PAPER • OPEN ACCESS

The Effect of Blanching Toward Chemical Properties and Sensory Quality of Brown Seaweed *Sargassum* Sp. Tea

To cite this article: E Sinurat *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **292** 012001

The Effect of Blanching Toward Chemical Properties and Sensory Quality of Brown Seaweed *Sargassum* Sp. Tea

E Sinurat, J Basmal, T D Suryaningrum
Research Center for Marine and Fisheries Product and Biotechnology, Jakarta, Indonesia

Corresponding email: ellya_sinurat@yahoo.com

Abstract. Brown seaweed has been known to be a natural source for bioactive compounds. Brown seaweed has a distinctive aroma, namely fishy, sometimes a problem for preparations in the form of simplicia. In this study, a total of 3 different treatments were performed on Sargassum sp at 1, 3 and 5 minutes of blanching compared without blanching. Sensory evaluation of tea samples was conducted to establish preference rating of tea for flavor, taste, color and overall acceptability using 17 panelists. The results of water content of seaweed tea meet up requirement of herbal tea and free aflatoxin. The result of sensory product of seaweed tea blanching for 1 minute is preferred by panelists in terms of flavor compared to other products including commercial products. The condition also keeps the content of active compounds in it more retained in the product. Overall panelist results prefer seaweed tea product blanching for 3 minutes.

Keywords: sensory evaluation, blanching, brown seaweed, *Sargassum* sp., tea

1. Introduction

Indonesia has been identified as a main aquatic plant producer worldwide. According to the Food and Agricultural Organization of the United Nations (FAO, 2017), Indonesia produced 9.298.474 tonnes of aquatic plants (34,6%), making Indonesia the 2nd largest producer of aquatic plants worldwide behind China produced 1.340.218 (50,1%). Seaweed is main commodities export in Indonesia. In year 2017 worth production seaweed from Indonesia 205 million USD (6,02% /year) (KKP, 2018).

Seaweed also called as algae is taxonomically classified under four groups namely: red algae (Rhodophyta), brown algae (Phaeophyta), green algae (Chlorophyta), and blue-green algae (Cyanophyta). Macroalgae, which include above three groups of seaweed other than blue-green algae, have a long history of utilization as direct or processed food across the globe (Niranjan and Kim, 2011). Seaweed is consumed habitually, in many countries in South-East Asia. In the West, seaweed isolates (e.g. alginate from brown algae and agar or carrageenan from red algae) are typically used industrially. Low consumer awareness regarding potential health benefits and a lack of previous experience of seaweed challenges its use in the daily diet (Brownlee et al, 2012). The rich mineral and trace element content of seaweed compared to terrestrial plant foods. Seaweed is a rich source of nutrients included in Asians traditional cuisine and is being extensively explored for its other merits as a food. Apart from its proven nutritional properties, bioactive molecules found in seaweeds have attracted the interest of health-conscious societies, as seaweed is regarded as a remarkable marine medicinal food (Niranjan and Kim, 2011).

Brown seaweed has been known to be a natural source for bioactive compounds compared to red and green seaweeds (Prabhasankar et al. 2009). In general, brown seaweed contains fucoxanthin as its natural pigment, which gives a distinct greenish-brown colour, from which it gets its name (Wu et al. 2014). The other natural pigment such as green *pigments* (chlorophyll a and c) and xanthophylls. It has been reported that brown seaweed produces various active components, including unique secondary metabolites, such as phlorotannins, which exhibit specific biological activities. Other components found in brown seaweeds such as polyphenols and flavonoids were also reported to have strong anti-oxidative activities (Seng et al., 2017).

The chemical composition of tea varies and largely depends on climatic conditions, horticultural practices, soil, growth altitude, plucking season, sorting, grading, processing, extraction, storage and drying (Le Gall et al., 2004). Variability in composition is an important factor that dictates the taste, flavor and health benefits of a specific type of tea. There is a direct association between tea quality and the content of tea amino acids, caffeine and polyphenols in tea leaf (Cheng, 1983; Khalid et al., 2011).

Therefore, it was prudent to have these results translated into a functional product, i.e., seaweed tea. Seaweed tea came into consideration as this product is a minimally processed product, where there will be less effective towards the quality and bioactivity of fucoidan. At the same time, the hot water used to brew the seaweed tea is similar to the extraction procedure of fucoidan and alginate performed in the laboratory. Therefore, consumers will be able to enjoy the health benefits of fucoidan from seaweed tea.

It is well known that blanching is an important processing step during commercial drying of vegetables and fruits (Adedeji et al, 2008). The use of hot-water blanching (HWB) as a pretreatment is usually carried out to inactivate enzymes and remove air from intercellular space of fruits and vegetables in order to prevent off color and flavor changes during drying (Severini et al, 2003; Hai et al., 2018). Some studies revealed that blanching pretreatment can enhance mass transport in the tissue and affect the drying behavior of fruits and vegetables (Falade & Soladame). Seaweed is identical to the fishy flavor so that it becomes one of the obstacles in receiving the product for consumption, in this study a blanching process with hot water was carried out to determine the quality of seaweed tea on sensory quality.

2. Materials And Method

2.1. Materials

Sargassum sp from Krui, West Lampung, was harvested in April 2018. Commercial tea was supplied Yogyakarta. Empty tea bags were purchased from PT. LHI, Bogor). All other chemicals were of analytical grade and purchased from Sigma (UK) unless otherwise stated.

2.2. Method

Method of Seaweed Tea Produced

Sargassum sp samples were washed to remove salt and impurities and blanching varied time 1,3, and 5 minutes as control without blanching. All of samples dried with sangray for 15-20 minutes. They were then cut into small pieces with a knife mill before being ground into powder using a high-speed grinder and shifter to size 20 mesh. The samples were kept at 4°C until use.

Methode of Brew Tea From *Sargassum sp*

Powdered form of Sargassum sp was weighed into empty tea bags, at 2 g per tea bag, and the tea bags folded to close them. These tea bags were then boiled (brewed) in 100 mL distilled water for 6 minutes). Distilled water was added from time to time to ensure the boiling water was at the 100 mL mark. The tea bags were then removed from the brews after the allocated time, and the brews were filled up to 100 mL.

Water content analysis using gravimetry. The moisture content in tea samples was determined by using hot air oven at temperature of 105°C by following the Anon., (2000) method No.925.19. Analysis of seaweed heavy metals using AAS. A porcelain crucible with a capacity of 50ml was oven dried for approximately 30 minutes at 1050C. The crucible was then cooled in a desiccator and weighed. Approximately 2 g of seaweed powder of each of the 2 seaweed species was weighed accurately into the crucible and dried in an oven at 105 °C overnight (16 hours). Then, the crucible and contents were cooled in a desiccator, weighed and then charred slowly under a watch glass on a hotplate for about one and a half hours. The crucible and contents were then placed in a cool muffle furnace <100 °C) and the temperature raised slowly (about 100 °Cper hour) to 420 ± 5 °C. After muffling, the crucible and contents were cooled and weighed to determine the weight of crude ash. The crucible was covered with a watch glass and the ash was moistened with 1-2 drops of distilled water. 3 ml of 5 M hydrochloric acid was pipetted under the lip of the watch glass with care to avoid any loss by effervescence. The covered crucible was then warmed on a boiling water bath for 30 minutes. The cover was rinsed and removed, 0.2 ml 15 M nitric acid added and the solution evaporated to dryness. The crucible was then placed in an oven at 1050C for 1 hour to complete the dehydration. The dried salts were moistened with 2 ml 5 M HCl. 10 ml of distilled water was added and warmed on a boiling water bath until all salts were in solution (about 10 minutes). The solution was filtered through a Whatman No. 44 filter paper into a 250 ml volumetric flask and the insoluble residue was transferred using a rubber tipped glass rod. The filter paper was rinsed with warm 0.02 N HCl followed by distilled water. The filter paper was discarded and the solution made to volume with distilled water. The absorbance was then determined using a computerized Hitachi Model 170-10 type atomic absorption spectrophotometer. Blank solutions were prepared similarly. The methodology was tested using standard solutions for each of the three heavy metals (Hg, Cd and Pb).

Aflatoxin Test using UPLCMSMS

The working mix standard solution containing AFs (400 ng/mL in methanol) was obtained by the further dilution of stock individual solutions with methanol and stored at -20 °C. Calibration solution from 1-20 ng/mL was prepared in mixture methanol/water (50/50, V/V) containing 0.1%HCOOH. The samples were homogenized and prepared using standard methodology in accordance with the Vicam Instructions for use for AOZTM HPLC Instruction Manual. Twenty g of ground sample was blended with 100 mL mixture of methanol: water at a ratio of 70:30 for 2-3 min. Pour extract was filtrated trough filter paper (Whatman No 41), and 10 ml of the filtrate was diluted with 40 mL of PBS before cleanup using AOZTM HPLC affinity column. If the diluted solution was cloudy, the diluted extract was filtered through a glass microfiber filter into a clean vessel. Then the column was washed by passing 10 mL PBS buffer, and shortly dried by vacuum. AFs were eluted with 6 mL methanol, evaporated to dryness with nitrogen and reconstitute sample in 1 mL of methanol/vater (1/1, V/V). The method was validated according to SANCO/12571/2013. The recovery was checked, using MMS, by enriching of a blank sample with the mixture of AFs, to get the final mass concentration of 1.0 and 5.0 μg/kg (intfive replicates).

Sensory Evaluation of Tea Samples

Sensory evaluation of tea samples was conducted to establish preference rating of tea for flavor, taste, color and overall acceptability. Tea samples (2g) were infused with 100ml freshly boiled water for six minutes and then the liquid was poured into 100ml tea tasting porcelain bowl for quality assessment. A trained panel of six judges was employed for sensory evaluation of tea samples. Before start of the evaluation a training session of 15 minutes was conducted with the panelists. Afterwards, one sample at a time was offered to each member. The sensory testing was made in the panel room with controlled temperature and relative humidity. The panel room was completely free of food/chemical odors, unnecessary sound and mixing of daylight. Judges were provided with prescribed questionnaire to record their sensory observations. The information contained on the sensory performa was indicated as 5 = Like; 4 = Like slightly; 3 = Dislike moderately; 1 = Dislike (Larmond, 1977).

Statistical analysis: Data obtained from each parameter was analyzed statistically by Analysis of variance and Duncan's Multiple range test ($p<0.05$) by using SPSS 17.0 software package (LEAD Technologies Inc, Chicago, USA) as described by Steel et al., (1997).

3. Results and Discussion

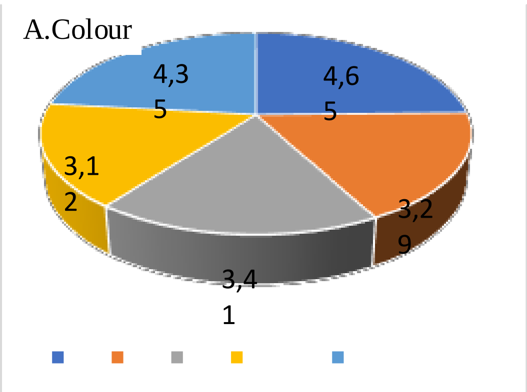
3.1. Chemical properties

The results of the test of heavy metals for seaweed used were obtained that the raw material s of Sargassum sp seaweed used was free of heavy metals Pb and Hg and also free of aflatoxin. Tea water content of A1 6.59%; A3 7.59%; A5, Control 2.63% and tea commercial 5.67%. All of products are below the threshold according to the standard herbal tea which is a maximum of 8%.

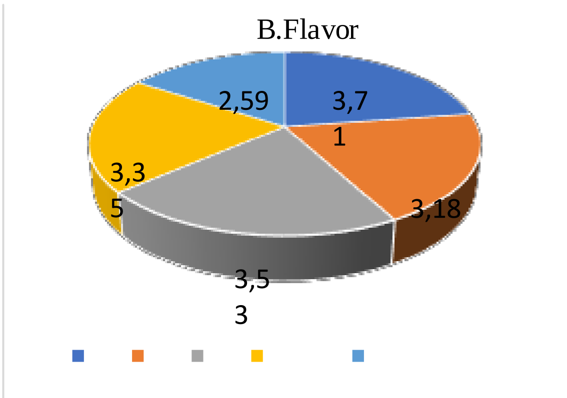
3.2. Sensory Properties

3.2.1 Color

The results regarding color scores of tea samples are depicted in Fig. 1A which revealed significant variation ($p<0.05$) among different tea sample. The average color scores of tea samples ranged between 3 and 4. The highest color scores 5 were assigned to sample commercial tea and while the lowest color scores 3 were assigned to sample control (without blanching). The color scores assigned to blanching 1-minute samples, 3-minute samples and 5-minute samples ranged from 4-5, which revealed that highest color scores were found in A1.



A1 A5 A3 Control
Commercial Tea



A1 A5 A3 Control
Commercial Tea

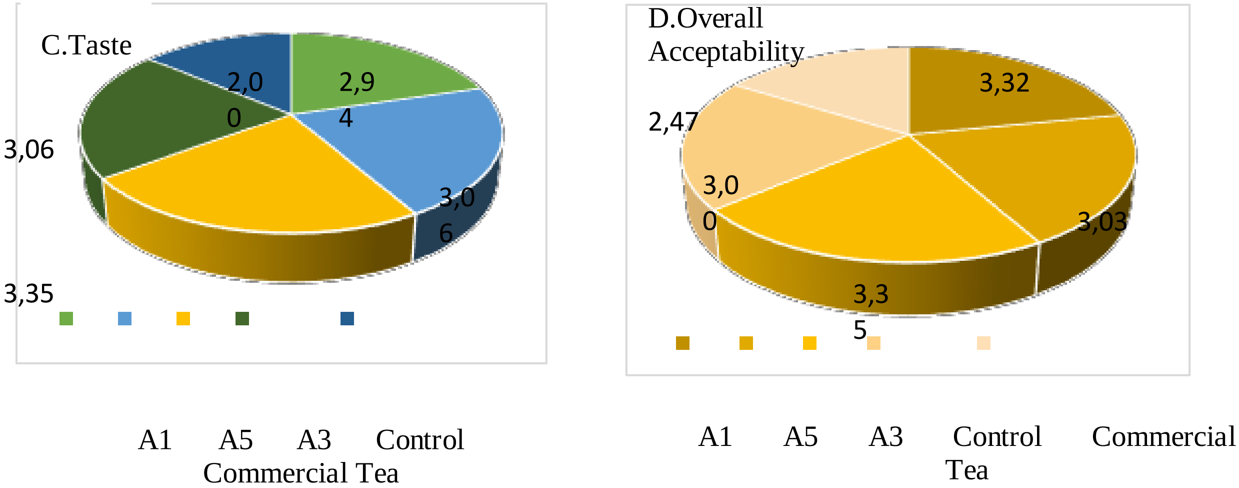


Fig. 1. Sensory Evaluation of Seaweed Tea Samples. A Indicates color of tea samples, B indicates flavor of tea samples, C corresponds towards taste and D indicates overall acceptability of tea samples judged.

3.2.2 Flavor

The results pertaining to flavor scores of different tea samples are depicted in Fig. 1B which indicated significant difference ($p<0.05$) among different tea samples. The average flavor scores of tea samples ranged from 2-5, with highest flavor scores (3,71) were assigned to sample A1 while lowest flavor scores (2,59) were assigned to sample commercial tea. Blanching 1-minute flavor scores range
4-5 indicating highest flavor scores of A1 tea. The highest flavor scores in A1 may be reduced fishy.

3.2.3 Taste

The results regarding scores assigned to taste of commercial tea samples are presented in Fig. 1C which revealed significant difference ($p<0.05$) among different tea samples. The average taste scores of tea samples ranged from 1-5 with highest taste scores (3.35) assigned to sample A3 while lowest taste scores (2) were observed in commercial tea. In A3 samples taste scores ranged from 3-5 in comparison with commercial tea samples which ranged from 1-3 scores, it revealed that highest taste was found in A3 and A1. The scores assigned to taste ranged from 3-5 for both A3 and A1 samples indicating better taste in both types of tea. Polyfenol is regarded as important parameter for commercial tea sensory evaluation having significant contribution in the development of taste. The quality of tea is strongly associated with the amount of polyphenol content for the formation of flavored precipitates during infusion process.

3.2.4 Overall acceptability:

The results regarding scores assigned for overall acceptability of tea samples are depicted in Fig. 1D which revealed significant variation ($p<0.05$) among different tea samples. The overall acceptability scores of seaweed tea samples ranged from 2-5 with maximum scores 3,35assigned A3. In both A1 and A3, almost similar overall acceptability scores ranged between 3-5 scores. Quality evaluation of commercial tea depends up on number of factors such as polyphenol, amino acids, and tannin. Tea samples with high amount of both chemical and volatile compounds have positive association with respect to sensory attributes of tea including overall acceptability. The results of present study are in line with previous results of Owuor & Obanda (2001) who observed better sensory quality of tea samples having high quality of raw material with maximum amounts of chemical and volatile components used during processing.

The blanching effect reduces flavor fish in seaweed also maybe to reduce its active compound. Because active compound like as alginate and fucoidan can be dissolved in hot water. The next research should be focued on effect blanching towards active compound content in seaweed tea. Based on the results of the sensory test there was not significant the panelists on the quality of seaweed tea. This concerns because the seawater content is all prepared according to SNI and the value is almost the same.

4. Conclusion

Pre-treatment of hot water blanching affects the quality of seaweed tea. Blanching time affects the panelists' acceptance of flavor and taste. Blanching for 1 minute is preferably flavor while in terms of taste and acceptance of 3 minutes blanching, the panelist is preferred.

References

1. FAO. Food and Agriculture Organization of the United Nations. Seaweed production countries. 2017. From Fisheries and aquaculture software.
2. KKP,- Dirjen PDSP-KP 2018. *https://kkp.go.id/wp.../2018/.../KKP-Dirjen-PDSPKP-FMB-Kominfo-19-Januari-2018*
3. Niranjan Rajapakse and Se-Kwon Kim. Advances in Food and Nutrition Research, 2011. Volume 64.Chapter 2 Nutritional And Digestive Health Benefits Of Seaweed. Elsevier Inc
4. Seng Joe Lim, Wan Aida Wan Mustapha* & Mohamad Yusof Maskat. Seaweed Tea: Fucoidan-Rich Functional Food Product Development from Malaysian Brown Seaweed, Sargassum binderi. 2017. Sains Malaysiana 46(9): 1573–1579 http://dx.doi.org/10.17576/jsm-2017-4609-28
5. Le Gall, G., I.J. Colquhoun and M. Defernez. Metabolite profiling using 1H NMR spectroscopy for quality assessment of green tea, Camellia sinensis L. 2004. J. Agric. Food Chem., 52(4): 692-700.
6. Cheng, 1983; Cheng, Q.K. 1983. Ratio of polyphenols to amino acids in tea biochemical indicator for selection of tea varieties. China Tea, 38 (1): 122-136.
7. Khalid et al., 2011). Khalid, N., S.A. Fawad and I. Ahmed. 2011. Antimicrobial activity, phytochemical profile and trace mineral of black mulberry (Morus nigra L.) fresh juice. Pak. J. Bot., 43: 91-96.
8. Adedeji,A.A, T. K. Gachovska, M. O. Ngadi, and G. S. V. Raghavan. 2008. “Effect of pretreatments on drying characteristics of okra,”DryingTechnology,vol.26,no.10,pp.1251–1256.
9. Severini C, A. Baiano, T. De Pilli, R. Romaniello, and A. Derossi. 2003.“Prevention of enzymatic browning in sliced potatoes by blanching in boiling saline solutions,”LWT-Food Science and Technology,vol.36,no.7,pp.657–665.
10. Hai-ou Wang, Qing-quan Fu, Shou-jiang Chen, Zhi-chao Hu, and Huan-xiong Xie. 2018. Effect of Hot-Water Blanching Pretreatment on Drying Characteristics and Product Qualities for the Novel Integrated Freeze-Drying of Apple Slices. Hindawi Journal of Food Quality. Volume 2018, Article ID 1347513, 12 pages. https://doi.org/10.1155/2018/1347513

11. Anonymous. 2000. Official Methods of Analysis. 17th ed: Association of Analytical Chemists, Arlington, Virginia. USA.
12. Brownlee, A. C.Fairclough, A. C. Hall, and J. R. Paxman. The potential health benefits of seaweed and seaweed extract. 2012. Sheffield Hallam University Research Archive. P:1-18.
13. Muhammad Adnan, Asif Ahmad, Anwaar Ahmed, Nauman Khalid, Imran Hayat And Iftikhar Ahmed.Chemical Composition And Sensory Evaluation Of Tea (Camellia Sinensis) Commercialized In Pakistan. 2013. Pak. J. Bot., 45(3): 901-907.
14. Falade K.O and Solademi O.J. 2010. "Modelling of air drying of fresh and blanched sweet potato slices,"International Journal of Food Science&Technology,vol.45,no.2,pp.278–288.
15. Larmond, 1977. Larmond, E. 1977. Laboratory methods for sensory evaluation of food. Res Branch, Canada Deptt. of Agric. Canada.
16. Steel et al., (1997). Steel, R.G.C., J.M. Torrie and D.A. Dickey. 1997. Principles and Procedures of Statistics. A Biometrical Approach. 3rd ed. McGraw Hill Book Co. NewYork, USA.
17. SANCO/12571/2013, Method validation and quality control procedures for pesticide residues analysis in food and feed.
18. Owuor & Obanda (2001). Owuor, P.O. and M. Obanda. 2001. Comparative responses in plain black tea quality parameters of different tea clones to fermentation temperature and duration. Food Chem.,72(3): 319-327.
19. Prabhasankar, P., Ganesan, P., Bhaskar, N., Hirose, A.,Stephen, N. and Gowda, L.R. Edible Japanese sea-weed, wakame (Undaria pinnatifida) as an ingredient in pasta: Chemical, functional and structural evaluation. 2009. Food Chem.,115, 501–508. *(17) (PDF) Chemical Composition of Seaweeds*. Available from: https://www.researchgate.net/publication/277698824_Chemical_Composition_of_Seaweeds [accessed Oct 08 2018].