



< Back to results | 1 of 1

Download Print Save to PDF Add to List More... >

Full Text

International Food Research Journal • Open Access • Volume 29, Issue 6, Pages 1279 - 1292 • December 2022

Document type

Article • Bronze Open Access

Source type

Journal

ISSN

19854668

DOI

10.47836/ifrj.29.6.05

Publisher

Universiti Putra Malaysia

Original language

English

View less ^

Effects of thermal treatments on the characterisation of microencapsulated chlorophyll extract of *Caulerpa racemosa*

Dewi E.N.^a ; Purnamayati L.^a; Jaswir I.^{b,c}

Save all to author list

^a Department of Fish Product Technology, Faculty of Fisheries and Marine Sciences, Universitas Diponegoro, Jl. Prof. H. Soedarto, SH, Tembalang, Semarang, 50275, Indonesia

^b International Institute for Halal Research and Training, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, 53300, Malaysia

^c Faculty of Pharmacy, Universitas Ahmad Dahlan, Jl. Prof. Dr. Soepomo SH, Umbulharjo, Daerah Istimewa, Kota Yogyakarta, Yogyakarta, 55164, Indonesia

1

Views count

View all metrics >

Full text options Export

Cited by 0 documents

Inform me when this document is cited in Scopus:

Set citation alert >

Related documents

Effect of chlorophyll in alginate-based edible film in inhibiting spoilage of fish snacks

Dewi, E.N. , Tassakka, A.C.M.A.R. , Yuwono, M. (2022) *Canrea Journal: Food Technology, Nutritions, and Culinary Journal*

In vitro bioaccessibility evaluation of pheophytins in gelatin/polysaccharides carrier

Jin, Z. , Emiezi Agarry, I. , Li, Y. (2023) *Food Chemistry*

Preparation and characterization of whey protein isolate-chlorophyll microcapsules by spray drying: Effect of WPI ratios on the physicochemical and antioxidant properties

Zhang, Z.-H. , Peng, H. , Woo, M.W. (2020) *Journal of Food Engineering*

View all related documents based on references

Find more related documents in Scopus based on:

Authors > Keywords >

Abstract

Author keywords

SciVal Topics

Metrics

Funding details

Abstract

Caulerpa racemosa is a macroalga that has a green pigment, that is, chlorophyll. Chlorophyll is highly sensitive to damage during heat processing. In the present work, *C. racemosa* chlorophyll extract was microencapsulated with fish gelatine and Arabic gum coatings, using a freeze-drying technique, to protect against heat damage. The microcapsules were subjected to high temperatures (120, 140, and 160°C) for 5 h. The protective effect of microcapsules on chlorophyll stability was assessed by measuring chlorophyll a and b degradation, total phenolic content, antioxidant activity, functional group analysis, colour, particle size, and morphology via scanning electron microscopy. Chlorophyll b significantly decreased by 87.78% in comparison with chlorophyll a (61.49%) during heating; the characteristic green colour of chlorophyll changed to brownish-green following heat exposure. However, chlorophyll was still present in the microcapsules as detected by the presence of the functional group C=O bond at 1600 nm wavelength. The heat treatment did not affect microcapsule particle size and morphology. Particle size distribution ranged from 91.58 to 112.51 µm, and the microcapsule was flake-shaped. The activation energy of chlorophyll a was 19336.96 kJ/mol·K; this was higher than that of chlorophyll b, which was 1780.53 kJ/mol·K. Based on the results, microcapsules produced using fish gelatine and Arabic gum as coating materials were able to protect chlorophyll in *C. racemosa* extract from heat damage. © All Rights Reserved

Author keywords

C. racemosa; Chlorophyll thermal stability; Quality microcapsules

SciVal Topics 



Metrics



Funding details



References (54)

[View in search results format >](#)

All

[Export](#)  [Print](#)  [E-mail](#)  [Save to PDF](#) [Create bibliography](#)

- 1 Aamir, M., Ovissipour, M., Rasco, B., Tang, J., Sablani, S.
Seasonality of the thermal kinetics of color changes in whole spinach (*Spinacia Oleracea*) leaves under pasteurization conditions

(2014) *International Journal of Food Properties*, 17 (9), pp. 2012-2024. Cited 23 times.

www.tandf.co.uk/journals/titles/10942912.asp

doi: 10.1080/10942912.2013.779701

[View at Publisher](#)

-
- 2 Anthonissen, M., Meirte, J., Moortgat, P., Maertens, K., Daly, D., Fieuws, S., Lafaire, C., (...), Van den Kerckhove, E.
Influence on clinical parameters of depressomassage (part I): The effects of depressomassage on color and transepidermal water loss rate in burn scars: A pilot comparative controlled study ([Open Access](#))

(2018) *Burns*, 44 (4), pp. 877-885.

www.elsevier.com/locate/burns

doi: 10.1016/j.burns.2017.11.004

[View at Publisher](#)

- 3 Arepally, D., Goswami, T.K.
Effect of inlet air temperature and gum Arabic concentration on encapsulation of probiotics by spray drying
(2019) *LWT*, 99, pp. 583-593. Cited 85 times.
<https://www.journals.elsevier.com/lwt>
doi: 10.1016/j.lwt.2018.10.022
View at Publisher
-
- 4 Armesto, J., Gómez-Limia, L., Carballo, J., Martínez, S.
Impact of vacuum cooking and boiling and refrigerated storage on the quality of galega kale (*Brassica oleracea* var. *acephala* cv. Galega)
(2017) *LWT*, 79, pp. 267-277. Cited 24 times.
<https://www.journals.elsevier.com/lwt>
doi: 10.1016/j.lwt.2017.01.050
View at Publisher
-
- 5 Array, E.J., Tonfack Djikeng, F., Kingne Kingne, F., Kinge, E.E., Womeni, H.M.
Effect of different extraction solvents on the phenolic content and antioxidant activity of turmeric (*Curcuma longa*) from south-west region, Cameroon ([Open Access](#))
(2019) *Food Research*, 3 (1), pp. 86-90. Cited 12 times.
https://www.myfoodresearch.com/uploads/8/4/8/5/84855864/_12_fr-2018-227_array.pdf
doi: 10.26656/fr.2017.3(1).227
View at Publisher
-
- 6 Aryee, A.N., Agyei, D., Akanbi, T.O.
Recovery and utilization of seaweed pigments in food processing
(2018) *Current Opinion in Food Science*, 19, pp. 113-119. Cited 72 times.
<http://www.journals.elsevier.com/current-opinion-in-food-science/>
doi: 10.1016/j.cofs.2018.03.013
View at Publisher
-
- 7 Christ, B., Hörtensteiner, S.
Mechanism and Significance of Chlorophyll Breakdown ([Open Access](#))
(2014) *Journal of Plant Growth Regulation*, 33 (1), pp. 4-20. Cited 102 times.
<http://www.springer.com/life+sci/plant+sciences/journal/344>
doi: 10.1007/s00344-013-9392-y
View at Publisher
-
- 8 da Silva, P.T., Fries, L.L.M., de Menezes, C.R., Holkem, A.T., Schwan, C.L., Wigmann, E.F., Bastos, J.O., (...), da Silva, C.B.
Microencapsulation: Concepts, mechanisms, methods and some applications in food technology ([Open Access](#))
(2014) *Ciencia Rural*, 44 (7), pp. 1304-1311. Cited 93 times.
<http://www.scielo.br/pdf/cr/v44n7/0103-8478-cr-44-07-01304.pdf>
doi: 10.1590/0103-8478cr20130971
View at Publisher

- 9 Veiga, R.D.S.D., Aparecida Da Silva-Buzanello, R., Corso, M.P., Canan, C.
Essential oils microencapsulated obtained by spray drying: a review

(2019) *Journal of Essential Oil Research*, 31 (6), pp. 457-473. Cited 47 times.
<http://www.tandfonline.com/toc/tjeo20/current>
doi: 10.1080/10412905.2019.1612788

View at Publisher
-
- 10 Chen, H., Yang, M., Shan, Z., Mansouri, S., May, B.K., Chen, X., Chen, H., (...), Woo, M.W.
On spray drying of oxidized corn starch cross-linked gelatin microcapsules for drug release

(2017) *Materials Science and Engineering C*, 74, pp. 493-500. Cited 34 times.
doi: 10.1016/j.msec.2016.12.047

View at Publisher
-
- 11 Derrien, M., Badr, A., Gosselin, A., Desjardins, Y., Angers, P.
Optimization of a green process for the extraction of lutein and chlorophyll from spinach by-products using response surface methodology (RSM)

(2017) *LWT*, 79, pp. 170-177. Cited 54 times.
<https://www.journals.elsevier.com/lwt>
doi: 10.1016/j.lwt.2017.01.010

View at Publisher
-
- 12 Dewi, E.N., Purnamayati, L., Kurniasih, R.A.
Physical characteristics of phycocyanin from spirulina microcapsules using different coating materials with freeze drying method (Open Access)

(2017) *IOP Conference Series: Earth and Environmental Science*, 55 (1), art. no. 012060. Cited 16 times.
<http://www.iop.org/EJ/volume/1755-1315>
doi: 10.1088/1755-1315/55/1/012060

View at Publisher
-
- 13 Du, W., Yu, J., Gu, Y., Li, Y., Han, X., Liu, Q.
Preparation and application of microcapsules containing toluene-di-isocyanate for self-healing of concrete

(2019) *Construction and Building Materials*, 202, pp. 762-769. Cited 60 times.
doi: 10.1016/j.conbuildmat.2019.01.007

View at Publisher
-
- 14 Erge, H. S., Karadeniz, F., Koca, N., Soyer, Y.
Effect of heat treatment on chlorophyll degradation and color loss in green peas
(2008) *GIDA*, 33 (5), pp. 225-233. Cited 42 times.
-

- 15 Floegel, A., Kim, D.-O., Chung, S.-J., Koo, S.I., Chun, O.K.
Comparison of ABTS/DPPH assays to measure antioxidant capacity in popular antioxidant-rich US foods

(2011) *Journal of Food Composition and Analysis*, 24 (7), pp. 1043-1048. Cited 977 times.
doi: 10.1016/j.jfca.2011.01.008

View at Publisher
-
- 16 (2019) *Gelatin handbook*. Cited 89 times.
United States: GMIA
-
- 17 Gunathilake, K.D.P.P., Somathilaka Ranaweera, K.K.D., Vasantha Rupasinghe, H.P.
Effect of different cooking methods on polyphenols, carotenoids and antioxidant activities of selected edible leaves (Open Access)

(2018) *Antioxidants*, 7 (9), art. no. 117. Cited 57 times.
<http://www.mdpi.com/2076-3921/7/9/117/pdf>
doi: 10.3390/antiox7090117

View at Publisher
-
- 18 Guo, J., Li, P., Kong, L., Xu, B.
Microencapsulation of curcumin by spray drying and freeze drying

(2020) *LWT*, 132, art. no. 109892. Cited 37 times.
<https://www.journals.elsevier.com/lwt>
doi: 10.1016/j.lwt.2020.109892

View at Publisher
-
- 19 Hamishehkar, H., Emami, J., Najafabadi, A.R., Gilani, K., Minaiyan, M., Mahdavi, H., Nokhodchi, A.
Influence of carrier particle size, carrier ratio and addition of fine ternary particles on the dry powder inhalation performance of insulin-loaded PLGA microcapsules

(2010) *Powder Technology*, 201 (3), pp. 289-295. Cited 28 times.
doi: 10.1016/j.powtec.2010.04.017

View at Publisher
-
- 20 Hikmawanti, N.P.E., Fatmawati, S., Asri, A.W.
The effect of ethanol concentrations as the extraction solvent on antioxidant activity of Katuk (*Sauropus androgynus* (L.) Merr.) leaves extracts (Open Access)

(2021) *IOP Conference Series: Earth and Environmental Science*, 755 (1), art. no. 012060. Cited 18 times.
<https://iopscience.iop.org/journal/1755-1315>
doi: 10.1088/1755-1315/755/1/012060

View at Publisher
-

- 21 Hsiao, C.-J., Lin, J.-F., Wen, H.-Y., Lin, Y.-M., Yang, C.-H., Huang, K.-S., Shaw, J.-F.
Enhancement of the stability of chlorophyll using chlorophyll-encapsulated polycaprolactone microparticles based on droplet microfluidics
(2020) *Food Chemistry*, 306, art. no. 125300. Cited 34 times.
www.elsevier.com/locate/foodchem
doi: 10.1016/j.foodchem.2019.125300
View at Publisher
-
- 22 Indrasti, D., Andarwulan, N., Purnomo, E.H., Wulandari, N.U.R.
Stability of chlorophyll as natural colorant: A review for suji (*dracaena angustifolia* (medik.) roxb.) leaves' case (Open Access)
(2018) *Current Research in Nutrition and Food Science*, 6 (3), pp. 609-625. Cited 16 times.
<http://www.foodandnutritionjournal.org/download/8158>
doi: 10.12944/CRNFSJ.6.3.04
View at Publisher
-
- 23 Irwandi, J., Faridayanti, S., Mohamed, E.S.M., Hamzah, M.S., Torla, H.H., Che Man, Y.B.
Extraction and characterization of gelatin from different marine fish species in Malaysia
(2009) *International Food Research Journal*, 16 (3), pp. 381-389. Cited 57 times.
[http://www.ifrj.upm.edu.my/16%20\(3\)%202009/11\[1\]%20Irwandi.pdf](http://www.ifrj.upm.edu.my/16%20(3)%202009/11[1]%20Irwandi.pdf)
-
- 24 Jiao, J.-G., Liu, Y., Zhang, H., Li, L.-Y., Qiao, F., Chen, L.-Q., Zhang, M.-L., (...), Du, Z.-Y.
Metabolism of linoleic and linolenic acids in hepatocytes of two freshwater fish with different n-3 or n-6 fatty acid requirements
(2020) *Aquaculture*, 515, art. no. 734595. Cited 14 times.
<http://www.journals.elsevier.com/aquaculture/>
doi: 10.1016/j.aquaculture.2019.734595
View at Publisher
-
- 25 Jing, P., Zhao, S.-J., Jian, W.-J., Qian, B.-J., Dong, Y., Pang, J.
Quantitative studies on Structure-DPPH· scavenging activity relationships of food phenolic acids (Open Access)
(2012) *Molecules*, 17 (11), pp. 12910-12924. Cited 48 times.
<http://www.mdpi.com/1420-3049/17/11/12910/pdf>
doi: 10.3390/molecules171112910
View at Publisher
-
- 26 Jouki, M., Khazaei, N., Rashidi-Alavijeh, S., Ahmadi, S.
Encapsulation of *Lactobacillus casei* in quince seed gum-alginate beads to produce a functional synbiotic drink powder by agro-industrial by-products and freeze-drying
(2021) *Food Hydrocolloids*, 120, art. no. 106895. Cited 42 times.
<https://www.journals.elsevier.com/food-hydrocolloids>
doi: 10.1016/j.foodhyd.2021.106895
View at Publisher

- 27 Jouki, M., Khazaei, N., Rezaei, F., Taghavian-Saeid, R.
Production of synbiotic freeze-dried yoghurt powder using microencapsulation and cryopreservation of *L. plantarum* in alginate-skim milk microcapsules

(2021) *International Dairy Journal*, 122, art. no. 105133. Cited 27 times.
www.elsevier.com/inca/publications/store/4/0/5/8/6/0/index.htm
doi: 10.1016/j.idairyj.2021.105133

View at Publisher
-
- 28 Kang, Y.-R., Lee, Y.-K., Kim, Y.J., Chang, Y.H.
Characterization and storage stability of chlorophylls microencapsulated in different combination of gum Arabic and maltodextrin

(2019) *Food Chemistry*, 272, pp. 337-346. Cited 106 times.
www.elsevier.com/locate/foodchem
doi: 10.1016/j.foodchem.2018.08.063

View at Publisher
-
- 29 Kim, A.-N., Kim, H.-J., Chun, J., Heo, H.J., Kerr, W.L., Choi, S.-G.
Degradation kinetics of phenolic content and antioxidant activity of hardy kiwifruit (*Actinidia arguta*) puree at different storage temperatures

(2018) *LWT*, 89, pp. 535-541. Cited 54 times.
<http://www.elsevier.com/inca/publications/store/6/2/2/9/1/0/index.htm>
doi: 10.1016/j.lwt.2017.11.036

View at Publisher
-
- 30 Lee, W.J., Tan, C.P., Sulaiman, R., Hee, Y.Y., Chong, G.H.
Storage stability and degradation kinetics of bioactive compounds in red palm oil microcapsules produced with solution-enhanced dispersion by supercritical carbon dioxide: A comparison with the spray-drying method

(2020) *Food Chemistry*, 304, art. no. 125427. Cited 17 times.
www.elsevier.com/locate/foodchem
doi: 10.1016/j.foodchem.2019.125427

View at Publisher
-
- 31 Leng, L.Y., Nadzrin, Shaari, A.R., Norawanis, A.R., Khor, C.Y.
Antioxidant capacity and total phenolic content of fresh, oven-dried and stir-fried tamarind leaves ([Open Access](#))

(2017) *Current Research in Nutrition and Food Science*, 5 (3), pp. 282-287. Cited 10 times.
<http://www.foodandnutritionjournal.org/download/4613>
doi: 10.12944/CRNFSJ.5.3.13

View at Publisher
-
- 32 Mekinić, I.G., Skroza, D., Šimat, V., Hamed, I., Čagalj, M., Perković, Z.P.
Phenolic content of brown algae (Pheophyceae) species: Extraction, identification, and quantification ([Open Access](#))

(2019) *Biomolecules*, 9 (6), art. no. 244. Cited 114 times.
<https://www.mdpi.com/2218-273X/9/6/244/pdf>
doi: 10.3390/biom9060244

View at Publisher

- 33 Milani, A., Jouki, M., Rabbani, M.
Production and characterization of freeze-dried banana slices pretreated with ascorbic acid and quince seed mucilage: Physical and functional properties ([Open Access](#))
- (2020) *Food Science and Nutrition*, 8 (7), pp. 3768-3776. Cited 24 times.
[http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)2048-7177](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)2048-7177)
onlinelibrary.wiley.com/journal/10.1002/%28ISSN%292048-7177
doi: 10.1002/fsn3.1666
- [View at Publisher](#)
-
- 34 Moser, P., Telis, V.R.N., de Andrade Neves, N., García-Romero, E., Gómez-Alonso, S., Hermosín-Gutiérrez, I.
Storage stability of phenolic compounds in powdered BRS Violeta grape juice microencapsulated with protein and maltodextrin blends ([Open Access](#))
- (2017) *Food Chemistry*, 214, pp. 308-318. Cited 104 times.
www.elsevier.com/locate/foodchem
doi: 10.1016/j.foodchem.2016.07.081
- [View at Publisher](#)
-
- 35 Muhoza, B., Xia, S., Cai, J., Zhang, X., Duhoranimana, E., Su, J.
Gelatin and pectin complex coacervates as carriers for cinnamaldehyde: Effect of pectin esterification degree on coacervate formation, and enhanced thermal stability
- (2019) *Food Hydrocolloids*, 87, pp. 712-722. Cited 110 times.
doi: 10.1016/j.foodhyd.2018.08.051
- [View at Publisher](#)
-
- 36 Munteanu, I.G., Apetrei, C.
Analytical methods used in determining antioxidant activity: A review ([Open Access](#))
- (2021) *International Journal of Molecular Sciences*, 22 (7), art. no. 3380. Cited 223 times.
<https://www.mdpi.com/1422-0067/22/7/3380/pdf>
doi: 10.3390/ijms22073380
- [View at Publisher](#)
-
- 37 Oancea, S.
A review of the current knowledge of thermal stability of anthocyanins and approaches to their stabilization to heat ([Open Access](#))
- (2021) *Antioxidants*, 10 (9), art. no. 1337. Cited 30 times.
<https://www.mdpi.com/2076-3921/10/9/1337/pdf>
doi: 10.3390/antiox10091337
- [View at Publisher](#)
-

- 38 Pareek, S., Sagar, N.A., Sharma, S., Kumar, V., Agarwal, T., González-Aguilar, G.A., Yahia, E.M.

Chlorophylls: Chemistry and biological functions

(2017) *Fruit and Vegetable Phytochemicals: Chemistry and Human Health: Second Edition*, 1, pp. 269-284. Cited 43 times.

<https://onlinelibrary.wiley.com/doi/10.1002/9781119158042.ch14>

ISBN: 978-111915804-2; 978-111915794-6

doi: 10.1002/9781119158042.ch14

[View at Publisher](#)

- 39 Parthasarathi, S., Anandharamakrishnan, C.

Enhancement of oral bioavailability of vitamin E by spray-freeze drying of whey protein microcapsules

(2016) *Food and Bioproducts Processing*, Part A 100, pp. 469-476. Cited 70 times.

http://www.elsevier.com/wps/find/journaldescription.cws_home/713883/description#description

doi: 10.1016/j.fbp.2016.09.004

[View at Publisher](#)

- 40 Pertiwi, R. D., Suwaldi, Martien, R., Setyowati, E. P.

Radical scavenging activity and quercetin content of *Muntingia calabura* L. leaves extracted by various ethanol concentration

(2020) *Journal of Food and Pharmaceutical Sciences*, 8 (1), pp. 173-183. Cited 8 times.

- 41 Popuri, A. K., Pagala, B.

Extraction of curcumin from turmeric roots

(2013) *International Journal of Innovative Research Study*, 2 (5), pp. 289-299. Cited 29 times.

- 42 Purnama, F.N.W., Agustini, T.W., Kurniasih, R.A.

The effect of different temperature on the stability of phycocyanin on microcapsule *Spirulina platensis* ([Open Access](#))

(2020) *IOP Conference Series: Earth and Environmental Science*, 530 (1), art. no. 012008.

<https://iopscience.iop.org/journal/1755-1315>

doi: 10.1088/1755-1315/530/1/012008

[View at Publisher](#)

- 43 Scheepers, J.C., Malan, S.F., du Preez, J.L., van Dyk, S.

The high performance liquid chromatography (HPLC) analysis of ultraviolet (UV) irradiated chlorophyll a and secondary plant compounds

(2011) *African Journal of Biotechnology*, 10 (74), pp. 16976-16985. Cited 5 times.

<http://www.academicjournals.org/AJB/PDF/pdf2011/23Nov/Scheepers%20et%20al.pdf>

doi: 10.5897/ajb11.1999

[View at Publisher](#)

- 44 Shaimaa, G., Mahmoud, M., Mohamed, M., Emam, A.
Effect of heat treatment on phenolic and flavonoid compounds and antioxidant activities of some Egyptian sweet and chilli pepper (2016) *Natural Product Chemistry and Research*, 4 (3), p. 1000218. Cited 20 times.
-
- 45 Sihono, Tarman, K., Madduppa, H., Januar, H. I.
Metabolite profiles and antioxidant activity of *Caulerpa racemosa* with different handlings (2018) *Squalen Bulletin of Marine and Fisheries Postharvest and Biotechnology*, 13 (3), pp. 93-100. Cited 9 times.
-
- 46 Stevenson, M., Long, J., Seyfoddin, A., Guerrero, P., Caba, K.D.L., Etxabide, A.
Characterization of ribose-induced crosslinking extension in gelatin films

(2020) *Food Hydrocolloids*, 99, art. no. 105324. Cited 35 times.
<https://www.journals.elsevier.com/food-hydrocolloids>
doi: 10.1016/j.foodhyd.2019.105324

View at Publisher
-
- 47 Thao, L. N.
Effect of ethanol on the anthocyanin extraction from the purple rice of Vietnam (2015) *Journal of Food and Nutrition Sciences*, 3 (1), p. 45. Cited 8 times.
-
- 48 Wu, H.-Y., Yang, K.-M., Chiang, P.-Y.
Roselle anthocyanins: Antioxidant properties and stability to heat and pH (Open Access)


(2018) *Molecules*, 23 (6), art. no. 1357. Cited 79 times.
<http://www.mdpi.com/1420-3049/23/6/1357/pdf>
doi: 10.3390/molecules23061357

View at Publisher
-
- 49 Yalcin, D. D., Udoh, A. U., Baykal, T. O., Aydin, A., Acikgoz, I. E., Yildiz, K., Guler, D.
Fourier transform infrared (FTIR) spectroscopy for identification of *Chlorella vulgaris* Beijerinck 1890 and *Scenedesmus obliquus* (Turpin) Kützing 1833 (2012) *African Journal of Biotechnology*, 11 (16), pp. 3817-3824. Cited 129 times.
-
- 50 Yamashita, C., Chung, M.M.S., dos Santos, C., Mayer, C.R.M., Moraes, I.C.F., Branco, I.G.
Microencapsulation of an anthocyanin-rich blackberry (*Rubus* spp.) by-product extract by freeze-drying (Open Access)

(2017) *LWT*, 84, pp. 256-262. Cited 116 times.
<https://www.journals.elsevier.com/lwt>
doi: 10.1016/j.lwt.2017.05.063

View at Publisher
-

- 51 Yu, Y., Lv, Y.
Degradation kinetic of anthocyanins from rose (*Rosa rugosa*) as prepared by microencapsulation in freeze-drying and spray-drying ([Open Access](#))
- (2019) *International Journal of Food Properties*, 22 (1), pp. 2009-2021. Cited 22 times.
<https://www.tandfonline.com/loi/ljfp20>
doi: 10.1080/10942912.2019.1701011
- [View at Publisher](#)
-
- 52 Zhang, Z.-H., Peng, H., Ma, H., Zeng, X.-A.
Effect of inlet air drying temperatures on the physicochemical properties and antioxidant activity of whey protein isolate-kale leaves chlorophyll (WPI-CH) microcapsules
- (2019) *Journal of Food Engineering*, 245, pp. 149-156. Cited 20 times.
<http://www.sciencedirect.com/science/journal/02608774>
doi: 10.1016/j.jfoodeng.2018.10.011
- [View at Publisher](#)
-
- 53 Zhao, H.
Endogenous Antioxidants and Antioxidant Activities of Beers
- (2014) *Processing and Impact on Antioxidants in Beverages*, pp. 15-24. Cited 19 times.
<http://www.sciencedirect.com/science/book/9780124047389>
ISBN: 978-012404738-9
doi: 10.1016/B978-0-12-404738-9.00002-7
- [View at Publisher](#)
-
- 54 Zheng, Y., Shi, J., Pan, Z., Cheng, Y., Zhang, Y., Li, N.
Effect of heat treatment, pH, sugar concentration, and metal ion addition on green color retention in homogenized puree of Thompson seedless grape
- (2014) *LWT*, 55 (2), pp. 595-603. Cited 24 times.
<https://www.journals.elsevier.com/lwt>
doi: 10.1016/j.lwt.2013.10.011
- [View at Publisher](#)

 Dewi, E.N.; Department of Fish Product Technology, Faculty of Fisheries and Marine Sciences, Universitas Diponegoro, Jl. Prof. H. Soedarto, SH, Tembalang, Semarang, Indonesia; email: nurdewisatmoko@gmail.com

© Copyright 2022 Elsevier B.V., All rights reserved.

About Scopus

[What is Scopus](#)

[Content coverage](#)

[Scopus blog](#)

[Scopus API](#)

[Privacy matters](#)

Language

[日本語版を表示する](#)

[查看简体中文版本](#)

[查看繁體中文版本](#)

[Просмотр версии на русском языке](#)

Customer Service

[Help](#)

[Tutorials](#)

[Contact us](#)

ELSEVIER

[Terms and conditions](#) ↗ [Privacy policy](#) ↗

Copyright © Elsevier B.V. ↗. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

We use cookies to help provide and enhance our service and tailor content. By continuing, you agree to the use of cookies ↗.

