studied by blown film processors whereas they had never been studied for the automobile industry, especially pick up truck liner sheet. For this reason we had an idea to study HDPE/MLLDPE blends, which were used for sheet extrusion and thermoforming pick up truck liners. In addition, the automobile industry requires new material. Thus this research will be delegated to ways and means of improving mechanical properties, in order to find a polymer which has an impact strength and coefficient of friction (C.O.F) to integrate with HDPE, because the HDPE itself cannot be integrated because of the coefficient of friction, impact strength and tear resistance.

In consideration of a polymer which has a high coefficient of friction, we found that rubber and ethylene vinyl acetate (EVA) is another choice, but the rubber and EVA has the disadvantage of heat distortion, tear resistance and flexural modulus. In particular, with ethylene vinyl acetate, whenever its temperature heats up the smell of acetate comes out in this case. For this important reason, it cannot be denied that manufacturers do not want to change extruder, screw and other equipment if unnecessary. However, if rubber blends are used one needs a Banbury internal mixer for compounding with HDPE, then pelletization and afterwards sheet extrusion, which is costly and complicated. It can be seen that rubber and EVA is unsuitable for HDPE blends. As a result the MLLDPE is best suited to be blended with HDPE. A common feature of sheet extrusion lines is the roll stack, but its calendering function is distinct from the polishing function it carries out on extrusion lines **[3]**.

Sheet is produced as flat webs which are wound as intermediate products or cut into sheet. The sheet is subsequently used to manufacture a diverse collection of thermoformed products by vacuum-thermoforming. Thermoforming is a generic term

encompassing many techniques for producing useful plastic articles from flat sheet, it is one of a family of processes that deal with the pressing or squeezing of pliable plastic into a final shape **[4]**. For the automobile industry not only have innovations been made in the thermoforming machinery but also extensive efforts to produce uniform property extruded sheet. Therefore, vacuum thermoforming has become economically important since it offers processing advantages over competitive processes such as compression molding, injection blow molding, rotational molding, injection molding.

1.2 The Objective of the Research

The purpose of this study was to improve the impact strength and coefficients of friction of HDPE/MLLDPE sheet for the vacuum thermoforming industry.

1.3 Scope of the Research

1. The present study involved blending of HDPE with MLLDPE at various ratios.
2. Determination the mechanical properties of HDPE/MLLDPE blends will be investigated, evaluated by using the specimens and also compared with conventional HDPE sheet for pick up truck liner.
3. Determination the influence of HDPE/MLLDPE blends in extrusion and vacuum thermoforming processability compared with conventional HDPE.