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学 位 論 文 要 旨
Dissertation Abstract

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学位論文題目：
Title of Dissertation

New processing technologies for the enhancement of antioxidant and antiallergic activities of Thai and Japanese sweet potatoes
(タイ産及び日本産さつま芋の抗酸化活性並びに抗アレルギー活性の増加を促す新加工技術)

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Phytochemicals in sweet potatoes varied on the color of flesh. The processing of colored sweet potatoes may affect the phytochemicals and their antioxidant activity. In this study, the effect of pre-gelatinization of colored sweet potato powders on extractable polyphenols and antioxidant activity was investigated. Pre-gelatinized double drum-dried powders prepared with Torperk and Purple, purple-fleshed cultivars, were superior to the conventional hot air-dried powder in terms of total phenolic content and total anthocyanin content. Formation of TBA reactive substances (4.4 nM MDA/mg linoleic acid) and DPPH free radical (SC_{50} 72.1 µg/mL) were significantly lower in Torperk cultivars after pre-gelatinization. In consequence, pre-gelatinized powders of individual sweet potato cultivars showed higher extractable polyphenol content, including anthocyanins, and greater antioxidant activity than conventional powders, probably due to the destruction of cell matrix during the pre-gelatinization process. Moreover, the antioxidant activity (TBA value) of pre-gelatinized Torperk was statistically correlated to concentration of chlorogenic acid (peak **1**) ($r = 0.93$ with $p < 0.05$) and an acylated anthocyanin (peak **3**) ($r = 0.98$ with $p < 0.01$). The releasing of the potent antioxidant substances of colored sweet potatoes during pre-gelatinization indicate the potential for promoting health and commercial application in food industry, health food market, natural food colorants, and nutraceuticals. This kind of information is useful for selection the thermal processing that suited for biological activity enhancement of target compounds in sweet potatoes.

In the following study, the importance of cooking technique in daily life was studied on antiallergic activity of Naruto Kintoki variety among sweet potatoes. The antiallergic activity of extracts of Naruto Kintoki sweet potato peel was enhanced after cooking the peel using three conventional methods. At 400 µg/mL extracts, baking at 200°C for 12 min showed the highest suppression of β-hexosaminidase release of 36.9%,

followed by microwaving at 500 W for 6 min (41.9%) and boiling at 100°C for 15 min (64.2%). Based on 7 extracts of Naruto Kintoki from liquid-liquid partition technique, significant suppression of *β*-hexosaminidase release from RBL-2H3 cells of Naruto Kintoki peel was attributed to compounds **9** ($r = 0.91$ with $p < 0.01$) and **11** ($r = 0.76$ with $p < 0.05$). It was noticed that baking and microwaving can enhanced compounds **5**, **8**, **9**, and **11** of Naruto Kintoki compare with those of raw one. UPLC/ESI-Q-TOF-MS analyses of compounds **5**, **8**, **9**, and **11** clarified the existence of two sulfates of flavonol aglycons (3, 5, 3′-trihydroxy-7, 4′-dimethoxyflavone 3-*O*-sulfate and 3, 5-dihydroxy-7, 4′-dimethoxyflavone 3-*O*-sulfate). Baking the sweet potato peel changed compounds **5** and **8** to compounds **9** and **11** with enhanced antiallergic activity: IC_{50} changed from 11.0 µg/mL (**5**) to 4.1 µg/mL (**9**) and from 12.1 µg/mL (**8**) to 4.4 µg/mL (**11**). The results indicated those four chemicals contributed to the antiallergic activity. Cooked Naruto Kintoki peels are the excellent source of flavonols and flavonol sulfates for the suppression of allergy Type I. Moreover, this is a first to quantify two flavonol sulfates in raw and cooked Naruto Kintoki peel as the potent antiallergic substances.

This study provides the information of phytochemicals, antioxidant substances and antiallergic substances, in sweet potatoes and their biological activity enhancement using thermal processing technologies. Increasing in amount of acylated anthocyanin led to a strong antioxidant activity in pre-gelatinized Torperk. Moreover, conversion of flavonol suflates to flavonol aglycon led to a great antiallergic activity in cooked Naruto Kintoki peels. The results proposed technique could be served as the useful tool for further development of antioxidants, antiallergic substances or nutraceuticals from sweet potatoes.