

CHAPTER I

INTRODUCTION

The majority of Thailand industrial plastics made in Thailand are commodity plastics such as polyethylene (PE), polypropylene (PP) and polyvinyl chloride (PVC). These plastics have good properties at room temperature but the strength is not comparable to engineering plastic. However, commodity plastics are considerably cheaper than engineering plastics. So it is necessary to modify and develop the properties of commodity plastics by incorporating additives such as fillers or blend it with other polymers. To develop and modify the properties of commodity plastics, it is necessary consider which properties need improvement. For industrial resins, various additives are compounded into commodity plastics to get desirable properties.

High-density polyethylene (HDPE) is one of the outstanding thermoplastic polyolefins. It is manufactured by ethylene polymerization and has a density between 0.94-0.97 g/cm³. The serendipitous discovery of HDPE was by investigators at Standard Oil of Indiana and Phillips Petroleum seeking to oligomerize ethylene to gasoline-size molecules. Whereas low-density polyethylene (LDPE) finds its greatest use in the manufacture of film, the stiffer HDPE has its major uses in the manufacture of bottles by blow molding and in structural parts by injection molding. During manufacturing of HDPE products, they were passed through many fabrication processes. They undergo reaction with oxygen, where accelerated by high temperature, high shearing rate and residual free radical. Not only the manufacturing steps, which bring about oxidation in HDPE molecules, but also the storage conditions of the material. So we have to eliminate this phenomena to enhance polymer properties and make polymer recycle again.

Addition of antioxidants is the most common method of stabilization. However, there are many types of antioxidants available in the marketplace, so the more information the more profit. As mention above to study the effect of antioxidants on service properties of HDPE and performance testing of antioxidants of HDPE are much more important.

This thesis was a cooperative project between the Petroleum Authority of Thailand (PTT) and The Petroleum and Petrochemical College Chulalongkorn University (PCC CU) to study the effects of antioxidants on the thermal properties of HDPE. The results of this thesis should prove valuable for investments in future HDPE processes. However, HDPE markets are highly competitive. The main HDPE producers in Thailand are Thai Petrochemical Industry (TPI), Thai Polyethylene Co. Ltd., (TPE), and Bangkok Polyethylene Co. Ltd., (BPE). The major market for HDPE is in packaging products with a minor market in injection-molded products. Comparison of additive performance could help to reduce costs if we choose additives of the same or better efficiency but lower in price. To accomplish this research goal, phenolic primary antioxidant and phosphite secondary antioxidant were employed. Extrusion grade HDPE was supplied by Thai Polyethylene Co., Ltd. and Bangkok Polyethylene Co., Ltd.