Short Communication

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Influence of stabilizers on chlorophyll and total phenolic content of *Pandanus Amaryllifolius* leaf extract

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Abstract

The addition of zinc chloride ($ZnCl_2$) and pectin to pandan (*Pandanus Amaryllifolius*) leaf extract in response to total chlorophyll and total phenolic content (TPC) changes at storage temperatures of 10 °C, 25 °C, 40 °C , and 50 °C, and 60 °C for 1, 2, 3, 4, and 5 hr were investigated. Total chlorophyll of pandan extract with the addition of $ZnCl_2$ did not show a significant decrease at all storage temperatures. This implied that $ZnCl_2$ is a good stabilizer to be incorporated into pandan extract when involving heat. TPC of pandan extract with or without stabilizers did not show an obvious trend or changes at all levels of storage temperatures and durations. Pectin has been revealed not a good stabilizer to stabilize both total chlorophyll and TPC for pandan extract.

Introduction

Chlorophylls are distinctive green pigments found in a large variety of plants, algae, and cyanobacteria [1]. Chlorophyll is a key element for the green plant to produce their food by a process named photosynthesis through transforming light energy absorbed from the sun into chemical energy [2]. In recent years, chlorophyll has been extracted from plants and it has been discovered having numerous possible health benefits to humans. The potential of chlorophyll as a cancer preventative agent has been reviewed [3]. A recent study revealed that chlorophyll and carotenoids extracted from lactura green algae which loaded into chitosan as potential targeted therapy and bioimaging agents for breast carcinoma [4]. Pandan (*Pandanus Amaryllifolius*) is an easily grown and abundantly available tropical plant. The greenish pandan extract, which contains chlorophyll and other valuable bioactive compounds, is obtained by blending the leaf with water. It is a great source of chlorophyll which is widely used as flavour or green colorant to many local desserts and culinary. However, most of the food industries may involve heating when producing the desired food product. Chlorophyll not only degrades naturally during leaf senescence and fruit ripening [2], it is also a thermolabile substance. $ZnCl_2$ has been used as a stabilizer in extracting chlorophyll from spinach [5] and suji leaf [6], yet its corporation with pandan extract has not been reported. Therefore, this study aimed to investigate the influence of stabilizers (zinc chloride and pectin) on chlorophyll and total phenolic content (TPC) of pandan leaf extract at various storage temperatures and durations.

Research Methodology

Pandan leaves were purchased from Pasar Borong at Seri Kembangan. A hundred grams of cut leaves were blended with 100 mL of water for 30 seconds. The blended pandan is filtered with a 1-mm mesh kitchen sieve. The filtered pandan is poured into a bottle and put into the fridge for 12 hours until a layer of pandan sediment (extract) appeared at the bottom of the bottle. 10-mL of the pandan extract was transferred and mixed with 10-mL solutions of 300 mg/L of $ZnCl_2$ and 1 g/mL of pectin, respectively. Then, the mixture was subjected to storage at temperatures of 10 °C, 25 °C, 40 °C , and 50 °C, and 60 °C for 1, 2, 3, 4, and 5 hours. Total chlorophyll and TPC of the mixture from each storage condition were determined. Total chlorophyll (mg/mL) was calculated by summation of Chlorophyll a and Chlorophyll b. Chlorophyll a and chlorophyll b were measured at wavelengths of 663 nm and 645 nm and calculated using the following equations [4]:

Chlorophyll a [milligrams/milliliter (mg/mL)] = 12.7 A_{663} - 2.69 A_{645}

Chlorophyll b (mg/mL) = 22.9 A_{645} - 4.68 A_{663}

TPC pandan extract was determined using the Folin-Ciocalteu method and expressed in milligram gallic acid equivalent (mg GAE/mL).

Results and Discussion

Figure 1 shows the influence of stabilizers (zinc chloride and pectin) and storage temperatures (10 °C, 25 °C, 40 °C, 50 °C, and 60 °C) on the total chlorophyll of pandan extract. Results showed that total chlorophyll of pure pandan did not show significant changes when stored at 10 °C up to 5 h. However, the total chlorophyll of pure pandan started to degrade significantly when stored at an elevated temperature at and beyond 25 °C. Total chlorophyll of pure pandan was degraded profoundly from 22.53 ± 0.08 mg/mL to 15.29 ± 0.17 mg/mL when stored at 60 °C. It is worth noting that pandan extract with the addition of $ZnCl_2$ stabilizer, total chlorophyll did not show a significant decrease at all storage temperatures, especially at 60 °C. This implied that zinc chloride could stabilize the chlorophyll content of pandan extract at high storage temperature. On the other hand, results showed that pectin was not a good stabilizer to stabilize chlorophyll content for pandan extract as evidenced by a significant decrease of total chlorophyll at all storage temperatures (Figure 1). Obvious colour changes of pandan extract with and without stabilizers are shown in Figure 2.

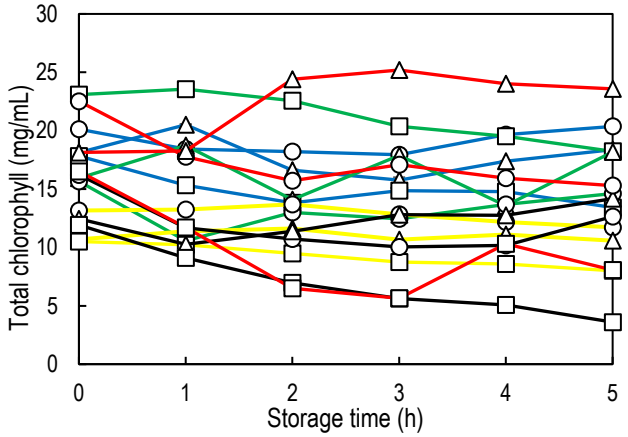

Figure 1 Effects of storage temperature and time on total chlorophyll of (○) pandan, (Δ) pandan + $ZnCl_2$, and (□) pandan + pectin at various temperatures of 10 °C (blue), 25 °C (green), 40 °C (yellow), 50 °C (black), and 60 °C (red)

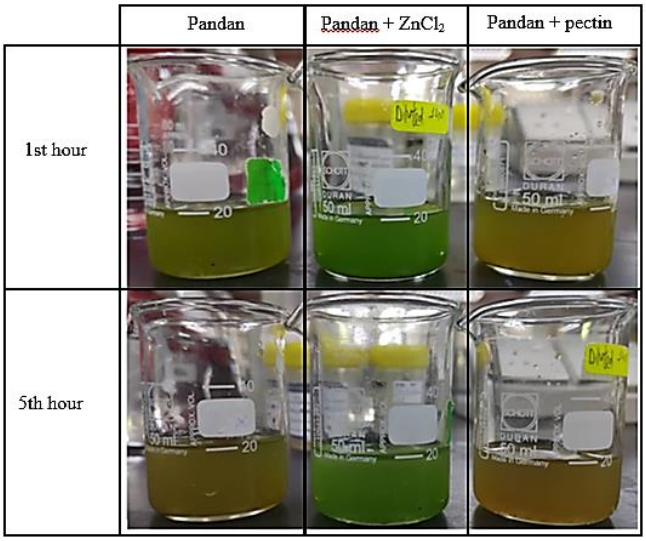

Figure 2 Colour changes of pandan extract with and without stabiliers after storage at 60 °C for 1st and 5th hour

Figure 3 illustrates the influence of stabilizers (zinc chloride and pectin) and storage temperatures (10 °C, 25 °C, 40 °C, 50 °C, and 60 °C) on TPC of pandan extract. Regardless of pandan extract with or without stabilizers, TPC did not show an obvious trend or changes at storage temperatures and durations. However, results discovered that pectin was not an ideal stabilizer to retain the TPC for pandan extract as evidenced by lower TPC values after adding pectin.

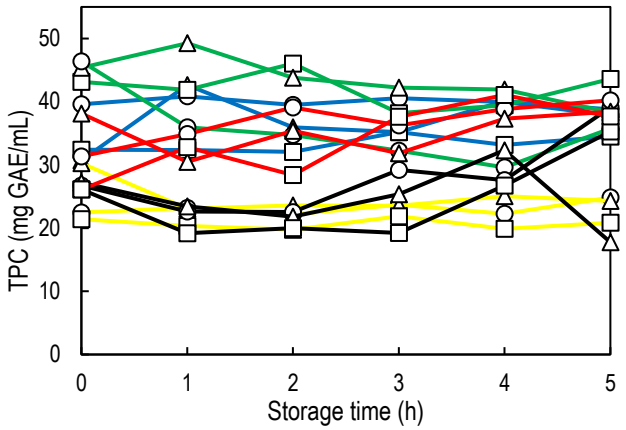

Figure 3 Effects of storage temperature and time on TPC of (○) pandan, (Δ) pandan + $ZnCl_2$, and (□) pandan + pectin at various temperatures of 10 °C (blue), 25 °C (green), 40 °C (yellow), 50 °C (black), and 60 °C (red)

Conclusion

This study shows that Zinc chloride is highly recommended to incorporate into pandan extract when to be used as a green food colorant for food manufacturing where involves heat treatment.

References

[1] P.P. Adkar, V.H. Bhaskar, Pandanus odoratissimus (Kewda): A Review on Ethnopharmacology, Phytochemistry, and Nutritional Aspects. Advances in Pharmacological Sciences Vol. 2014 pg.9.

[2] S. Hörtensteiner, B. Kräutler, Chlorophyll breakdown in higher plants, Biochimica et Biophysica Acta (BBA) - Bioenergetics 1807 (2011) 977-988.

[3] M.G. Ferruzzia, B. Joshua, Digestion, absorption, and cancer preventative activity of dietary chlorophyll derivatives, Nutrition Research 27 (2007) 1– 12.

[4] N.A.N. Hanafy, S. Leporatti, M.A. El-Kemary, Extraction of chlorophyll and carotenoids loaded into chitosan as potential targeted therapy and bio imaging agents for breast carcinoma, Int. J. Biological Macromolecule 182 (2021) 1150–1160.

[5] G. Özkan, S.E. Bilek, Enzyme-assisted extraction of stabilized chlorophyll from spinach, Food Chem 176 (2015) 152–157.

[6] E. Rahayuningsih, M.S. Pamungkas, M. Olvianas, A.D.P. Putera, Chlorophyll extraction from suji leaf (Pleomele angustifolia Roxb.) with ZnCl2 stabilizer, J Food Sci Technol 2018 https://doi.org/10.1007/s13197-017-3016-7.