



## CHAPTER I INTRODUCTION

Mouth guards are plastic dental appliances which is worn to provide a degree of protection for both the mouth's soft tissues (lips, cheeks, gums, tongue) and hard tissues (teeth and jaw bones). The most important criterion of mouth guards is the fit of its shape to the teeth. Custom mouth guard is the best type of mouth protector that is individually made for an athlete. A well-designed custom mouth guard is typically considered to be able to provide the greatest level of protection for an athlete as compared to the other types of mouth guards. However, custom mouth guards are difficult to make and have very high cost.

This research tries to make the mouth guard with fit shape, easy making, and suitable cost. Polycaprolactone (PCL) is the material chosen in this work, it is biodegradable polyester and very tough. The interesting property of PCL is its melting temperature about 60°C which is the temperature of warm water, it becomes soft and can be shaped around this temperature. Therefore, we can use this property to make boil and bite mouth guard with fit shape for each person. Although PCL is very tough but to use it as mouth guard materials, the mechanical properties should be concern. This work aims to study the structure and mechanical property relationship of PCL, its nanocomposites, and its graft copolymer with Ethylene Vinyl Acetate (EVA). Making of PCL nanocomposites and graft copolymer are the expected method to improve the mechanical properties of PCL, the former is the addition of rigid part, the latter is the addition of soft part into PCL. Nanoclay is an interesting filler that will be added for the rigid part and EVA, the copolymer between ethylene and vinyl acetate that approaches elastomeric materials in softness and flexibility, will be the backbone of graft copolymer for the soft part.

In this study, the different molecular weight of PCL were synthesized to examine the structure and mechanical properties. The rigid part, bentonite clay modified by Stepantex SP-90 surfactant, so called organoclay was added to commercial PCL, CAPA®6500. The soft part, EVA modified through transesterification was used as backbone for grafting of  $\epsilon$ -caprolactone. The structure and mechanical properties of both expected methods were investigated.

## **OBJECTIVES**

The objectives of this research are:

1. To investigate the effect of molecular weight on the structure, dynamic mechanical properties, mechanical properties, and thermal properties of PCL.
2. To investigate the effect of organoclay contents on the structure, dynamic mechanical properties, mechanical properties, and thermal properties of PCL nanoclay nanocomposites.
3. To investigate the effect of PCL contents on the structure, dynamic mechanical properties, mechanical properties, and thermal properties of EVA-g-PCL.

## SCOPE OF RESEARCH WORK

The scope of this research work covers

1. The preparation of PCL with different molecular weight by solution polymerization
2. The preparation of organoclay by using ion exchange reaction
3. The preparation of PCL nanoclay nanocomposites by melt intercalation
4. The preparation of EVA-g-PCL by solution polymerization
5. The determination on the structure, dynamic mechanical properties, mechanical properties, and thermal properties of different molecular weight PCL, PCL nanoclay nanocomposites and EVA-g-PCL