

CHAPTER I

INTRODUCTION

Nowadays, the concerns on the environmental problems have dramatically increased throughout the world. The environmental issues have led to a great impact on materials engineering and design. Fibers from natural resources have been considered as good choices for making materials that can reduce the environmental problems because natural fibers can be degraded in nature and they are abundant as the major components found in most residues and by-products from agriculture and agro-industries. Natural fibers have many advantages such as low cost, mass production, degradability, renewability and rich in nature. However, natural fibers also have some drawbacks, such as large variations in mechanical properties, sensitivity to humidity and UV radiation, and low resistance to impact (Benitez A.N. *et al.*, 2013). One important application of natural fibers is paper industry. Because of good flexibility of paper, so it is suitable for use as substrate and coat with polymer in order to be used as conductors in some electronic devices.

Banana is a plant growing well in tropical countries like Thailand. Normally banana tree will be cut after giving fruits and banana trunks become wastes. In addition, banana trunk is a very good source of cellulose and low levels of lignin so the delignification is relatively easy (Bilba K. *et al.*, 2007). Plant fibers consist of many compositions such as cellulose, hemicellulose, lignin, pectins and waxes that allow moisture absorption from environment which leads to poor bonding with the matrix materials. We need only cellulose, so we have to remove hemicellulose, lignin, pectins and waxes by treatment that usually based on the use of reagent functional group that capable reacting with the fiber structure and changing their composition.

The electrically conductivity is one of the desirable properties of materials. The most interesting conductive polymer is polyaniline (PANI). It is also known as aniline black (Ghasemi-Mobarakeh L. *et al.*, 2011). It exists in various forms based on its oxidation level: the fully oxidized pernigraniline base, half-oxidized emeraldine base and fully reduced leucoemeraldine base (Zhou DD *et al.*, 2010).

PANI emeraldine is the most stable and conductive. PANI has many advantages, such as ease of synthesis, low cost, good environmental stability and the ability to be electrically switched between its conductive and resistive states (Yu QZ. *et al.*, 2008) and some drawbacks such as poor processibility, lack of flexibility and non-biodegradability. PANI have been extensively studies for the wide ranges of application such as sensors, analytical separation, proposed as diagnostic, applied in the electrorheological studies, catalyst, controlled drug delivery and tissue engineering applications (Liu X. *et al.*, 2011).

Several kinds of metal can be a good conductive such as gold, nickel, copper, zinc and silver. However, silver is one of the most interesting materials because it can be used in many applications. For example, in industries it used in electrical conductors and in catalysis of chemical reactions. Silver exhibited the high electrical conductivity with 10^7 S/cm. On the other hand, the dilute silver nitrate solutions and other silver compounds can be added to wound-dressings, bandages and medical instruments.

Solution plasma is a new plasma system which is liquid-phase plasma. This system is able to produce highly active species such as hydroxyl radical (OH^\cdot), hydroperoxyl radical (HO_2^\cdot), free electron (e^-), superoxide anion (O_2^-), and atomic oxygen anion (O^-) (Potocky, Saito, and Takai, 2009). Since solution plasma does not involve any chemical reagents, the removal of chemical residue is not required. By plasma activation it is possible to create new chemical groups and active specie in the solution which can react with functional groups of cellulose fibers to coat on cellulose fiber surface.

In the present work, cellulose sheet will prepared from banana trunks for use as substrate of polyaniline (PANI). In addition, solution plasma process was used to improve the coating of polyaniline on cellulose sheet. The coating can solve the drawback of polyaniline in poor processibility and lack of flexibility. Adding the silver particles can help improve the electrical conductivity of as-prepared coating polyaniline on cellulose sheet. The optimum condition for SPP treatment will choose based on the results of Fourier-transformed infrared (FTIR) spectroscopy, x-ray diffraction (XRD), scanning electron microscopy (SEM), thermal gravimetric

analysis (TGA), x-ray photoelectron spectroscopy (XPS), two point probe and water contact angle.