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Seablite (*Suaeda maritima*) Product for Cooking, Samut Songkram Province, Thailand

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Abstract

Seablite (*Suaeda maritima*) is a salt marsh plant growing in mangrove forest. Local people in Samut Songkram, Thailand use seablite for different types of cooking such as traditional seablite salad, seablite curry with crabs, or scalded seablite with chili paste. The objectives of this research were: 1) to develop appropriate commercial seablite products of Samut Songkram province; 2) to evaluate the nutritional values of the seablite products; and 3) to investigate biological characteristics of seablite on health promotion. The result showed that: 1) for food processing, seablite must be harvested in rainy season. Before cooking process, seablite should be scalded in boiled water added with sugar. However, dried seablite is the most suitable product which can be used to make vegetable salad; 2) Based on the nutrition, the developed seablite products contained similar nutritional values to that of traditional fresh cooking except the developed products contained higher carbohydrate (4.85% vs. 4.59% w/w, respectively) with less water content (91.22% vs. 91.98% w/w) and lower amount of vitamin A (7982 vs. 9632 µg/100g) and vitamin E (2.80 vs. 3.51 mg/100g); 3) Seablite contains antioxidants especially the seablite extracted with water and no poisonous effect to normal cells. The results of this study can be used as preliminary data for further developing of seablite in commercial scale. In addition, seablite can be applied in cooking recipes as well as raw materials with high nutritional quality.

Keywords

Seablite; *Suaeda maritime*; Food Processing; Nutritional Values; Biological Activities

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1. Introduction

Seablite (*Suaeda maritima*) is a salt marsh plant growing in mangrove forest. Its young leaves can be used as fresh vegetable or cooked. The cooked seablite is quite salty, so it should be cooked with other types of vegetable to reduce salty taste [1]. Local people in Samut Songkram province use seablite for different types of cooking such as traditional seablite salad, seablite curry with crabs, or scalded seablite with chili paste. The edible part is the young leaves which should be scalded for about 10 - 15 minutes and then knocked with cold water to make them crispier. There have been very few recipes of seablite. This shows that seablite is not as popular as other type of vegetable, e.g. white popinac, ivy gourd, etc. Seablite can grow naturally, so it is the low cost vegetable with high nutritional value. There should be a promotion of seablite as ready-made products for the convenience of the consumers in other regions. Moreover, it can be a new source of income of the people in the community.

In the South of India, seablite is pickled in vinegar or used for cooking as well as domestic animal food [2] [3]. Sudjaroen studied the nutritional values of seablite reporting that the amounts in seablite were of water, protein (3.46% ± 0.04% w/w), fat (0.15% ± 0.01% w/w), carbohydrate (2.18% ± 0.02% w/w), fibers (6.21% ± 0.01% w/w), calcium (2471.37 ± 0.054 mg/100g), beta-carotene (3545.16 ± 0.093 mg/100g) [4]. It can be seen that seablite is an interesting vegetable with high nutritional values. It has been studied that the seablite leaves can be used to prevent hepatitis [3] [5] and for antivirus. Such biological activity is related to triterpenoids and sterols.

The objectives of this study were: 1) to develop appropriate commercial seablite products of Samut Songkram province; 2) to evaluate the nutritional values of the seablite products; and 3) to investigate biological characteristics of seablite on health promotion. The products can also be used to show the community uniqueness as well.

2. Materials and Methods

2.1. Appropriate Type of Seablite Product

The production was done in April to September 2012 which started by picking young leaves at average 3 - 5 cm. from the top. They were washed and scalded for cooking.

2.1.1. Different Types of Scald

1) Boiling Scald

The temperature of boiling water was about 90 - 100 deg C. Soak the seablite in this hot water for about 5 minutes at the ratio of seablite and water = 2:1. After that, the seablite was then soaked in cool water with the same ratio.

2) Soak Seablite in Vinegar before Scalding

The seablite was soaked in 0.5% diluted vinegar at the same ratio for 30 minutes. After that it was scalded in boiling water for 5 minutes and finally, the seablite was soaked in cool water.

3) Scald Seablite in Boiling Water Added with Sugar

The seablite was scalded in 0.5% sugar boiling water at the same ratio for 5 minutes. After that it was soaked in cool water.

After each type of scalding, the seablite was pressed to dry before cooking. The product was tested by 50 volunteers to rate their satisfaction of the product from 1 to 7 scaling.

2.1.2. Processing Process

1) Dried seablite was done by blowing hot air in the oven at 80 deg C for 6 - 8 hours until it was completely dried.

Figure 1. Hot air blower (abc electro, Kirchheim-Teck, Germany)

2) Seablite chunk was done by several stages as follows:

Mix 2% of tapioca flour in water (or 2 gm/100ml of water) and then cook by stirring until it was clear and sticky like glue, then it was mixed with the scalded seablite. Put the mixture in the mold before drying with hot air. Different type of seablite chunk was made by mixing the scalded seablite with 2-spoons of instant rice porridge before putting in the mold and drying. Another type of seablite chunk was done by mixing it with crispy rice chips before putting in the mold and drying.

Figure 1. Dried seablite (left) and seablite after cooking (right).

2.1.3. Use Seablite in General Thai Recipes

The comparison between the dried seablite and the seablite chunk (**Figure 1**) after cooking by using the 2 types of seablite products to make clear soup by adding 12 gm of dried seablite into the stock, add with 2 tea spoons of soya sauce. The researcher used dried seablite to cook in general Thai food such as fried fish cake, sour and spicy soup, and wing bean salad. Then, taste for their satisfaction from 50 volunteers.

2.2. The Evaluation of the Nutritional Values of Seablite Products

2.2.1. Sample Preparation

1) Traditional cooking

100 gm of seablite was boiled in 250 ml water for 15 - 30 minutes. After that, it was soaked in cool water and squeeze to drain out the salty taste.

2) The developed cooking method

100 gm of seablite was boiled in 250 ml water added with 1 table spoon of sugar for 5 minutes. After that, it was soaked in cool water for 2 times and squeeze to drain out the salty taste.

2.2.2. Evaluate the Nutritional Value of the Seablite

1) Water quantity in the sample was done by AOAC 925.45, 2005 [6].

2) Measure the crude protein quantity by AOAC 992.23, 2005 [6].

3) Measure the crude fat quantity by AOAC 989.05, 2005 [6].

4) Measure the fiber (Insoluble dietary fiber) quantity by AOAC 978.10, 2005 [6].

5) Measure ash content quantity by AOAC 938.08, 2005 [6].

6) The measured carbohydrate quantity was done by calculating the fresh seablite weight and water quantity added with crude protein, total fibers, and ash content.

7) The whole energy measurement was done by getting the calculated energy value from carbohydrate, fat, and protein above.

8) Measure vitamin A by High Performance Liquid Chromatography (HPLC) applied from the method of Munzuroglu, *et al.* [7].

9) Measure vitamin A by HPLC applied from the method of Qian, *et al.* [8].

10) Measure vitamin A by HPLC applied from the method of Sanchez-Moreno, *et al.* [9].

2.3. Test of Biological Activities

The sample must be dried by hot air and ground. Bring 121.47 gm of ground seablite for continuous extraction, then, extract with ethanol and water using Soxhlet apparatus. Finally, get the solvent evaporated through rotary evaporation apparatus under vacuum.

Total phenolic content: measurement using Folin-Ciocalteu reagent [10] was done by comparing it with standard solvent, *i.e.* gallic acid at 1 - 0.125 mg/ml concentration; then, calculating total phenolic content of gallic acid in mg/gm of the extracts.

2.3.1. Antioxidant Activity Measurement

1) DPPH radical scavenging assay to measure the decreasing light absorbance of DPPH radical [11] using

negative control by DPPH radical (6×10^{-5} M), promptly measure at nm and positive control using vitamin C.

2) ABTS cation radical scavenging assay similar to the 1st method but using 2,2-azinobis (3-ethyl-benzothiazoline-6-sulfonic acid) (ABTS) radical instead [12] and also using Trolox (soluble vitamin E) as standard substance to create standard graph (0.5 - 5.0 mg/ml concentration). The anti oxidant activity of the seablite would be shown in Trolox equivalent antioxidant capacity (TEAC)/gm of the seablite extracts.

2.3.2. Cytotoxic Activity Screening Test

Test cytotoxic activity on primate cell line (Vero cell) using green fluorescent protein (GFP)-based assay [13] by ellipticine as a positive control and 0.5% DMSO as a negative control.

3. Results

3.1. Seablite for Cooking

Rainy season (July-October in Thailand) is the most appropriate time for picking seablite for processing because of less salty taste and a less times of scalding. The best scalding method was to use boiling water added with sugar getting the best seablite cooked product with more freshness, crispier, less salty, and less stinky (**Table 1**).

When using dried seablite and seablite chunk processed by this scalding method for 3 types of cooking, *i.e.* fried, boiled, and traditional salad, the researchers got the best cooking food characteristics. The researchers chose 3 menus, *i.e.* fried fish cake, sour and spicy soup, and wing bean traditional salad to compare using seablite as raw material in all menus with using yardlong bean, Acacia pennata, and wing bean as raw materials in each menu respectively. The researchers found that in wing bean traditional salad, seablite gave the similar taste as using wing bean as raw material but crispier (**Table 2**).

3.2. Nutritional Value of Seablite Dish

It was found that there was no difference between the 2 cooking methods, *i.e.* the traditional method and the developed method. In the developed method, there was less water content and higher carbohydrate. This might be because in the developed method, sugar was added in the boiling water with more squeezing. However, it still gave the same amount of calories but a little bit lower in vitamin A and E as in **Table 3**.

3.3. Biological Properties of Seablite

It was found that seablite extracted with water (SW) contained crude extract more than the seablite extracted with ethanol (SE) at yield = 19.65% and 9.34% respectively which was related with the total phenolic content of SW which was higher than that of SE at 14.47 and 6.93 mg GAE/g extract. The test of biological property was done on SW and SE to find DPPH revealing that SW and SE could stop DPPH at 20.60 and 14.69 μmol TEAC/g extract respectively (**Table 4**). The results of the study supported the previous study about ABTS antioxidant that SW could stop ABTS better than SE at 61.5 and 44.8 μmol TEAC/g extract respectively. This can be concluded that SW contained higher antioxidant than that of SE due to higher total phenolic content. The results of

Table 1. Seablite preparation and characteristics.

Preparation method	Color	Salty taste	Crispy	Total agreement
Boil in boiling water	110	75	60	82
Soak in vinegar before boiling	325	220	320	288
Boil in boiling water added with sugar	310	305	291	302

Table 2. The taste comparison of normal wing bean salad and seablite wing bean salad.

Preparation	Color	Salty taste	Crispy	Total agreement
Seablite wing bean salad	326	280	302	303
Normal wing bean salad	330	295	274	300

Table 3. Nutritional value of seablite dish prepared by 2 methods.

	Developed method**	Traditional method*
Water (%w/w)	91.22	91.98
Crude protein (%w/w)	1.71	1.69
Crude fat (%w/w)	0.63	0.64
Total ash (%w/w)	1.59	1.10
Dietary fiber (%w/w)	4.10	4.06
Carbohydrate (%w/w)	4.85	4.59
Total calories (Kcal/100g)	4.59	4.85
Vitamin A** (µg/100g)	7982	9632
Vitamin E (mg/100g)	2.80	3.51

*The average of 3 types of seablite; **The analysis and calculation from beta-carotene.

Table 4. Total phenolic content and free radical scavenging activities of water and methanolic extracts from seablite*.

Extract	Phenolic content	$ABTS^+$ scavenging	DPPH scavenging
	GAE[1]	TEAC[2]	TEAC[2]
SW	14.47 ± 2.85	61.48 ± 8.74	14.69 ± 0.68
SE	6.93 ± 2.27	44.77 ± 4.01	20.60 ± 0.71

*Data are expressed as means ± S.D., n = 3; [1]GAE (mg/g DW), Gallic acid equivalent (mg of gallic acid/g of dried weight of extract); [2]TEAC (µmol/g DW); Trolox equivalent antioxidant capacity (mg of trolox/g dried weight of the extract).

the study also supported the work by Patra, *et al.* [2]. The test about the cytotoxic activity on cell showed that SW and SE yielded no toxic on Vero cell at the concentration of 50 µg/ml (**Table 5**). Ravikumar, *et al.* [5] found that seablite extracts had hepatoprotective activity with antioxidant.

4. Discussion

Dried seablite has crispier texture than normal vegetable when cooking as can be seen in seablite wing bean salad. It is suggested that dried seablite is suitable for making Thai salad while other types of cooking, seablite can give similar property to other vegetable. The preparation of seablite with the developed method revealed taste and nutritional values similar to those of the traditional method. However, some volunteers mentioned that the developed method to prepare seablite yielded better taste with less salty and less stinky. The readymade seablite is easier for cooking and for transportation. Moreover, seablite contains antioxidant and might contain some substances that can kill microorganism as well. It is suggested that the seablite should be harvested in rainy season and soaked in boiling water added with sugar. Dried seablite is the most suitable type for cooking Thai salad. The nutritional values of seablite prepared by the developed method are not different from those of traditional method. Seablite contains antioxidant substances and non toxic. Polyphenolic compounds may the major bioactive components in seablite, which are responsible for antioxidation and antiproliferation. Natural antioxidants have been proved to inhibit tumor growth selectively, because of different redox status between normal cells and cancer cell [14].

5. Conclusion

Dried seablite is suitable for Thai cooking style and gives similar property to other vegetable. The nutritional values of seablite prepared by the developed method are not different from those of traditional method and may contain antioxidant substances with non toxic property.

Table 5. Cytotoxic effect of seablite extracts to Vero cells in each concentration[a,b].

Extract	Final conc. (µg/ml)	% Growth	Cytotoxicity
SW	50.0	75.60	Non-cytotoxic
	25.0	85.11	Non-cytotoxic
	12.5	92.24	Non-cytotoxic
	6.25	97.16	Non-cytotoxic
	3.125	98.11	Non-cytotoxic
	1.5625	94.69	Non-cytotoxic
	0.7813	92.31	Non-cytotoxic
SE	50.0	90.13	Non-cytotoxic
	25.0	93.79	Non-cytotoxic
	12.5	94.04	Non-cytotoxic
	6.25	96.82	Non-cytotoxic
	3.125	100.00	Non-cytotoxic
	1.5625	100.00	Non-cytotoxic
	0.7813	92.82	Non-cytotoxic

[a]Positive control: Ellipticine 0.603 µg/ml; [b]Negative control: 0.5% DMSO.

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