CHAPTER I

INTRODUCTION

1.1 Hot melt adhesives[1]

Thermoplastic hot melt adhesives have been used in a wide variety of applications in houses, offices and factories such as packaging, fabrication and automotive for many years. These formulations have generally been thermoplastic materials which are coated from a heat melt and solidify when cooled to produce a uniform coating of adhesive, which subsequently can be softened to permit other materials to bonded there to when the adhesive cools and solidifies. The others composition such tackifiers which are given material comes to contact with another surface, waxes which are reduced in viscosity and cost of adhesives. Adhesion is thereby achieved by an entrapment mechanism whereby the fluid thermoplastic adhesive, having the proper tacky characteristics, wets the material to be adhered and then solidifies on cooling to form a mechanical bond or a chemical and mechanical bond between the materials.

Solidification of adhesive by virtue of its cooling can be achieved by cooling the materials being contacted through the adhesive either directly or by permitting the adhesive to lose heat the materials to be bonded. In the either case, the coating and cooling characteristics of the adhesive are generally controlled by careful temperature control of the materials to be bonded, during the process.

In summary, hot melt adhesives achieved their bonding characteristics through cooling as contrasted with other adhesive by evaporation of a solvent carrier or through other mechanisms such as polymerization.

1.2 Biodegradable plastics

The interaction between synthetic polymers and the natural environment in terms of the effects of oxygen, radiant energy, and living organisms has been extensively studied since 1981.

However, the recent trends in the preservation of the environment have created much public interest. This is due to heavy usage of plastics as packaging materials in consumer industry. Materials usage as packaging films and the like are not expected to have a long service life. Among several such materials, polyolefins have received special criticism because of their longevity and stability under soil burial conditions. The most likely degradative processes acting on buried polyolefins are simple oxidation and microbial attack, in addition to photodegradation under the influence of UV sunlight. The disposal of plastics as refuse or litter is thus a volume problem rather than a weight problem. The relative proportion of plastics in refuse increases every day on account of their low degradability. The widespread concern of the public regarding waste plastic products prompted us to undertake an overview of the degradation of plastic products.

The conventional applications of most of the existing plastics are based on their relative resistance to biodegradation in comparison to natural polymers. Until recently, the inertness of these materials with respect to biological attack and subsequent deterioration of their properties was a favorable characteristic. In view of the production of numerous consumer items from synthetic polymers for disposal, the need has been created, based on environmental considerations, for the development and study of biodegradable polymers. Biodegradable polymers have found application in medicine such as in sutures, wound dressings, surgical implants and controlled-release and drug delivery systems. There is a great demand for biodegradable plastic films for use in garbage bags, food and beverage containers, and for mulching.

Several industries are currently developing biodegradable polymers for ultimate use in the consumer products. Several products have been made with starch as filler to improve the corporation starch materials in plastics as filler enabling them to undergo quick biodegradation. In the same way, the usage of plastic including hot melt adhesives-based thermoplastic is increasing whereas the environment is beginning to concern. Thus, the biodegradable materials will be interested to study. The synthetic polymers based hot melt adhesives that can be degraded with fungus by added some natural materials such as starch in composition is interested choice according to the aim. With very low in price of starch, it can be reduced in cost of manufacturing. In this experiment, the hot melt adhesive-based EVA/Starch blends will be produced and studied their physical properties for the packaging application and it will be degraded by fungus in nature.

Furthermore, with the little research in this field, it could be expanded to the commercial goods as soon.

1.3 Objectives

The objectives of this study are:

1. To investigate the performance of ethylene vinyl acetate copolymer and starch blends as biodegradable hot melt adhesive preparation.
2. To investigate the physical properties of ethylene vinyl acetate copolymer and starch blends as biodegradable hot melt adhesive.

1.4 Scope of this study

1. To investigate the performance of the prepared ethylene vinyl acetate copolymer and starch blends as biodegradable hot melt adhesive under the composition as following ;
   - EVA 10-60 %
   - Modified starches 10-50 %.
   - Rosin esters 10-50%.
   - Polyethylene waxes 10-20 %.
   - Antioxidants 0.25 %
2. To investigate the performance of physical properties of ethylene vinyl acetate copolymer and starch blends as biodegradable hot melt adhesive as following ;
   - T-peel strength
   - Viscosity
   - Phase separation study by SEM and DSC
   - Biodegradation testing

The hot melt adhesive products were produced by batch mixer and co-rotating twin screws extruder with diameter of screw 35 mm. length per diameter ratio 20:1. All of raw materials were premixed by hand. From this experiment, it can be noted that all materials should be premixed together before introduced into batch mixer or twin screws extruder. Hot melt adhesives were analyzed for the physical properties by several techniques in order to give the best properties for packaging application. The T-peel strength was determined according to ASTM D-1876 standard test method. Viscosity of hot melt adhesives was determined according to ASTM D-3236 standard test method. The phase separation was determined by SEM. The glass transition temperature of hot melt adhesive was determined by DSC. Finally, the resistance of polymeric materials to fungi was studied by visual observation from the growth of the fungi on a piece of specimen placed on top of agar plate.