CHAPTER I
INTRODUCTION

Among various applications of the PP/clay nanocomposite, new food-packaging systems have been developed, due to the way foods are produced, distributed, stored and retailed. Moreover, they reflect the continuing increase in consumer demands for improved quality, extended shelf-life, cost efficiency, safety, convenience, and environmental issues for packaged foods. In order to fulfilling the packaging function in meeting these different demands, innovative active and intelligent packaging concepts are being developed and applied in various countries. The active and intelligent packagings are attracting a lot of attention in the food industry, because it performs more than just protection, interacting with products and actually responding to changes. Especially, active packaging includes those packaging methods which change the condition of the packed food to extend shelf-life or improve safety or sensory properties while maintaining the quality of the food. Meanwhile, intelligent packaging or smart packaging includes packaging which able us to monitor the condition of packaged food to give us information about the quality of the packaged food during transport and storage. Currently both active and intelligent systems can be combined as integral parts of the package or as a separate part contained inside the package.

Intelligent packaging is one of the innovative food packaging concepts that have been introduced as a response to the continuous changes in current consumer demands and market trends. Major intelligent packaging techniques are concerned with external indicators attached to the outside of the package (time-temperature indicators), and internal indicators which are placed inside the packaging, either to the headspace of the package or attached into the lid (oxygen indicators, carbon dioxide indicators, microbial growth indicators, and pathogen indicators). Many indicator systems have been patented, but only a limited number of these patents have been commercialized because of strict requirements. At present, commercially available indicators of interest for monitoring food quality include indicators of time-temperature, leakage and freshness. For freshness indicators, an ideal one for the quality control of packaged foodstuffs would indicate the spoilage or lack of freshness of the product, in addition to temperature abuse or packaging leaks. In patent literature, a number of freshness indicator or detector concepts are described that are based on the detection of volatile metabolites produced during ageing of foods, such as CO_2, diacetyl, amine, ammonia, and hydrogen sulphide. However, new concepts of freshness indicators are expect that in the future they will become commercially available products.

In the fisheries industry, there is a large amount of emphasis in developing rapid methods to evaluate fish freshness by using general quality indicators. One concept to meet this requirement is by using a smart packaging in cooperation with a simple freshness color indicator that monitors the microbial breakdown products in the headspace of the packaged fish. When fish spoils, it releases a variety of basic volatile amines which are detectable with appropriate pH indicating sensors through visible color changes to the spoilage-volatile compounds that contribute to a quantity known as total volatile basic nitrogen (TVB-N) and the response of changing microbial populations (aerobic plate count or APC and *Pseudomonas spp.*).

In this research, the pH sensor for determination of amine spoilage product in packaged fish based on PP/clay nanocomposites were focused on and fabricated. Bromocresol green, which indicates through a visible color change (yellow to blue) to the spoilage volatile compounds known as total volatile basic nitrogen (TVB-N) was incorporated on polymer/clay nanocomposite films by using spin-coated technique. The mechanical properties, permeability, thermal properties, and the effects of processing conditions of polymer/clay nanocomposite films was investigated. Moreover, the suitability to use this nanocomposite films as pH-indicating sensor packaging was also determined by using an X-ray Diffractometer (XRD), Scanning Electron Microscope (SEM), Fourier Transform Infrared Spectroscopy (FTIR), Differential Scanning Calorimeter (DSC) and Thermogravimetric Analysis (TGA). In addition, leaching of the dye was assessed over time to assess the suitability of the sensor formulation for food packaging application. Finally, the correlation between sensor response, bacterial growth patterns, and TVB-N level in fish samples was studied thus enabling the material to be able to ''real-time'' monitoring of spoilage.