Process Development

Heliyon 7 (2021) e08292

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Microwave vacuum-dried durian flour and its application in biscuits

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ARTICLE INFO

Keywords:
Durio zibethinus Murr.
Dough
Cookies
Baking
Starch

ABSTRACT

Durian is one of most popular fruits due to its nutritional values and unique flavor. Durian products have been continuously developed to meet market needs. In this study, durian (*Durio zibethinus* Murr.) cv. 'Monthong' was subjected to microwave vacuum-drying at 1,200 W to produce durian flour for use in biscuits that are normally made from wheat flour. The microwave treatment induced starch gelatinization to a significant extent. As a result, compared to the wheat flour, the durian flour had lower viscosity, pasting temperature, gelatinization temperatures, and enthalpy of gelatinization but higher water absorption capacity. Dough properties including development time, dough stability, time to breakdown and the phase angle tangent of the durian dough were less than those of the wheat dough. The elastic modulus (G′) and viscous modulus (G″) of the durian dough were higher than for the wheat dough. All the tested durian doughs had higher G′ values than G″, indicating a viscoelastic structure. Substitution of wheat flour with durian flour should not exceed 50% to obtain reasonable dough properties and baking quality of durian biscuits.

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Process Development

AGRICULTURE AND NATURAL RESOURCES

Journal homepage: http://anres.kasetsart.org

Research article

Stabilization of rice bran using ohmic heating or ultra-superheated steam

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Article Info

Article history:
Received 22 October 2020
Revised 6 August 2021
Accepted 22 August 2021
Available online 31 October 2021

Keywords:
Free fatty acid,
Lipase,
Ohmic heating,
Stabilization,
Ultra-superheated steam

Abstract

Rice bran (RB) is stabilized to improve its quality and extend its shelf life. RB stabilization reduces lipases, peroxidase, lipoxygenases and auto-oxidation enzymatic activities to prevent rancidity. This study investigated the effects of ohmic heating (OH) or ultra-superheated steam (USS) treatments on the free fatty acid (FFA) content and lipase activity (LA) compared to a hot-air (HA) oven during 15 d of storage in open containers at room temperature. After 15 d, the FFA level of the untreated RB was 23.55%, while the FFA levels for the RB subjected to HA for 15 and 90 min were 12.40% and 7.82%, respectively. On the other hand, the FFA levels for the RB subjected to OH at 100°C for 15 min and USS at 400°C for 25 s were 3.91% and 4.71%, respectively, and were considered suitable for industrial purposes (FFA< 5%) in edible oil extraction. A low LA (< 0.1 international units per gram of RB (IU/g RB)) was observed in the RB treated using the OH or USS treatments, whereas an LA range of 0.654–1.051 IU/g RB was detected for HA. The OH and USS treatments effectively inactivated LA and inhibited FFA formation in shorter heating times, compared to HA. OH-applied electricity as the heating source had rapid and uniform energy conversion that might be advantageous compared to HA. USS used very high temperatures for short times with high throughput. In conclusion, OH at 100°C for 15 min and USS at 400°C for 25 s were recommended for effective RB stabilization.

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Process Development

AGRICULTURE AND NATURAL RESOURCES

Journal homepage: http://anres.kasetsart.org

Research article

Comparative study on conventional, accelerated solvent extraction and ultrasonic-assisted extraction of total phenolic and anthocyanin contents and antioxidant activities from Riceberry bran

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Abstract

Importance of the work: The majority of phenolic compounds in cereals is bound to cell wall components, making extraction challenging.

Objectives: This study compared three extraction methods: accelerated solvent extraction (ASE), conventional solvent extraction (CSE) and ultrasonic-assisted extraction (UAE).

Materials & Methods: The total phenolic and anthocyanin contents of the Riceberry bran (RBB) extracts were evaluated using the Folin-Ciocalteu and pH differential methods. Antioxidant activities were determined using ferric reducing antioxidant power (FRAP), 2,2-diphenyl-1-1picrylhydrazyl (DPPH) and 2,2-azino-bis-3-ethylbenzothiazoline-6-sulfonic acid (ABTS) assays. The phenolic acids and anthocyanins contents of the extract were detected using high performance liquid chromatography (HPLC).

Results: The optimal conditions for each method were: CSE, UAE (80°C for 15 min) and ASE (80°C for 5 min). Comparing the optimal condition among the three methods, ASE had mean values for the total phenolic content (TPC) and total anthocyanin content (TAC) of 19.70 ± 0.68 mg gallic acid equivalents/g RBB and 88.54 ± 0.57 mg/100g RBB, respectively. The FRAP value, %scavenging activity of DPPH and ABTS of the ASE extract were 85.06 ± 0.28 µmol/g RBB, 57.94 ± 0.31 and 26.39 ± 0.27, respectively. Significant differences ($p < 0.05$) in the amounts of phenolic acids and anthocyanins in the extract depended on the extraction method. The ASE and UAE extracts had the highest amount of vanillic acid, cyanidin 3-glucoside and total bioactive compounds that were significantly different from the CSE method.

Main Finding: The ASE method could be more appropriate for the extraction of total phenolic and anthocyanin contents as it had the highest levels of TPC and TAC efficiency.

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Process Development

COGENT FOOD & AGRICULTURE
2019, VOL. 5, NO. 1
https://doi.org/10.1080/23311932.2019.1633076

Taylor & Francis
Taylor & Francis Group

Physicochemical properties and antioxidant activities of white dragon fruit peel pectin extracted with conventional and ultrasound-assisted extraction

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ABSTRACT

The objective of this study was to investigate the optimal condition for extracting dragon fruit peel (DFP) pectin with the best physicochemical properties and high antioxidant activity by using conventional extraction (CE) and ultrasound-assisted extraction (UAE). DFP was extracted using CE and UAE method at 45, 60 and 75°C for 30 and 60 min. In this study, UAE significantly improved antioxidant activity of the extracted DFP pectin when comparing to CE. DFP extracted with UAE at 45°C for 30 min had the highest antioxidant activity (51.58 ± 0.30 by DPPH, 39.81 ± 1.43 mgGAE/100 g by ABTS) ($p < 0.05$). Moreover, UAE also increased the production yield of sample at 45°C for 30 min (9.38 ± 0.50%) ($p < 0.05$) which was higher than the treatments with CE. The chemical properties of DFP pectin including equivalent weight, degree of esterification, methoxyl content and total anhydroronic acid revealed that DFP pectin could be categorized as low-methoxyl pectin. Present study demonstrated that DFP pectin was an ideal alternative source of pectin with high antioxidant activity compared with commercial citrus pectin. The optimal condition for extraction of pectin by UAE was at 45°C for 30 min which could be established as a potential method to extract pectin from DFP for industrial scale.

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Process Development

COGENT FOOD & AGRICULTURE
2019, VOL. 5, NO. 1
https://doi.org/10.1080/23311932.2019.1696512

Effect of ultrasonic-assisted extraction on the properties, antioxidant and inflammatory activities of carotenoids from gac (*Momordica cochinchinensis*) fruit pericarp

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ABSTRACT

This study investigated the effects of ratio of ethanol to water (green solvent), extraction temperature and reaction time on properties of carotenoids ultrasonically extracted from pericarp of gac fruit. The solvent ratio and temperature significantly affected the antioxidant activity and carotenoid contents. Ultrasonic-assisted extraction (UAE) with absolute ethanol at 75°C for 15 min produced the extract with the highest antioxidant activity and carotenoid level similar to the extract extracted for 30 min. This extract consisted of lycopene, β-carotene, and lutein, as confirmed by HPLC-DAD and did not degrade during extraction as detected by FTIR analysis. However, extraction with a high temperature in UAE changed carotenoid isomerization from all *trans* to *x-cis* lycopene. Additionally, the anti-inflammatory properties of this ethanolic extract on THP-1 cells were investigated. As a result, the extract at the concentration of 0.25–1.00 μg/ml should be considered for its benefit in enhancing IL-1β cytokines and safe for THP 1 cell.

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Process Development

Hindawi
Journal of Food Quality
Volume 2020, Article ID 4350274, 9 pages
https://doi.org/10.1155/2020/4350274

WILEY | Hindawi

Research Article

Effect of Microwave Cooking on Quality of Riceberry Rice (*Oryza sativa* L.)

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Received 9 October 2019; Revised 8 August 2020; Accepted 13 August 2020; Published 28 August 2020

Academic Editor: María B. Pérez-Gago

Microwaves have been applied for cooking, warming, and thawing food for many years. Microwave heating differs from conventional heating and may cause variation in the food quality. This study determined the quality of Riceberry rice (*Oryza sativa* L.) after microwave cooking using various rice-to-water ratios at three power levels (360, 600, and 900 W). The texture of all microwave-cooked samples was in the range 162.35 ± 5.86 to 180.11 ± 7.17 N and was comparable to the conventionally cooked rice (162.03 N). The total phenolic content (TPC) and the antioxidant activity of the microwave-cooked rice were higher than those of the conventional-cooked rice. Microwave cooking appeared to keep the TPC in the range 241.15–246.89 mg GAE/100 g db and the antioxidant activities based on DPPH and ABTS assays in the ranges 134.24–137.15 and 302.80–311.85 mg·TE/100 g db, respectively. Microwave cooking also maintained similar contents of fiber, ash, and total starch to those from conventional cooking. The glycemic index (GI) for all freshly cooked rice samples was not significantly different, and the rice was classified as a high-GI food. Microwave cooking could be recommended as an alternative technique for rice cooking due to its rapid heating regime and the comparable quality and maximized TPC and antioxidant activity of the cooked rice.

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Process Development

Journal of
Food Process Engineering

Original Article

Effects of ultrasonic and enzymatic treatment on physical and chemical properties of brown rice

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First published: 30 January 2019 | https://doi.org/10.1111/jfpe.13016 | Citations: 4

Funding information: Department of Product Development, Faculty of Agro-Industry, Kasetsart University; Kasetsart University Research and Development Institute, Kasetsart University

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Abstract

Brown rice (*Oryza sativa* Linn.) was subjected to ultrasonic treatment (UT) and enzymatic treatment (ET) with cellulase (CT), glucoamylase (GT), and α-amylase (AT). UT showed no significant effect on thermal properties, crystalline pattern and, glycemic response of brown rice. AT decreased gelatinization enthalpy from 7.19 g/J (control) to 5.31 g/J and reduced degree of crystallinity from 23.06% (control) to 21.02%. These changes significantly increased glycemic index of AT brown rice. CT and GT had insignificant effect on crystallinity and thermal properties of rice. Both UT and ET decreased hardness of cooked rice from 206.05 to 189.63–148.87 N in which the AT cooked rice was the softest. Both AT and UT were potentially used as novel processes to develop the soften brown rice. However, UT brown rice had lower glycemic response, required shorter cooking time, and was more practically produced in industrial scale than ET brown rice.

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Process Development

Springer Link

Original Paper | Published: 05 August 2019

Antioxidant properties and selected phenolic acids of five different tray-dried and freeze-dried mushrooms using methanol and hot water extraction

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Journal of Food Measurement and Characterization **13**, 3097–3105 (2019) | Cite this article

267 Accesses | **3** Citations | Metrics

Abstract

Mushrooms are health foods due to their nutritional values and antioxidant properties. This study investigated chemical properties, total phenolic content (TPC), antioxidant activities (2, 2-diphenyl-1-picrylhydrazyl; DPPH and 2, 2-azino-bis-(3-ethylbenzothiazoline-6-sulfonic acid); ABTS) and selected phenolic acids from five different tray-dried and freeze-dried mushrooms (*Pleurotus ostreatus*, *Pleurotus pulmonarius*, *Schizophyllum commune*, *Volvariella volvacea* and *Lentinus edodes*). The extracts were prepared using methanol and hot water extractions. The results revealed that *V. volvacea* had the highest protein (28.70%) and ash (9.48%) contents. There were significant differences among some tray dried and freeze dried mushrooms regarding TPC, DPPH and ABTS. However, tray drying tended to improve TPC, DPPH and ABTS in *P. ostreatus*, *P. pulmonarius* and *L. edodes*. Among five mushroom species, both methanol and hot water extractions of *V. volvacea* had the highest TPC, DPPH and ABTS values but there were no significant differences between mushrooms prepared using tray drying and freeze drying. Moreover, the yield and contents of gallic acid and *p*-hydroxybenzoic acid from the hot water extracts were higher than from the methanol extracts. Therefore, tray-dried *V. volvacea* had the most potential as a natural antioxidant and could be used as a functional ingredient in healthy food products.

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Process Development

Springer Link

Research Article | Published: 03 July 2018

Temperature Compensation on Sugar Content Prediction of Molasses by Near-Infrared Spectroscopy (NIR)

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Sugar Tech **21**, 162–169 (2019) | Cite this article

Abstract

The rapid, nondestructive, cost-effective NIR measurement method was used for final molasses quality monitoring to determine fermentable sugar content to optimize ethanol yield. Molasses is stored in temperature-controlled tanks during the cane crushing and remelt seasons to ensure molasses quality and availability. However, there is variation in molasses temperature during storage. The impacts of temperature variation on molasses NIR spectra and calibration performance were studied. About one hundred molasses samples were collected for spectral profiling (400–2500 nm) at three different temperatures (25, 35 and 45 °C) using a FOSS NIR DS2500 spectrometer. A partial least squares regression (PLSR) model was developed using full cross-validation. The predictive models were developed using molasses spectra at 25, 35 and 45 °C and used to determine sucrose, glucose, fructose (fermentable sugars) concentrations in the molasses. External validation was achieved using thirty percent of calibration samples for each validation set, 25, 35, and 45 °C. Variation of the sample spectra was observed for the visible region and NIR region (1450 and 1970 nm), due to O–H bonding. The root means squared standard error of cross-validation obtained varied depending on sample temperature. Root means squared standard error of prediction results for external validation samples tended to increase with increasing temperature. Predicted values were not statistically different ($p > 0.05$) to reference values using different temperatures of models and validation. Calibration models including three temperature spectra showed potential of fermentable sugar analysis in molasses without temperature compensation.

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