# CHAPTER I
# INTRODUCTION

Dental impression tray is used not only to study oral anatomy of a person but also to make a replication of teeth and gums. However, it is difficult to find the impression trays customized to patient's jaws. The dental technician tries to produce the individual impression trays for each person, but the production cost is so high. To overcome this problem, the use of biodegradable disposal trays is the alternative way. For the disposal trays, they can change their shape with patient's jaws when they are softened at high temperature.

Poly(lactic acid) (PLA), produced from renewable resources (e.g., wheat, rice, sugar or corn), is one of the most important bio-based and biodegradable polymers. It can be biodegraded within 4-5 weeks by heat. Although PLA has several favorable properties such as, high strength and stiffness at room temperature, the limitation of PLA is brittleness. In recent years, there are several methods to improve PLA properties such as plasticization, copolymerization and blending with various biodegradable and non- biodegradable polymers. For these methods, blending PLA with other polymers is the most effective and convenient way to improve PLA properties. However, phase separation of PLA and other polymers can occur due to thermodynamical incompatibility, resulting in the limitation of toughness improvement.

Ethylene (Vinyl Acetate) (EVA) is the copolymer of ethylene and vinyl acetate. For Vinyl Acetate (VA), it is an extremely elastic material that can be sintered to form a porous material similar to rubber. Therefore, softness and flexibility of EVA can improve properties of PLA and its blend can be processed like other thermoplastics. There are many researches focusing on the improvement in the properties of PLA. Ma et al. (2012) studied compatibility between poly(lactic acid) (PLA) and Ethylene (Vinyl Acetate) (EVA). They found that PLA is miscible with poly(vinyl acetate) (PVAc) but not miscible with polyethylene (PE). As a result, the optimum toughening effect of EVA on the PLA (impact and tensile properties) was obtained at a VA content of 50-60%. This suggests that introduction of hydroxyl groups to EVA chains via catalytic reactive extrusion makes EVA more polar and miscible with polar polymers.

As mentioned above, phase separation of PLA and other polymers can occur due to thermodynamical incompatibility, resulting in the reduction of blend performance. Compatibility of immiscible blends can be done by adding a compatibilizer (third phase) in order to reduce the interfacial tension coefficient and stabilize the desired morphology (Utracki L.A., 2002). As a consequence, mechanical properties and phase morphology of these immiscible blends can be improved.

In this work, PLA/modified EVA/compatibilizer blends were prepared by melt mixing in a twin-screw extruder. The effects of modified EVA (mEVA) content, compatibilizer types and compatibilizer loading on morphology, thermal properties, mechanical properties and biodegradability were then investigated by using FE-SEM, FTIR, TGA, DSC, DMA, and universal testing machine.