CHAPTER 1

Introduction

Radio frequency (RF) power is produced when electricity is applied to an RF generator whose signal is amplified and delivered to a parallel electrode system (RF cavity), in which a selected material is placed. Within the RF cavity, an oscillating electric field is created, and energy is transferred to the treated material through electronic-field interactions with dipole or induced dipole molecules (those formed by the polarization of neutral molecules). These dipole molecules are forced to reorient within the changing electronic field, which results in movement or drifting that causes internal friction and creates thermal energy (heat). The process is known as "RF thermal processing" or simply "RF heating". At certain frequencies or frequency bands, some foods and nonfood materials can be heated preferentially and faster, creating rapid thermal effects on pests but minimal interactions with the host material. This is due to the difference in electrical conductivity between arthropod pests (high) and the host commodity (low). This process is called "selective or differential RF heating" of which the technique could provide an alternative disinfestations process for thermally sensitive fruit and vegetable products. The radio frequency application is an advanced telecommunication technology first invented in the early 1900s, which is in use today for wireless communication worldwide. Because of its ability to penetrate and heat various materials, RF has the potential to disinfect and/or disinfest food, agricultural and environmental materials. However, research to validate this approach has been restricted by limited understanding of how RF photons interact with materials, and by limited access and the high cost of its source electronics. Since the early 1990s, the researchers have conducted research at University of California: Davis, University of Washington and Chiang Mai University on continuous RF power applications. Recently, the potential of agricultural application is radio frequency heat

treatment for solving various problems of pest and disease in post-harvest agricultural production have been done with Radiofrequency-Microwave application unit was also developed. The dielectric heating is referred to the phenomenon as caused by dipole rotation which the molecules reverse direction and accelerate the motion of individual molecules or atoms, then heat are formed. RF heat treatments have been proven to degrade cellular activity to control pest and pathogenic microorganisms in agricultural products. Laboratory tests have successfully demonstrated the effectiveness of RF power to disinfect and/or disinfest fresh produce, rice, soils, agricultural wastewater, and other food and materials. Likewise, rapid pulses of RF are lethal to arthropod pests and may provide a non-thermal disinfestations process for fresh, temperature sensitive commodities, as well as a promising alternative to the fumigant application as methyl bromide. A major challenge in producing and distributing disease- and insect free agricultural products is the need to maintain their high quality attributes while minimizing the adverse impacts of treatment. This challenge emerged because of consumer attitudes and market expectations concerning the safety, quality and condition of foods; the adverse environmental impacts of agricultural practices; and expanding global markets, which impose logistical demands on regional, national and international trade. To a large extent, food safety depends on the use of adequate disinfection and disinfestations technique, while quality is maintained by integrating multiple handling packaging, and storage and distribution practices. Disinfection is aimed at eliminating spoilage and pathogenic organisms to reduce storage losses and prevent food-related illnesses. Disinfestations (control of insect pests) are needed mostly to comply with trade barriers aimed at preventing the spread of nonnative arthropod pests. In general, complex organisms such as arthropod pests are more severely and easily affected by heat. The higher response of pests and lesser sensitivity of host commodities offer a window of opportunity for disinfection with minimal or no impact on the commodity. The differential effect is generally less effective with microbial contaminants, since microbes are significantly smaller in mass and are usually well attached to a much larger volume (and mass) host, thus being rapidly and effectively cooled. For disinfection to occur, the microbe must reach lethal temperatures, which are usually also deleterious to the host commodity.

Therefore, this study is to investigate radio frequency treatment on decontamination of microorganisms infested with rice bran containing color pigment as purple rice which

was considered for various kinds of a medicinal treatment. Moreover, the techniques are more capability to use as heat accelerated condition which will be benefit for the stabilization process to prolong rice bran shelf life. Not only low moisture content agricultural product material but also the climacteric fruits as mango was also exposed pass through radio frequency application combined with fruit mover container for finding out the new technique on controlling fruit fly infestation in the thermal sensitive fruit in the case used as mango

Research Objectives

1. To find out optimize treatment for reduction post-harvest diseases contaminated in purple rice bran using radio frequency technique and change of some chemical composition
2. To investigate effect of radio frequency heat treatment as stabilization or heat accelerated conditions on chemical compositions of rice bran and after storage
3. To control insect infestation in thermally sensitive fruit as mango by developing a container and mango mover combined with radio frequency technique application
4. To study the effectiveness of radio frequency to control insect infestation and determine the quality of the mango sample after radio frequency heat treatment