CHAPTER I

INTRODUCTION

1.1 Introduction

Polymeric composite is a heterophase material that is composed of polymer (as matrix) and at least one component (as reinforcing element, fillers, and binder). Normally, the components can be physically identified and exhibit an interface between one another. [Jeanne M.Ang[illegible].1988]. Nowadays it plays an important role in many fields such as construction, medical application and etc. It is because of its high strength by weight, low cost and easiness to process comparing to metal.

In dental field, poly(methyl methacrylate) (PMMA) has been widely used as a main component of denture base. For many years, this material is sometimes fractured or cracked in clinical use. One of the factors that causes fracture is considered to be low resistance to impact and flexural. There have been many studies on the strength problem and they are summarized in the following two approaches. The first approach is to increase the strength of denture base polymer by adding a cross-linking agent of poly-functional monomer such as polyethyleneglycol dimethacrylate. The second approach is to devise a reinforcement of denture base polymer with fiber or rods such as metal wires or metal nets [T. Kanie *et al.* 1999]. From the study [Carroll CE and Von Fraunhofer JA 1984; Ruffino AR.1985], high-strength metal slightly increases the flexural strength and impact strength of denture base polymer, and its use is limited because of the obvious effect on aesthetics. Recently there are many studies about using various types of fibers such as carbon fiber, aramid fiber and ultra high molecular weight polyethylene fiber as reinforcing materials. [Yazdanie N and Mahood M1985; Ekstrand K and Ruyter IE1987; Braden M *et al.*1988; Gutteridge DL 1988; Berrong JM 1990; Gutterridge DL 1992; Chow TW *et al.*1993; Uzun G *et al.* 1999] It has been shown that

these fibers also increase the flexural strength and impact strength of denture base polymer. However, carbon fiber has springy nature in handing and is less aesthetic than the other fibers. Some disadvantages of aramid fiber are poor aesthetics and difficulties in polishing. In the case polyethylene fiber, the surface treatment to improve the adhesion between fibers and denture base polymer is complicated [Ramos VJ *et al.*1996; Samadzadeh A *et al* 1997]. In the past few years, glass fibers or glass rods have been investigated for the reinforcement of denture base polymer [Vallittu PK et al. 1997-1999; Stipho HD 1998]. It has been shown that the impact test values of denture base polymer with glass fibers is higher than those of denture base with all of the above fibers. However in dental work, it has been difficult to introduce continuous long glass fibers into dough of liquid methyl methacrylate (MMA) monomer and poly(methyl methacrylate) (PMMA) powder [T. Kanie *et al.*2000]

In this study, the bamboo fiber is used as a reinforcing element because of many good points such as easiness to afford and good physical properties, which comes from its distinguished microstructure [Shihong Li *et al.*1994]. However, the weak point of using natural fiber like bamboo fiber is the poor adhesion between the fiber and the matrix. Using the silane-coupling agent to enhance the adhesion between the bamboo fiber and polymer can solve this problem.

1.2 Objectives

1.2.1 To improve the mechanical properties of denture base material made from PMMA by using bamboo fiber.

1.2.2 To study the effect of the amount of the bamboo fiber used to reinforce PMMA.

1.2.3 To observe the effect of coupling agent to the adhesion between the bamboo fiber and PMMA.

1.2.4 To study the effect of aspect ratio of bamboo fiber to the mechanical properties of composite materials.

1.3 Scope of work

1.3.1 Study the properties of denture base material made of PMMA and bamboo fibers.

1.3.2 Study the effect of the amount of bamboo fiber on the properties of composite between PMMA and bamboo fibers.

1.3.3 Study the effect of the coupling agent on the properties of composite between PMMA and bamboo fibers.

1.3.4 Study the effect of aspect ratio of the bamboo fiber on the properties of the bamboo fiber / PMMA composite.

1.3.5 Determine the physical properties of the specimen as the following items

a) Flexural Strength

b) Compressive Strength

c) Impact Strength

1.3.6 Determine the interface between PMMA and fiber by using Scanning Electron Microscope (SEM).