CHAPTER II
LITERATURE SURVEY

In recent years, natural fiber reinforced composites have been of great interest as engineering materials and have penetrated many markets which were dominated by metals. According to their advantages such as high strength, high modulus, biodegradable, and environmental friendly, natural fibers are used widely as the reinforcing agent nowadays.

However, the composites or the blends still suffer from the immiscibility between natural fiber with other synthetic polymer. There are many reports shown the studies of the surface modification in order to improve interfacial interaction and the compatibility between fiber and matrix.

Mukherjea *et al.* (1983) reported that the strength of epoxy resin composites showed the significant increase after treated with polyester amide polyol as the interfacial agent between fiber surface and resin.

The grafting of polyacrylonitrile and poly(methyl methacrylate) onto the fiber surface using phenol and resorcinol formaldehyde resins was studied by Ghosh and Ganguly (1993). The composites consisting of modified fiber had increased strength.

It was found that the composites of kenaf fibers and polyethylene show the improved stiffness by Chen and Porter (1994). According to their crystallization kinetics of PE in the composites, the interfacial bonding between kenaf and PE appeared to be unfavorable.

Joseph *et al.* (1995) studied the mechanical properties of sisal fiber composites of both thermoset resin matrices (polyester, epoxy, phenol-formaldehyde) and thermoplastic matrix, high density polyethylene (HDPE). It was found that the fiber length was an important factor required to gain the optimum properties of the composite. The composite gave a significant trend in increasing properties. Moreover, sisal fiber-LDPE composites showed a better reinforcing effect.

Geethamma *et al.* (1998) studied the effect of chemical modification, fiber loading, and orientation of fiber in short coir fiber and natural rubber (NR) composite. It was found that the composites containing alkali-treated coir fibers that subjected to a pretreatment with depolymerized liquid of natural rubber solution showed the improved tear strength. The interfacial adhesion between coir and NR was improved after treated with alkali (sodium hydroxide and sodium carbonate) and NR solution.

Apart from using as the engineering composite material, many researchers have aimed the interest to the new application of natural fiber in the medical-bioplastic purpose. The compositions of the natural fiber are considered as the important factor to be used in the medical field. One of the most important composition that makes some natural fibers have the outstanding properties to be used as fiber suited to living bodies over other kinds of fibers is amino acid.

Silk is one of the fibers that gain these compositions. Moreover, silk fiber (SF) is in the form of close packing with fully oriented structure leading to high modulus and high strength, so it can be used as reinforcing agent also. There are many reports dealing with silk fiber as the medical bioplastic and as the reinforcing fiber.

Setua *et al.* (1984) studied the short silk fiber-reinforced polychloroprene rubber composites in the presence of 3 different dry bonding systems. A) cohedur RK-cohedur A-silica B) cohedur RK-cohedur A-carbon black C) resosinol-hexamethylenetetramine silica. It was found that the degree of fiber-rubber adhesion of the different bonding systems followed the order by A) was greater than B), and B) was greater than C).

Akhtar *et al.* (1986) studied silk as the reinforcing fiber in thermoplastic elastomers from the blends of natural rubber and polyethylene. It was found that the increasing of fiber loading in the NR-PE composite caused an increase in some properties such as hardness, compression set, tensile strength, tensile modulus, tear strength, tear modulus, and abrasion loss but lowering the elongation at break. Moreover, increasing fiber loading in the mixes led to a significant improvement in processing characteristics.

Sun *et al.* (1998) reported that the modulus of the blends of acrylic polymer and silk fibroin had increased up to 20% (wt) silk fiber. Moreover, the moisture absorption increased from 2.06 to 6.2%.

Even the chemical treatment and the surface modification of the natural fiber-composites in the conventional system were found to be the effective ways to improve interfacial interaction and compatibility between fiber and matrix, they are quite difficult, and many steps have to be done in order to get final product. Recently, a new method of producing compatible fiber reinforcement or thermoplastic blends is via reactive blending. Reactive blending provides convenient and useful way of improved properties of the blends from that the components themselves are modified by the chemical reaction occuring during melt blending step. Thus, there is no need for addition of the separated compatibilizers.

Benedetti *et al.* (1986) found that the presence of polyolefin grafted diethyl maleate as the compatibilizer in the system of polyethylene/polyvinyl chloride blends resulted in the reducing interfacial tension and improving the morphology and the processibility of the blends.

Ballegooie and Rudin (1988) found that the reactive extruded blends of PS/PE blends using triallyl isocyanate coupling agent in the presence of dicumyl peroxide had improved properties and morphology at the optimum concentration of coupling agent.

From many research works, reactive systems by adding carboxylated functionalized polymer components to modify interfacial interactions between two phases of the matrix components, i.e. polyethylene grafted with methyl methacrylate or polyethylene grafted with maleic anhydride show the improved result in the properties of the blends. Graft-copolymerization of MMA or MA monomer onto PE matrix has established the chemical functionality through carbonyl groups which can interact with other functionalities on the another component. Thus the more compatibility is observed.

Gallucci *et al.* (1982) studied the grafting of various types of monomer e.g. glycidyle acrylate, glycidyle methacrylate, buthyl methacrylate, and maleic anhydride on polyolefin e.g. polyethylene. It was found that polyolefin was modified successfully in the melt blending step via free radical polymerization of monomor onto the polyolefin matrix. The degree of functionalization depends on type of monomer and initiator used.

Moreover, today many researchers play attention to the new blending process called one-step reactive blending in which the functionalized step and the blending step are carried out in the same mixing equipment.

Hu *et al.* (1996) studied the blends of polypropylene/polybuthylene terephthalate using glycidyl methacrylate as the functionalized monomer by one-step reactive blending in co-rotating intermeshing twin screw extruder. However, the properties of the blends of one-step reactive blending did not show the significant higher value compared to those of the two-step reactive blending.

Collier J.R. (1996) studied the cellulosic wood fiber reinforcement in reactive composite of maleated polypropylene in twin screw extruder and structural injection molding (SRIM). The melt viscosity and shear thinning characteristics in both systems increased with increasing wood fiber contents. However, the elongation at break decreases 30% with only 4% (wt) of fiber.