CHAPTER I
INTRODUCTION

Due to an increase in environmental consciousness and legislated requirements, the use and end–life handling of traditional composite materials based on synthetic materials are more concerned at this time. Governmental regulations and growing environmental awareness have shifted towards materials compatible with the environment. The use of cellulose fibers as reinforcing fibers in both thermoplastic and thermosetting matrix composites provides positive environmental benefits. On the other hand, glass or carbon based composites cannot be recycled at the end of their life. The persistence of those synthetic materials in the environment, the shortage of land fill space, concerns over emissions during the incineration, and the entrapment and ingestion hazards from those materials have spurred efforts to develop biodegradable plastics. This stimulates the increasing interest in using natural fibers in a verity of synthetic materials.

Cellulose fibers are inexpensive and easily obtained from renewable natural resources. They also have many advantages compared to glass fibers, including low density which makes it possible to obtain lighter composites, high flexibility which will not fracture when processed over sharp curvatures, low equipment wearing during their processing, non–abrasive which ensure a greater longevity of the process tools, non–toxic means no health problems and easy to handle. Socio–economics benefits arise because it generates an economic development opportunity for non–food products in rural areas and most important, they are biodegradable. Therefore, the environmental concerns and unique characteristics have allowed natural fibers to be considered for applications in the automotive, building, furniture and packaging industries.

Cellulose fibers have been extensively used as the reinforcing phase for several types of polymers. Among various thermoset plastics, the most commonly used ones are polyesters, epoxies, and phenolics whereas the most common thermoplastics are polystyrene (PS), polyethylene (PE) and polypropylene (PP). However, the hydrophilic nature due to hydrogen bonds inside the macromolecule itself (referred to an intramolecular bonding) and between the cellulose macromolecules (referred to an

intermolecular bonding) from hydroxyl groups of cellulose fibers is a major drawback for their applications as reinforcements for the polymers addressed above. The poor moisture resistance of cellulose fibers leads to the incompatibility and poor wettability with hydrophobic polymers. This also tends to weaken the interaction bonding at fiber–matrix interfaces. Chemical or physical modifications are usually applied to impart bonding and adhesion affinity to polymeric matrices. A surface chemical modification is usually applied to improve the interaction and adhesion between the non–polar matrix and the polar cellulosic fibers.

The grafting or coupling is one of the important techniques widely used for the surface modification of cellulose fibers. Grafting may take place at the surface of the cellulosic fibers, or at random within the fiber structure. A particular advantage of grafting is the possibility to carry out the reaction without altering the shape of the fibers, beads or particles. Grafting also helps to improve the solubility properties since cellulose fibers are difficult to dissolve in common solvents due to their high crystallinity and they degrade before reaching their melting temperature due to the strong hydrogen bonding present in the cellulose molecules.

In this present work, the modification of cellulose fibers (CF) and cellulose microfibrils (CMF) were performed by grafting hydrophobic chain alcohols, 1–Octadecanol, on fiber surface via coupling agent, TDI, in an attempt to render CF and CMF hydrophobiced. The polypropylene reinforced modified–fiber composites were prepared by a twin screw extruder. The grafting was verified using FTIR; whereas the corresponding changes on the morphology and surface (hydrophobic) properties of CF and CMF were characterized by SEM and a static contact angle measurement. The quantitative grafting was also investigated by TGA and the mechanical properties of the composites were studied.