Functional Ingredients derived from Rice Bran

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Introduction

Functional ingredient or functional food consisted of bioactive agents that are known to be able to exert health benefits beyond that of basic nutrition. Rice bran, which accounts for approximately 8% of brown rice, are presently considered as low-valued commodity, due to the rapid development of off flavours, odours and possibly toxic compound and thus must undergo rapid stabilization. Rice bran contains various components that have been associated with health benefits. It is an excellent source of mineral, vitamins, in particular, those with antioxidant properties (carotenoids, tocopherols, and tocotrienols), high quality protein, dietary fiber and unsaturated fat. In addition, rice bran consisted of precious micronutrients including oryzanol and various phenolic compounds that are known to be potent antioxidant. The aim of the project is to produce functional ingredients from stabilized rice bran.

Materials and Methods

Rice bran was obtained from BERNAS Sri Tiram Jaya, Selangor, Malaysia. The sample used in the study were obtained from "Milling Fraction 1" that have been shown to contain high oil content. Extraction of the oil was carried out using aqueous enzymatic method. Ferric Thiocyanate Test (FTC) and Thiobarbituric Acid Test (TBA) were employed in evaluating the antioxidative of the enzyme-extracted oil. Tocopherol, tocotrienol and oryzanol were determined utilizing RP-HPLC. The AOCS Official Methods (1993) were employed for determination of free fatty acid (FFA) content, iodine value (IV), anisidine value (AnV) and peroxide value (PV) of the oil (AOCS, 1993). Acidity, given as percent of oleic acid, was determined by titration of a solution of oil dissolved in ethanol–ether (1:1) with ethanolic potash. Peroxide value, expressed in milliequivalents of active oxygen per kilogram of oil (meq/kg), was determined as follows: a mixture of oil and chloroform–acetic acid was left to react with a solution of potassium iodide in darkness; the free iodine was then titrated with a sodium thiosulfate solution.

Results and Discussion

The study showed that rice bran Fraction I contains 18.92±0.33 % oil with 75% unsaturated and 25% saturated oils, 215.50±53.60 ug/100g total carotenoids (b-carotene 204.17±43.85 and lycopene 16.99±1.0). Optimum oil recovery of 70.3% was achieved at pH 9 and 70°C. The yield was seen to increase significantly when the incubation pH was adjusted to pH 9. The increase in oil recovery may be due to the breakdown and solubilisation of protein in cell walls' structures and those bound to lipid bodies.

The study also showed that temperature have considerable effect on yield of oil. Similarly, Lusas *et al.* (1982) observed that the extraction temperature was critical to oil extraction yields for soybeans. Result in Table 1 showed significant ($P<0.05$) differences with increase in temperatures. However, when the temperature exceed 70°C, oil recovery was seen to drop, indicating destruction of enzyme. Alcalase (protease) are known to perform well at 55-70°C (Novo Nordisk, 1999). In addition, the enzyme-extracted rice bran oil exhibited appreciable antioxidative activity which may account for the health benefits aforementioned.

Chemical Composition and Quality of the Oil

Iodine value (104.70± 0.31), peroxide value (0.49± 0.18) and anisidine value (24.75± 0.24) of enzyme extracted oil obtained was comparable to that of commercially available rice bran oil. The oil however, was found to contain appreciable free fatty acid (2.6± 0.3), although it is still within the acceptable level for edible oils. More than 10% FFA in the crude oil is considered unfit for human consumption. The color of the oil obtained in this study was greenish. This is may be due to the the chlorophyll content of 63.92±0.15

It is encouraging to find that the oil obtained in this study contain high levels of carotenoids (215.50±53.60 ug/100g) in particular, β-carotene (204.17±43.85 ug/100g) and (lycopene 16.99±1.00 ug/100g). In addition, the enzyme extracted oil was found to contain significantly higher concentration of both tocotrienols and tocopherols, which were (1105.53±133.28 ppm) and (737.87±81.72 ppm) respectively. Result on the individual isomers showed that enzyme extracted oil contained the highest concentration of all tocotrienols isomers (α-, β+γ, δ-), which were (468.13±54.91 ppm), (246.32±25.80 ppm) and (391.07±55.59 ppm) respectively. The oil also exhibited the highest concentration for all tocopherol isomers (α-, β+γ, δ-) with (484.22±81.44 ppm), (84.23±42.76 ppm), (169.47±31.83 ppm) respectively. In general, the study revealed that the enzyme-extracted rice bran oil contained high concentrations of antioxidants. The aforementioned data may partly explain the beneficial physiological effects that have been reported of rice bran oil, in particular in combating free radicals, and thus in the

prevention of degenerative diseases and aging processes. Thus, the oil has great potential to be produced as specialty oil that are of high demand in functional food industry.

Conclusions

Maximum oil recovery of 70.26% was obtained at pH 9 and 70°C with a <750 um particle size, 2.0% enzymes concentration and 3-hours incubation time in aqueous enzyme extracted rice bran oil. With respect to quality, the oil obtained from this study was found to be comparable to that commercially available. It is encouraging to note that the enzyme extracted consisted of significantly higher concentration of both total and individual isomers (α-, β+γ, δ-) of tocopherol and tocotrienol. High level of oryzanol and carotenoids (β-carotene and lycopene) were also found in the enzyme extracted rice bran oil. The enzyme-extracted oil exhibited appreciable antioxidative activity

Benefits from the study

Method developed for enzyme-extraction rice bran oil. Functional ingredients, in particular potent antioxidants including different isomers of tocopherol, tocotrienol and oryzanol. In addition phenolics rich extract will also separated in this study.

Patent(s), if applicable :

Nil

Stage of Commercialization, if applicable:

Nil

Project Publications in Refereed Journals:

Nil

Project Publications in Conference Proceedings

1. Raja Sulaiman, RR., Abdul-Hamid, A., Osman, A. and Saari, N. Effect of stabilization on total phenolic compounds in different rice (*Oryza sativa*) bran milling fractions. To be in proceedings of 5th MCBN-UNESCO / COSTAM / SFRR (Malaysia/Asean) Workshop,*"Micronutrients: Moecular Basis of Health and Disease"* 2003. Kota Kinabalu, Sabah,

2. Hussein, R., Abdul-Hamid, Saari, N. and Ismail, R. Antioxidant activity, tocopherol and tocotrienol content of enzyme extracted rice bran oil. To be in proceedings of 5th MCBN-UNESCO / COSTAM / SFRR (Malaysia/Asean) Workshop,*"Micronutrients: Moecular Basis of Health and Disease"* 2003. Kota Kinabalu, Sabah,

3. Hussein, R. and Abdul-Hanid, A. Macro and micronutrient contents of rice bran from four Malaysian rice varieties. To be in proceedings of 17th Scientific Conference of Nutrition Society of Malaysia" 2002. Park Plaza Hotel, Kuala Lumpur.

4. R. Sulaiman, R.R. and Abdul-Hamid, A. Activity of degradative enzymes in stabilized and unstabilized rice bran. To be in proceedings of 17th Scientific Conference of Nutrition Society of Malaysia" 2002. Park Plaza Hotel, Kuala Lumpur.

Graduate Research

Name of Graduate	Research Topic	Field of Expertise	Degree Awarded	Graduation Year
Reza Hussein	Aqueous Extraction of Rice bran oil	Food Chemistry	Master of Science	2004
R.Rohaya R. Sulaiman	Separation and characterization of phenolic rich extract	Food Chemistry	Master of Science	2004
Rosnizam Ismail	Extraction of tocopherol tocotrienol and oryzanol from Rice bran	Food Chemistry	Master of Science	2005

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