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論文概要
(Summary of the Thesis/Dissertation)

Doctoral Program in Life Science Innovation
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1. Title of the Thesis/Dissertation：

Valorization of Seaweeds for Novel Food and Non-Food Applications

2. Summary (800 – 1,000 words in English)

Indonesia is an archipelagic country, whereas the marine constitutes 75% of the total area. Hence, Indonesia is entitled with an abundance of tropical seaweed resources and the production is estimated at 482,400 ton per year. The commercial types of red and brown seaweed can be widely found in Indonesia, including Euchema cottonii, Euchema spinosum, and Gracilaria. These seaweed species have been utilized for the carrageenan and agar industry. Functional materials derived from seaweeds are also an appealing factor for their increased demand in food, pharmaceuticals, cosmetics, and other products. Seaweeds consist of various bioactive materials such as polysaccharides, pigments, proteins, minerals, phenols and bioactive peptides. These materials are well-known for their health benefit, emulsifying, stabilizing, and other properties.

The global demand for seaweeds is expected to further increase in coming years, owing to an increase in population, rapid industrial development and the community's preference for natural products. However, Indonesia still faces some problems in upgrading the value of seaweeds and their products. The utilization up to present is limited to only a few species. Almost all collected seaweeds are exported as a raw materials for industry, and small numbers of them are consumed domestically. Indonesian seaweed export is mainly dominated by edible and non-edible raw dried products (almost 60-70% of total export) which had much lower export value. Increasing the added value of Indonesian seaweed products is essential to increase its competitiveness in international market and fulfil the domestic market demands. The principal aim of this study is to develop the valuable products that could be generated from marine seaweed resources by utilizing their functional ingredients especially polysaccharides and pigments, which may present as potential candidates for future commercialization to support sustainable industry in Indonesia.

In this study, seaweed polysaccharides (alginate, ALG and carrageenan, CRG) were modified with dodecenylsuccinic anhydride (DSA) in aqueous system and their physicochemical and stabilizing properties in oil-in-water (O/W) emulsion system were evaluated (Chapter 2 and Chapter 3). The successful modification reaction was confirmed by FTIR analysis. Both CRG-DSA and ALG-DSA applied in O/W emulsion exhibited smaller droplet size over the increasing of concentration and were more stable during storage than native ones. The

results demonstrated that DSA-modified seaweed polysaccharide may serve as prospective emulsifier for application in food, pharmaceutical and other industrial fields. Next, the potential of seaweed pigment such as phycobiliproteins, chlorophylls and carotenoids from Indonesian red seaweed was investigated by carried out the extraction using different organic solvent at different temperature (Chapter 4). The results showed that phycobiliproteins were more prone to a high extraction temperature (50°C) than chlorophylls. The stability of phycoerythrin were relatively maintained at low and room temperature during storage. Natural pigments from seaweed can be proposed as an alternative to synthetic pigments in the preparation of foods, cosmetics or pharmaceuticals. Finally, a single integrated extraction process was conducted for the recovery of pigment and polysaccharides from seaweed biomass (Chapter 5). The integrated extraction model approach presented in this study allows to distinguish the potential of seaweed feedstock for multiproduct recovery in a sequential process and supports the green and sustainability conduct of seaweed processing.

It can be concluded that the findings presented in this study may provide insight and potential information for developing newly added value products from Indonesian red seaweeds. Nonetheless, this study still requires further development to commercialize, including the toxicity assessment is needed to conduct as the use of DSA and phycoerythrins in food and pharmaceutical field has yet been regulated.