CHAPTER I
INTRODUCTION

Food export business has been one of the most important businesses in Thailand economy. A variety of food (i.e. chicken, shrimps, etc.) or fruits (i.e. mangosteen and mangos) were exported throughout the world. However, the food industry has to encounter problems such as food spoilage since the shelf-life of fresh food is short after long distance transportation. An interesting approach is to develop a sensor which can detect meat spoilage.

Sensors have been widely used in many applications since they can be functional in many terms such as pH sensors, thermal sensors, motion sensors etc. When fresh meat spoils, it releases volatile amine compounds (VACs): trimethyl amine (TMA), dimethyl amine (DMA) and ammonia which has pH 9. Therefore, the sensors should be pH sensitive at pH 9 and also be an optical sensor to see clear changes by the naked eye.

Many pH sensitive materials can be added onto film or fibers such as curcumin. Curcumin is a yellow pigment extracted from Turmeric plant which has antimicrobial and anti-inflammatory properties. More importantly, curcumin is pH-sensitive and has the ability to change color from bright yellow to orange at pH 8-9. As a result, curcumin can be used as pH indicators during meat spoilage. However, to fabricate these sensors could be a challenge to the food industries. Nevertheless, there are techniques to fabricate sensors such as layer-by-layer deposition and electrospinning.

The Layer-by-Layer (LbL) deposition is a technique to alternately deposit oppositely charged polyelectrolytes which interact via electrostatic interactions onto a substrate resulting in a nano-scale thin film. This technique allows incorporation of various materials onto the thin film. As a result, curcumin can be incorporated in to the thin film to produce an optical sensor. Also, both synthetic (PDADMAC/PSS) and natural polyelectrolytes (CHI/ALG) can be used in the process. Moreover, the polyelectrolytes used in the LbL process may enhance the sensitivity of the material.

Electrospinning is a fiber-forming process which uses high voltage to attract fibers on to a substrate. This technique also allows different types of materials to be incorporated with a viscous polymer solution. Curcumin can be spun into fibers by incorporating it with poly(vinyl alcohol) (PVA) which keeps curcumin in a moist state and could enhance the pH sensitivity of curcumin.

The goal of this research is to develop a curcumin-based sensor to detect ammonia from food spoilage using two types of techniques i.e. LbL and electrospinning. The challenge of this research is mainly, to combine curcumin with a component that allows curcumin to maintain its activity since curcumin degrades overnight. Also, to enhance the sensitivity of curcumin due to the low concentration of VACs produced from actual meat. Curcumin was loaded on two types of thin films which are PDADMAC/PSS and CHI/ALG. It was discovered that curcumin thin films can tune its pH sensing properties by changing the top polyelectrolyte layer. Thus, changes color at lower pKa. However, the pH sensitivity of curcumin thin films only reacts when dipped in phosphate buffer not with ammonia vapor. Curcumin fibers showed clear changes to ammonia vapor due to its higher sensitivity.