Study on extraction and enzymatic inhibitor activity of bioactive compounds from brown seaweed Undaria pinnatifida stem

The Dissertation Summary

専　攻 Major	応用生命科学専攻	氏　名 Name	YIN SHIPENG
論文題目 Title	Study on extraction and enzymatic inhibitor activity of bioactive compounds from brown seaweed *Undaria pinnatifida* stem ワカメ *Undaria pinnatifida* 茎部からの生理活性化合物の抽出とその酵素阻害活性に関する研究		

Purpose: The present study was aimed to investigate the yields of various bioactive compounds in *Undaria pinnatifida* stems, one of typical unused part. Furthermore, enzymatic (α-amylase and glucoamylase) inhibitor activities of the stem extracts were examined, some of which have been little investigated in earlier studies. In Chapter 1, introduction the related literature review about seaweed sustainability, relevance of seaweeds, type of seaweed, and the experimental techniques used for extraction the bioactive compounds from the seaweed were described. The chapter 2 study was conducted to investigate the yields of various bioactive compounds in *Undaria pinnatifida* stems, such as total phenol, total flavonoid, fucoxanthin, epicatechin, and gallic acid. The chapter 3 study was optimize the supercritical carbon dioxide extraction parameters, by applying the response surface methodology. The last chapter 4 study was investigated the inhibitory effects of *Undaria pinnatifida* stem extract and its representative compound for α-amylase and glucoamylase.

Methodology: First, extraction of bioactive compounds from stems powder of lyophilized *Undaria pinnatifida* was conducted by several extraction methods were used by conventional liquid solvent extractions (water, ethanol, methanol, acetone and acetone mixed with methanol) and supercritical carbon dioxide (SC-CO_2) fluid extraction. And the contents of total phenol, total flavonoid, fucoxanthin, epicatechin, and gallic acid in the extracts were measured. Then, the response surface methodology (RMS) was used to optimize extraction conditions of bioactive components from *Undaria pinnatifida* stems for SC-CO_2 with ethanol extraction and the parameters including extraction time, pressure, temperature, sample particle size, CO_2 flow rate and entrainer,. The Box-Bhenken design was used for the optimization of extraction parameters in terms of total phenolic contents, total flavonoid contents, fucoxanthin, epicatechin, and gallic acid contents. At last, investigated the inhibitory effects of *Undaria pinnatifida* stem extract and its representative compound for α-amylase and glucoamylase, by used the enzyme kinetics.

Experiments/analysis: All mean values were analyzed by one-way analysis of variance (ANOVA). All the assays were performed in triplicate and the data was expressed as mean ± standard deviation. Statistical analysis was performed using GraphPad Prism software (version 7.0) (GraphPad Software Inc., San Diego, CA, USA), SigmaPlot software (version 12.5) (Systat Software Inc., San Jose, California, USA) or SPSS software for Windows (17.0). *p*-values were determined with corrections by

Tukey's multiple comparison and $p < 0.05$ was considered statistically significant.

Conclusion: In conclusions, it was shown that stems of *Undaria pinnatifida* was rich in bioactive substances, such as phenolic compounds, flavonoids, epicatechin, and fucoxanthin. The SC-CO_2 extraction with ethanol was a promising method to obtain these compounds from *Undaria pinnatifida* stems. Furthermore, the extracts obtained from *Undaria pinnatifida* stems had significant α-amylase and glucoamylase inhibitor activities; thereby potentially it can retard glucose liberation from starches and alleviation of postprandial hyperglycemia. As the *Undaria pinnatifida* stems are very cheap and available, they would have a potential to be used for new health supplements.