CHAPTER I
INTRODUCTION

One of the most commonly found problems of the horticaltural products is the decreasing of their quality with storage or holding time. Because fruits and vegetables are perishable products with active metabolism during the post harvest, so packaging plays an important role in maximizing the shelf life of both the handling and preservation approaches to shelf life extension. However, traditional-packaging concepts are limited in their ability, thus, the new food packaging has been introduced as a response to the continuous changes in consumer demand and market trends for better quality, mildly preserved, fresh-like, tasty, and convenient food products. In addition, the changing of retail and distribution practices such as centralization of activities, new trends, and globalization of markets, resulting in increased distribution distances with longer storage times and different temperature requirements for a set of different products, present major challenges and huge demand on food packaging industry. Therefore, the variety of active packaging technologies have been developed in order to extend shelf life while the packaged food maintain safety and quality as well. Important active packaging systems include carbon dioxide emitter/absorbers, moisture absorbers, ethylene absorbers, ethanol emitters, flavor releasing/absorbing systems, time-temperature indicators, and antimicrobial containing films.

The main problems of fresh fruits and vegetables are both ethylene and carbon dioxide gas. Ethylene (C_2H_4) is a growth-simulating hormone that has difference physiological effects on fruits and vegetables. It accelerates softening, ripening, and senescence by increasing the respiration rate, thereby decreasing shelf life. Ethylene also accelerate the rate of chlorophyll degradation, in other words, it can cause yellowing of green vegetables. Hence, ethylene gas is removed from the package headspace to slow senescence and prolong shelf life. For carbon dioxide (CO_2) gas, it is formed due to deterioration and respiration reactions. The produced CO_2 should be removed from the package to avoid food deterioration and gas pressure built up inside rigid packaging or volume expansion in flexible packaging.

Several techniques have been developed to prolong shelf life of fresh fruits and vegetables. Most of these are supplied as sachets or integrated into films. The most well-know, cheap, and extensively used ethylene absorbing system consists of potassium permanganate ($KMnO_4$) imbedded in an inert carrier with a large surface area. However, potassium permanganate cannot be integrated into food-contact surfaces of packaging films, but are supplied only as sachets due to their toxicity. Another ethylene scavenger is based on the absorption of ethylene on activated carbon and subsequent breakdown by metal catalyst, such as charcoal and palladium chloride. Incidentally, for carbon dioxide scavengers, they are commercialized as a sachet, such as the active compound $Ca(OH)_2$ of FreshLock®. Moreover, they can be composed of other physical absorbent (zeolite or active carbon powder), or a chemical absorbent (Na_2CO_3, $Mg(OH)_2$, etc.). In addition, the other absorbing technologies are based on the dispersed minerals (clays), which are embedded in polymer bags, and then used for fresh products.

Last year, Varothai Y. studied PP/organoclay films. She used aluminum hydroxide and aluminum acetate as ethylene scavenger in the active packaging films. However, the purpose of this work is also to prepare ethylene and carbon dioxide scavenger film based on PP/modified clay. Clay minerals, Bentonite, were treated for exfoliated the clay platelets by surfactant (Stepantex-90). The ethylene and carbon dioxide scavengers are aluminum hydroxide and calcium hydroxide, respectively. The ethylene scavenger was attached to nanoclay by using 3-aminopropyl-trimethoxysilane to act as surface treatment to stabilize the exfoliatated state of organoclay, and then, compound with polypropylene to be nanocomposite pellets. However, carbon dioxide scavenger is incorporated with polypropylene by melt intercalation. Both of them are fabricated to be active packaging films. In addition, X-ray Diffractometer (XRD), Scanning Electron Microscope (SEM), Fourier Transform Infrared Spectroscopy (FT-IR), and Thermogravimetric Analysis (TGA), was used for characterize this film. Mechanical properties, permeability, ethylene and carbon dioxide adsorption, and thermal properties of the obtained film were also investigated.