Chapter 4

Conclusions

1. Rigor mortis process

The rigor mortis process in fish killed by icing started from hour 1 and reached a peak around 4 to 5 hr then declined depending on the individual part. The head part has a longer period for the rigor stage compared with the middle and the tail part. As a whole, the fish completed the rigor process within 8 to 12 hr.

2. Sensory profile of fresh fish and ice stored fish

The shelf-life of seabass fish kept in ice in the ratio of ice to fish of 3:1 was approximately two weeks. The best indicator for premium-grade seabass was a bright and fluorescent eye. Slime of freshly caught fish was high, watery, and clear without apparent viscosity when compared with old iced-stored fish. After keeping fish in ice for two more days, the good indicators were gills in term of color, smell and quality of mucus. The longer the keeping time the greater the mucus viscosity, fishy, rancid smell and less bright red color occurred. The shiny body was not a good indicator for fish grading. Moreover, it is impossible to determine belly burst that may be due to thickness of belly flap and catching style. Seabass cultured in Songkhla Lake were stopped from feeding before catching them, so the fish were not in a heavy digestive stage.

3. Effect of the killing method, icing delay and part of flesh fish on its shelf-life quality

Fish firmness was highest in the tail part in comparison with all other parts except the belly part. Firmness in the head and middle parts decreased while tail part remained firm as storage time increased. Therefore the decrease in fish firmness during ice storage may be used as an indicator of the rigor mortis process and also the changes in fish texture in other storage forms. pH of newly caught fish was around 6.4-6.6 depending on the parts of the fish pieces and storage time. TVB was lower than the allowable limit during iced storage. TMA was not a good indictor of

deterioration of seabass because its concentration in the initial raw material is low. However, it was related to fishy odor even with its low concentration. So with seabass or brackish water fish, the standard value of TMA should be set lower. TBARS had a high variation even in the same sample so it cannot be used to determine lipid oxidation. Part of fish is one of the factors that determine the entire quality. So in certain circumstances it may be necessary to use a specified parts or a whole fish. Delay of iced storage within 45 min did not have a clear effect on fish quality deterioration. Shelf-life of fresh fish may vary from batch to batch.

4. Natural preservative properties of Tom-Yum mix and its ingredients

4.1 Antibacterial and antioxidant properties of β-carotene and isoflavone in the spices of Tom-Yum mix

Tom-Yum mix is composed of lemon grass, kaffir leaves, galagal root, red chili, shallot and garlic. Fresh garlic had the highest antimicrobial property because it inhibited all test bacteria. This was then followed by Tom-Yum mix and kaffir lime leaves whereas; shallot, lemon grass, galangal and chili had no inhibitive effect. This study indicated that red chili and kaffir lime leaves were the major source of β-carotene in Tom-Yum mix. There were no isoflavone compounds in Tom-Yum ingredients.

4.2 Effects of Tom-Yum mix on microbial growth and consumer preferences

The results concluded that Tom-Yum mix could reduce the population of target bacteria within a range of 1-4 log cycle depending on the type of bacteria. The most resistant bacterium in the mix was *L. monocytogenes*. However, antibacterial properties can be improved by adding more garlic, without having a customer preference problem. Adding garlic in certain amounts incresased consumer preference. It is a new Tom-Yum formula with high garlic content.

5. Shelf-life extension of cut fish marinated in Tom-Yum mix and packaged under various modified atmospheres

It can be concluded that marinating fish with Tom-Yum mix and keeping it under a modified atmosphere could extend the shelf-life when compared with conventional air. Even though at high concentrations of CO_2 it seemed to accelerate lipid oxidation, the suitable gas mixture for marinating fish with Tom-Yum mix was 90%CO_2: 5%N_2: 5%O_2 judging by microbiological quality. This condition could prolong the shelf-life of fish from conventional air packed by at least 7 days in terms of bacterial quality. From observation, no rancid odor was found in any marinating treatments during chilled storage. Marinated fish with Tom-Yum mix had better flavor when compared with control samples. However, fish texture and taste needed to be improved by adding some chemicals such as sodium phosphate to protect drip loss in the samples. Moreover, more ingredients such as such as salt, sugar and citric and/or limejuice should be introduced to eliminate the strange taste mentioned by consumers. Tom-Yum mix had a synergist effect with atmosphere packaging particularly with regard to hygienic bacteria such as *S. aureus* and coliform bacteria. Having more inoculums bacteria led to a less inhibitive effect. This product has a great commercial potential. The patent application is underway.