

Research Article

Characterization of cold pressed organic rice bran oil

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Abstract

This study aims to characterize cold pressed organic Khao dawk mali 105 (KDML 105) rice bran oil. The oil was obtained from the Rice Fund Surin Organic Agriculture Cooperative (RFSOAC) and different physico-chemical parameters were characterized. The refractive index, acid value, peroxide value and iodine value were recorded as 1.7294, 1.06 KOH mg/g oil, 3.12mg/kg and 93.02 mg/g, respectively. The fatty acid profile showed palmitic acid (21.79%), stearic acid (1.86%), oleic acid (44.85%), linoleic acid (31.32%) and linolenic acid (0.19%) as major fatty acids. In this research, γ -oryzanol is an important component in rice bran oil, it occurs in cold pressed organic jasmine rice bran oil at a high level up to 1.298%, where it serves as a natural antioxidant.

Keywords: Khao dawk mali 105, antioxidant, fatty acid profile, physico-chemical parameters, Thailand.

Introduction

Jasmine rice (*Oryza sativa* L. cv. KDML 105) is the most important agricultural product in Thailand, since it is a staple food for most of the population in this region. Rice milling yields 70% of rice (endosperm) as the major product and by-products consist of 20% rice husk, 8% rice bran and 2% rice germ. Rice bran can be used as feed or as a source of rice bran oil [1]. Earlier studies have reported that rice bran oil is an edible oil of unsaturated fatty acid (mono-unsaturated fatty acid 45% and poly-unsaturated fatty acid 37%) [2, 3]

In comparison with most vegetable oils, rice bran oil has a qualitatively different composition of bioactive compounds. γ -oryzanol derivatives in particular are found in only a very limited number of oils [1]. γ -oryzanol is a mixture containing compound ferulic acid ester of sterols and triterpene alcohols [4]. It has antioxidant properties. Various studies have found that γ -oryzanol has a number of beneficial properties such as decreasing plasma cholesterol, decreasing cholesterol absorption and decreasing disorders caused by menopause. [5, 6, 7, 8].

The overall composition, nutrition profile, functional characteristics of rice bran oil reveals its wide application in healthy diets due to low saturated fat and cholesterol lowering activity in humans [9]. The inherent fatty acid profile of rice bran oil makes it a natural candidate for use as frying oil without the need for hydrogenation. The hydrogenation of fats is the addition of hydrogen to the double bonds in the fatty acid chains. This process is very important in the food industry. Two major objectives are accomplished through hydrogenation of fats, (1) the allowance of the conversion of liquid oil to a semisolid fat that is more suitable for specific food applications such as margarines and shortenings, and (2) the improvement of oxidative stability of the oil. A major disadvantage of the hydrogenation process is the formation of trans-fats.

Surin Province has developed a reputation for producing high quality fragrant rice or KDML 105. The Province has recently established a pilot planting of organic jasmine rice, set up under the Rice Fund Surin Organic Agriculture Cooperative Ltd. (RFSOAC) and promoted to farmers to plant organic jasmine rice. This project has received the recognition of Organic Agriculture Certification Thailand (ACT). Moreover, it produces the cold pressed organic jasmine rice bran oil. To promote the cold pressed organic jasmine rice bran oil as organic agriculture product or healthy food in the future, it is necessary to understand the characterization of cold pressed organic jasmine rice bran oil. The present research work was designed to extract and study different chemical-physical parameters of cold pressed organic jasmine rice bran oil.

Materials and Methods

Materials

The cold pressed organic KDML 105 rice bran oil was purchased from RFSOAC. Heptadecanoic acid (99% purity) was obtained from Sigma-Aldrich Chemical Co. (St. Louis, MO). Sulphuric acid was analytical grade from Fluka (Buchs, Switzerland). Solvents were analytical grade from Lab Scan Co. (Bangkok, Thailand). Standard γ -oryzanol (98% purity) was obtained from Tsuno Rice Fine Chemicals Company (Wakayama, Japan). BPX-70 (70% cyanopropyl polysilphenylenesiloxane) was purchased from SGE International Pty, Ltd. (Victoria, Australia).

Methods

The present study was conducted at Surindra Rajabhat University. The cold pressed organic KDML 105 rice bran oil was analyzed for refractive index, peroxide value, iodine value and free fatty acids by following the respective methods outlined in AOAC [10].

GC analysis

Gas chromatographic (GC) analysis was carried out on a Shimadzu model 14B equipped with flame ionization detection (FID) and a split-splitless injector. BPX-70 (70% cyanopropyl polysilphenylenesiloxane) capillary column (15m \times 0.25mm i.d.) was purchased from SGE International Pty, Ltd. (Victoria, Australia). The chromatographic conditions were as follows: Helium carrier gas flow 2mL/min. Nitrogen makeup gas flow 14 mL/min: detector/injector, 230°C: split ratio, about 50:1.

UV-spectrophotometer analysis

UV-spectrophotometer was carried out on a Shimadzu model UV-1601 and spectrum 315 nm.

Transmethylation

About 10-20 mg of cold pressed organic KDML 105 rice bran oil in a 10 mL screw-capped tube with the addition of 1 mL of heptadecanoate acid (inter standard) 0.4mg/mL was dissolved in toluene and 0.5 mL of 2M H₂SO₄ was dissolved in methanol. The tube was capped tightly and heated in a water bath at 70°C for 4h. After cooling, 0.2mL of 4% Na₂CO₃ was added and the

mixture was washed three times each with 1mL of distilled water, dried over anhydrous Na_2SO_4 and evaporated to dryness under a stream of nitrogen. The esters were re-dissolved in hexane and were ready to be analyzed by GC.

Calibration curve of γ -oryzanol

γ -Oryzanol (stock standard) 10 mg was dissolved in hexane 100 mL. The calibration curve of γ -oryzanol is shown in Figure 1.

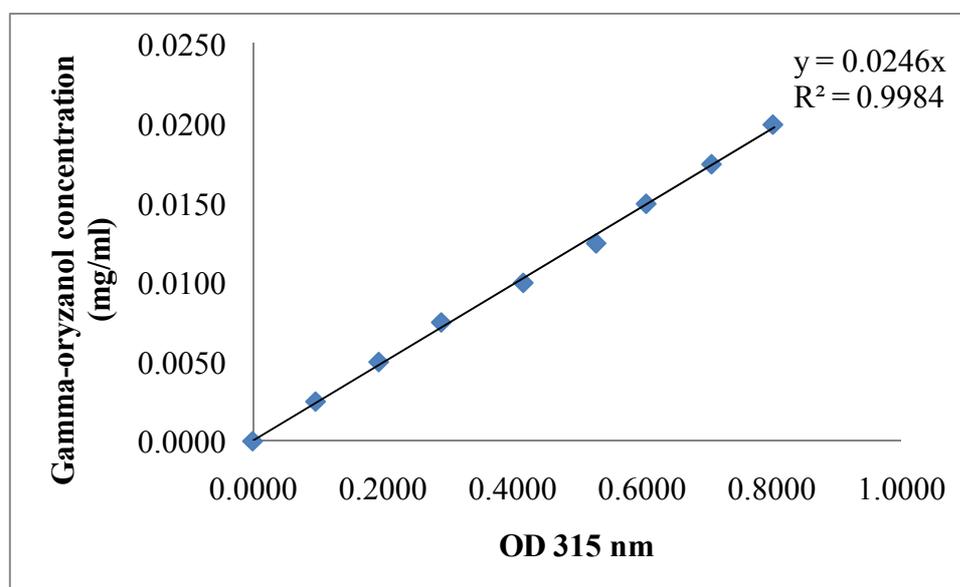


Figure 1. Calibration curve of γ -oryzanol dissolved in hexane.

Results and Discussion

The results on chemical-physical characteristics of cold pressed organic jasmine rice bran oil indicated that refractive index value was 1.3294 (Table 1). The acid, peroxide and iodine values were 1.06 KOH mg/g oil, 3.12mg/kg and 93.02mg/g, respectively. Thai Industrial Standards Institute (TIS) 44-2516 (1973) rice bran oil [11] and TIS 47-2533 (1990) edible oil [12] stipulate that quality characteristics of proper natural rice bran oil should show maximum acid values (4mg/g oil), peroxide values (10mg/kg) and iodine values (115mg/g). The present results are in line with these standards.

Table 1. Chemical-physical characteristics of cold pressed organic KDML 105 rice bran oil.

| No. | Parameters | Values |
|-----|------------------|-------------------|
| 1 | Refractive index | 1.7294 |
| 2 | Acid value | 1.06 KOH mg/g oil |
| 3 | Peroxide value | 3.12mg/kg |
| 4 | Iodine value | 93.02mg/g |

Table 2. Fatty acid composition of cold pressed organic KDML 105 rice bran oil.

| No. | Fatty acid | % of total fatty acid |
|-----|-----------------------------------|-----------------------|
| 1 | Palmitic acid; $\text{C}_{16:0}$ | 21.79 |
| 2 | Stearic acid; $\text{C}_{18:0}$ | 1.86 |
| 3 | Oleic acid; $\text{C}_{18:1}$ | 44.85 |
| 4 | Linoleic acid; $\text{C}_{18:2}$ | 31.32 |
| 5 | Linolenic acid; $\text{C}_{18:3}$ | 0.19 |

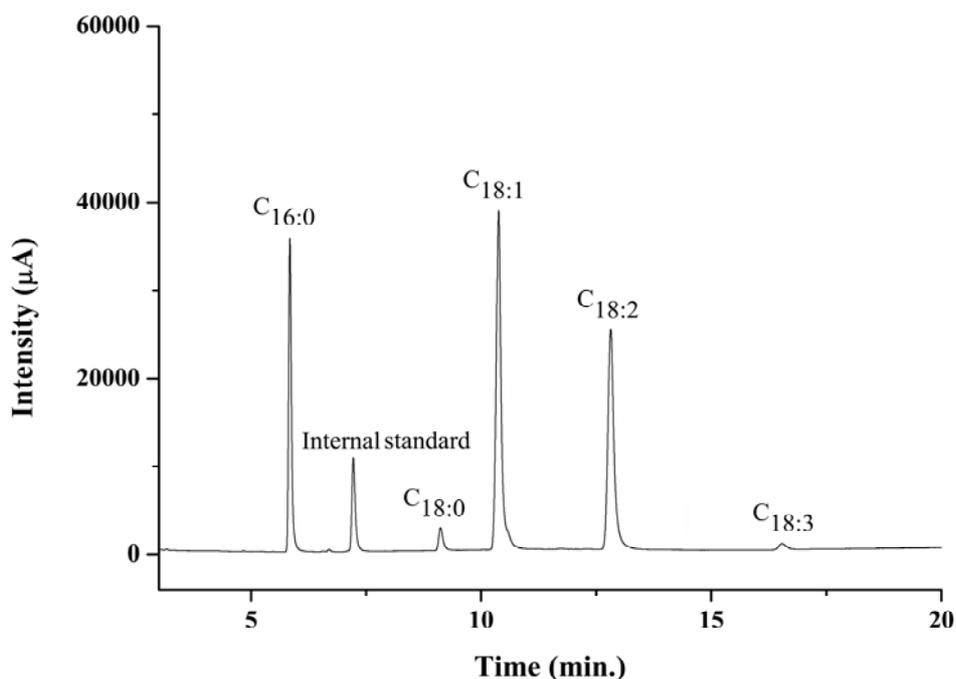


Figure 2. Gas chromatogram of fatty acid esters of cold pressed organic oil on a BPX-70 capillary column (15m×0.25mm i.d.).

Oven temperature: 160°C. Peaks are labeled with the names of fatty acid esters.

The fatty acid composition of cold pressed organic rice bran oil (Table 2 and Figure 2) indicated that oleic and linoleic acids were about 76.17%. Sugano and Tsuji [13] and Tahira *et.al.*[14] and Van Hoed *et.al.* [1] reported that oleic and linoleic fatty acids constitute more than 70% of fatty acids of glycerides.

The rice bran oil is similar to peanut oil in fatty acid composition having oleic acid 49.9% and linoleic acid 35.4% [15]. Lee *et al.* [3] also reported a higher percentage of oleic, linoleic and palmitic acids in rice bran oil. The saturation level is slightly higher than conventional soybean oil [16]. The linolenic acid constituted only 0.19% of rice bran oil and this lower linolenic acid content makes rice bran oil more resistant to oxidation than soybean oil [14].

The γ -oryzanol of cold pressed organic KDML 105 rice bran oil was about 1.298%. Krishna *et.al.* [17] and Xu and Godber [18] reported that γ -oryzanol is a mixture of ferulic acid esters of sterol and trierpene alcohols, it occurs in rice bran oil at a level of 1 to 2%, where it serves as a natural antioxidant.

Conclusion

Based on conformity with TIS 44-2516 (1973) Rice bran oil and TIS 47-2533 (1990) Edible oil and in view of the physico-chemical parameters of cold pressed organic KDML 105 rice bran oil resulting from this study, it can be efficiently used for cooking purposes, as a health food and for the development of community products of Surin (OTOP).

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