CHAPTER 1

INTRODUCTION

Consumers continue to demand foods that are minimally processed and posses fresh-like quality, while on the other hand, modern distribution systems require extended shelf life. Traditional methods of preserving foods from the effect of microbial growth include thermal processing, drying, freezing, refrigeration, irradiation, modified atmosphere packaging, and adding antimicrobial agents or salts. Unfortunately, certain of these techniques cannot be applied to some food products, such as minimally processed fruit and vegetables and ready-to-eat products, because of the damage they can do to the product (Quintavalla and Vicini, 2002).

Since microbial contamination of these foods occurs primarily at the surface, due to post-processing handling, attempts have been made to improve safety and to delay spoilage by use of antibacterial sprays or dips. However, direct surface application of antibacterial substances into foods has limited benefit because the active substances may be neutralized on contact or diffuses rapidly from the surface into the food mass. Further, incorporation of bactericidal or bacteriostatic agents into food may result in partial inactivation of the active substances by product constituents. Therefore it is expected to have only limited effect on the surface microflora. Antimicrobial packaging is a promising active packaging technique and may provide an alternate way to achieve an antimicrobial effect.

The use of packaging films containing antimicrobial agents could be more effective, by controlling migration of the agents from the packaging material to the surface of the product. Thus helping to maintain high concentrations where they are most needed. If an antimicrobial can be continuously released from the package during an extended period, the activity can then be extended into the transport and storage phases of food distribution. Release of antimicrobial substances from packaging materials may control microbial contamination by reducing the growth rate and maximum growth population, by extending the lag-phase of the target microorganism, and by inactivating microorganism on contact. Thus, these packaging technologies could play a role in extending shelf life of foods and reduce the risk from pathogens.

The demand for minimally processed, easily prepared and ready-to-eat 'fresh' food products, globalization of food trade, and distribution from centralized processing pose major challenges for food safety and quality. Recent food-borne microbial outbreaks are creating a need for innovative ways to inhibit microbial growth in foods which help maintain quality, freshness, and safety. Meanwhile, consumers are demanding the use of more natural preservatives.

Research and development of antimicrobial materials for food packaging applications and other food contact surfaces is expected to grow in the next decade with the advent of new polymer materials and antimicrobials (Appendini and Hotchkiss, 2002). Due to environmental concerns, the use of renewable resources to producing packaging was advantage. Research on alternative uses and reprocessing of these biopolymers will add commercial values and reduce pollution problems. Several polysaccharides have good film-forming capacities, including cellulose derivatives and chitosan (Garcia *et al*., 2004). Composite film may be designed to take advantages of pure components (Butler *et al*., 1996; Donhowe and Fennema, 1993b).

Researchers have incorporated essential oil from plants as antimicrobial active agents in packaging film, such as anise, basil, coriander, oregano and garlic oils (Zivanovic *et al*., 2005; Pranoto *et al*., 2005). They encountered a sensoric problem when used with food since essential oils have strong odors. Vanillin, which has been used as a flavoring in food has been shown to provide an effect on bacteria, yeast and mold (Fitzgerald, 2004; Cerrutti and Alzamora, 1996; Lopez-Malo *et al*., 1995; Cerrutti *et al*., 1997). In these studies, it was applied directly onto a culture medium or a food. Research in incorporating vanillin into films to maintain the minimum inhibitory concentration on the food surface is limited. The incorporation of vanillin into a biodegradable film will have as its intended purpose the release onto the surface of food at a specific rate to control microbial growth. Gradual release may have an advantage over direct incorporation into food. Research on the application of an antimicrobial biodegradable film to fresh-cut fruit is limited.

Research Objectives

1. To develop a biodegradable antimicrobial film and study its physical, mechanical, barrier and thermal properties.
2. To evaluate the inhibitory effect of the film on *Escherichia coli* and *Saccharomyces cerevisiae*.
3. To study the release of antimicrobial agent from the film.
4. To use the antimicrobial film with fresh-cut fruits and study its effect on product quality and safety.

The Usefulness of the Research

1. The antimicrobial biodegradable film may be used as an alternative to synthetic plastics.
2. The antimicrobial biodegradable film may extend the shelf life of products and reduce the growth of microorganisms.
3. The antimicrobial biodegradable film may have application with other types of food such as fruits, vegetables, bakery products, dairy foods, meat and meat products.

Scope of Research

In this study, a biodegradable film was made from chitosan and cellulose derivatives and vanillin was used as an antimicrobial agent.

Research Location

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2. Faculty of Agro-Industry, Chiang Mai University, Thailand.
3. School of Packaging, Michigan State University, USA.