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Thesis abstract

Development of composite films from seaweed hydrocolloids, Gac by-product, essential oils and plant extracts for preservation of fresh prawn

Tran Thi Bich Thuy

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A global concern has been raised over the use of plastic for food packaging because of its potential effects on the environment and human health. Therefore, there is an increasing interest in using edible, biodegradable and renewable packaging materials for food products. Recently, seaweed hydrocolloids have been applied to produce edible films, but the films have high cost and limitation in physio-mechanical properties. The overall aim of this project was to develop edible coatings from composites of seaweed hydrocolloids, Gac pulp (*Momordica cochinchinensis*) and plant extracts or oils for effective preservation of fresh prawn. This project used Gac pulp as it is a by-product from Gac oil production, and it can be applied to overcome limitations of the seaweed hydrocolloid-based films. The plant extracts and essential oils were also applied to further strengthen properties of the composite films because they have antioxidant and antimicrobial properties. The results (Chapter 4) showed that Gac pulp is a rich source of ash, protein, fibre and pectin, thus it can be potentially applied to improve properties of seaweed hydrocolloid-based films. The results also showed that pectin can be effectively recovered from Gac pulp with high solubility and viscosity, and potent DPPH scavenging antioxidant capacity, especially under optimal ultrasound-assisted extraction (UAE) with ultrasonic time of 35 min, ultrasonic power of 200W, and solvent pH of 1.5. Gac pulp and pectin derived from Gac pulp were further tested to strengthen properties of seaweed hydrocolloid-based films. The results (Chapter 5) indicated that both Gac pulp and its pectin can improve properties of the seaweed hydrocolloid-based films. With Gac pulp incorporation, the optimal formula of the composite films was: Sodium alginate 1.03%, kappa-carrageenan 0.65%, Gac pulp 0.4%, and glycerol 0.85% (w/v). This film has high mechanical properties, low water vapour permeability and acceptable physical properties. With pectin incorporation, the optimum formula was: Sodium alginate of 1.28% w/v, kappa-carrageenan of 0.58% w/v, and Gac pulp pectin of 0.25% w/v. This film has improved colour, water vapour permeability and mechanical properties. This project further examined the effect of essential oils and plant extracts on strengthening properties of composite films made of seaweed hydrocolloids and Gac pulp or pectin. The tested additives include ginger oil, lemongrass oil, peppermint oil, lemon-myrtle oil, and commercial

Gac oil as well as extracts of lemon-myrtle, blueberry ash, and macadamia skin. The results (Chapter 6) show that adding plant oils and extracts significantly affected the physical, optical, mechanical, and structural properties of the composite films. Incorporation of the essential oils resulted in a reduction in moisture content and opacity while increasing values for hue angle and elongation at break of the composite films. Incorporation of the plant extracts showed increases in thickness, opacity, ΔE, Chroma, and elongation at the break, while there is a decrease in hue angle values in comparison with the control film (Gac pulp-based film), without essential oils and extracts. Among the tested extracts and essential oils, the film with lemon-myrtle essential oil added showed the most potential with good elongation at break, physical and structural properties, and low water vapour permeability. Finally, to test the potential application of these composite films, fresh ocean king prawns were used as a case study. The results (Chapter 7) demonstrate that coating with these composite films was more effective in preservation of fresh prawn quality than the control for 16 days of storage under refrigerated conditions. All coatings were effective in prevention of lipid oxidation, formation of TVB-N, bacterial growth, pH change and weight loss during 16 days of chilled storage. At the end of storage time, seaweed hydrocolloid-based film with Gac pulp and lemon-myrtle oil showed the best performance in quality indicators. The best formula of the film was sodium alginate 1.03 % w/v, Kappa-carrageenan 0.65 % (w/v), Gac pulp powder 0.4 % (w/v), glycerol 0.85 % (w/v), lemon-myrtle essential oil 0.15 % (w/v). This composite film had low increasing rates in TBARS (2.83 times), TVB-N (2.49 times), TBC (1.18 times), and had the lowest weight loss (2.56%) in comparison with the control sample of 6.66, 4.14, 1.31 times, and 4.72%, respectively. In conclusion, food by-products like Gac pulp have demonstrated potential for the improvement of seaweed hydrocolloid-based films. These films can be more effective in preservation of food if they are incorporated with plant extracts and essential oils. Future studies are recommended to further investigate the impact of other Gac pulp constituents, other food by-products and other plant extracts as well as essential oils for obtaining better seaweed hydrocolloid-based films. These composite films are also recommended to apply on other food products to widen their applications.

Dr. Tran Thi Bich Thuy
Food Safety and Quality Assurance
Nha Trang University
Nha Trang, Khanh Hoa 650000
VIETNAM

E-mail: thuyttb@ntu.edu.vn

URL: http://hdl.handle.net/1959.13/1489616