

## CHAPTER I

### INTRODUCTION

There is currently a considerable interest in processing polymeric composite materials filled with nanosized rigid particles. This class of material is called “nanocomposite”. This growing interest in the field of nanocomposites originates from both the point of view of fundamental property determination and the development of new materials to meet a variety of applications. Nanocomposites are a relatively new class of composites that exhibit ultrafine phase dimensions of 1-1000 nanometers. As most of the present-day polymers used for preparing nanocomposites are synthetic materials, their processability, biocompatibility, and biodegradability are much more limited than those of natural polymers. Compared to the studies in the field of conventional microcomposites and nanocomposites based on synthetic non-biodegradable materials, only limited work has been reported in the area of bionanocomposites. Another advantage of the natural nanofillers is their availability and their resulting lower cost relative to synthetic nanofillers (Nair et al., 2003). The use of various natural fibers as nanofillers such as starch and cellulose was reported. Cellulose whiskers were extensively used as reinforcing phase in several kinds of polymer matrixes such as copolymer of styrene and butylacrylate (Favier et al., 1995), medium-chain-length poly(hydroxyalkanoate) (Dufresne et al., 1999), and plasticized starch (Anglès et al., 2000 and 2001). Starch whisker can be used as reinforcing material in poly ( $\beta$ -hydroxyoctanoate) (Dubief et al., 1999).

In biomedical application not only biocompatibility and non-toxicity are required but also biodegradability is needed. Chitin can be hydrolysed by lysozyme in human body. By this reason, chitin is more interesting than other natural fibers. Chitin is a high molecular weight biopolymer found predominantly in the hard external shell of crustaceans, and also in the flexible internal backbone of the squid. The structure of chitin consists of  $\beta$ -(1 $\rightarrow$ 4)-2-deoxy-D-glucopyranose units. This polymer is known to be non-toxic, odorless, biocompatible with living tissues, and enzymatically biodegradable (Kumar, 2000). Chitin has been known to form microfibrillar arrangements in living organisms. These fibrils are usually embedded in a protein matrix and have diameters from 2.5 to 2.8 nm. Crustacean cuticles

possess chitin microfibrils with diameters as large as 25 nm. The suspensions of chitin crystallites were prepared by acid hydrolysis. These suspensions display a colloidal behaviour, the stability of which was attributed to the presence of positive charge ( $\text{NH}_3^+$ ) at the surface of the crystallites resulting from the protonation of amino groups.

Poly (vinyl alcohol) (PVA) which is a synthetic polymer widely used in medical field and chitosan which is natural polymer with high potential application are used in this research for studying the nanocomposite material based on medical application

In this study, chitin whiskers were obtained by acid hydrolysis of chitin from shrimp shell. Nanocomposite materials were prepared by using poly (vinyl alcohol) and chitosan as the matrix. The morphology of chitin whisker was investigated by using transmission electron microscope (TEM). Mechanical properties, thermal properties, crystallinity, and swelling behaviour of the nanocomposite films were investigated.