

Natural Antioxidant Rich Dietary Oil Blends As Healthy Cooking Oil

Dr. Sagarika Bhattacharyya¹, Dr. Susil Kumar Sen², Ankhi Maiti³

^{1,3}Chemistry Department,

^{1,2,3}Dr. Sudhir Chandra Sur Degree Engineering College, JIS
Kolkata, India.

Abstract

The study investigates the quality of oil blends and possible utilization of such oil blends like of palmolein, rice bran oil, mustard oil, coconut oil and groundnut oil which have more significant health benefits instead of use of a single type of oil for high temperature cooking. The blend of palmolein and rice bran oil (50:50) is chosen to study the stability of the food sample during high temperature frying. It's found that blending of oil improves the physiochemical properties and stability of individual oil. The study revealed that natural antioxidant, γ -oryzanol content in rice bran oil before and after frying was not much altered than that for the blend of palmolein and rice bran oil (50:50). The experiment shows possible commercial production of such oil blends as cooking oil.

1. Introduction

A variety of vegetable oils marketed in India is focusing mainly on the health and nutritional benefits. The new sources of oils have potential to meet consumers' tastes as a cooking medium, stability at high temperature cooking and the essential fatty acid requirements. It is also necessary to know the potential side effects of such oils as consumption of saturated fats can lead to cardiovascular disease. Thus the new designed oil or oil blends must be stable at high temperature so that the natural micronutrients present in oil can be supplied through the cooked and fried products. Thus, there is an urgent need to find new blends of oil, with highly essential micronutrients[1,2], under Indian dietary conditions in order to lower the nutritional and health risks that may follow the consumption of these fats in large amounts.

Many studies have been conducted to get information on the ability of these oils to lower cholesterol levels, scavenge free radicals, cause mutagenicity and other effects. But still data about the effect of feeding them at very high level, effect on cardiovascular diseases, consumption of the high temperature fried oil, their

effect on the fatty acid composition and other tissues are under investigation. Generally a diet with linolenic (n-6 or w-6) and linoleic (n-3 or w-3) in ratio of 5-10, is recommended. The World Health Organisation (WHO) also recommends polyunsaturated fatty acid / saturated fatty acid (PUFA/SAFA) ratio of 0.8 to 1.0 and the American Heart Association recommends a balance of saturated, monounsaturated and polyunsaturated in the ratio of 1:1:1 and preferably with even a less than 1 ratio of polyunsaturates. No single oil shows the required amount of micronutrients for the stability of oil with balanced SAFA/MUFA/PUFA to provide standard nutritional quality. The poor oil quality includes test of Free Fatty Acids (FFA), change of color, low smoke point, low iodine value, total polar material, peroxide value, high foaming properties and increased viscosity (Loh Soh Kheang, et al. 2006).

On the basis of fatty acid composition with emphasis n-6 and n-3 fatty acids, our objective is to provide consumers nutritionally better quality oil by blending commercially available refined edible oil [3-5] at a reasonable price. Marketing of blended oil has been sanctioned by Government of India [6]. Considering the importance of the natural antioxidants some oil blends are prepared with the most commonly used edible oils like palmolein, rice bran oil, mustard oil, coconut oil and groundnut oil to improve the quality of dietary fat and also to exploit the health beneficial effect of component present in them.

Palmolein which is a fraction of palm oil contains a considerable amount of natural antioxidant vitamin E, i.e., tocopherol and tocotrienols and is one of the most stable oil at high temperature. The rice bran oil has emerged as a suitable alternative of frying oil as there is an absence of trans-fats and presence of several antioxidants.

Gamma-oryzanol is a naturally occurring component in rice bran oil which consists of a mixture of ferulic acid esters of sterols and triterpene alcohols. Rice bran oil exhibits excellent frying performance [7] and contributes a pleasant flavour to the fried food. It has some amount of naturally occurring saturated fatty

acids and has low linoleic acid content. These properties make it a premium choice for frying

Most Japanese restaurants in the USA have now switched to rice bran oil for their Tempura Frying oil because of its superior performance in this special application. Frying of potato chips, chicken, snacks exhibits better taste and texture profiles when rice bran oil is used. The present study aims to investigate the stability of the oryzanol and tocopherol present in palmolein and rice bran oil mixture (50:50) during high temperature frying of potato chips.

2. Methods and Materials

Palm oil (*Elaeis guineensis*) is exported from Malaysia. Palmolein is the liquid fraction obtained by fractionation of palm oil after crystallisation at controlled temperatures. Other oils like ground nut oil, rice bran oil, coconut oil and mustard oil are purchased from local market. On the basis of fatty acid composition some oil blends are prepared keeping in mind the prevention of food adulteration (PFA).

Oil blends are subjected to methylation using methanol following to AOCS method [8]. Fatty acid composition oil and oil blends are carried out using Gas Liquid Chromatography (GLC) fitted with FID (240°C), injector temperature at 240°C , using DEGS column (3cm X 0.3cm) and nitrogen as carrying gas, oven temperature 160°C to 230°C (with increase in temperature of $3^{\circ}\text{C}/\text{min}$).

All the parameters like acid value, peroxide value, iodine value, saponification value and unsaponifiable matter of oils and oil blends are determined according to standard procedure of AOCS [9].

The colour of the oil samples before and after frying are determined visually and also by Lovibond Tintometer (Toshiwal made) in a 1 cm. cell on the Lovibond scale. The oryzanol content of rice bran oil and rice bran oil blend before and after frying are determined by Spectrophotometric method [10].

3. Results and Discussion

Traditionally Indian foods are prepared through frying. So the cooking oil should meet the requirements of frying oil.

Table 1 shows the fatty acid composition of rice bran oil. Table 2 shows the preparation of some oil blends having balanced saturated fatty acid (SAFA), monounsaturated fatty acid (MUFA) and polyunsaturated fatty acid (PUFA). It also shows the presence of antioxidants in the individual oil [2]. Palmolein having approximately 40% SAFA and also containing considerable amount of tocopherol is very much stable oil [12]. Rice bran oil contains gamma-oryzanol which helps the oil to be stable at high temperature as well as plays an important role against the degenerative diseases [13]. So the blend of palmolein (50%) and rice bran oil (50%) is prepared to get the combined effect of tocopherol in palmolein and oryzanol in rice bran oil on the basis of stability as well as nutritional point of view [14].

Table 3 shows the physicochemical properties of original rice bran oil (RBO) and palmolein (PLO) used for the study. The values are compared with that of the PFA specifications. The values of blend of RBO and PLO (1:1) are more or less comparable with that of either of original oil used for the study.

Stability of the oil blend of RBO and PLO (1:1) is studied during deep frying of potato chips for 24 hours in six consecutive batches by 4 hours intervals.

Table 4 includes the different characterisation of the oil blend before and after frying for 24 hours. RBO and PLO (1:1) blend oil shows slight increase of the % acid value compared to that of RBO when fried for 24 hours. The peroxide value and the iodine value of the blend oil is more or less same comparable to the value of either of the oil before and after frying.

Table 5 shows colour change and viscosity change in oils before and after frying and that of the oil blend. The viscosity of the PLO and RBO (1:1) blend and RBO are more or less comparable to that of RBO after 24 hrs of frying. It is important to note that the oryzanol content of the experimental blend oil shows no remarkable change during frying.

4. Tables

Table 1
Composition of Rice bran oil

Fatty acid	Percentage
Myristic acid	0.6%
Palmitic acid	21.5%
Stearic acid	2.9%
Oleic acid	38.4%
Linoleic acid	34.4%
α-Linolenic acid	2.2%

Resource: F. Bailey's Industrial Oil and Fat Products.

Table 2
Fatty Acid Profiles of Some Oil Blends

Oil Blend	Fatty acids (%w/w)			
	SAFA	MUFA	PUFA	Micro-nutrients
Groundnut oil (50%) + Rice bran Oil (50%)	20	50	30	Oryzanol
Coconut oil (20%) + Mustard Oil (80%)	22	57	20	Tocopherol
Coconut Oil (50%) + Rice bran Oil (50%)	55	25.5	18.5	Oryzanol
Pamolein (50%) + Rice bran Oil (50%)	31.9	43.2	23.6	Oryzanol Tocopherol Tocotrienol
Pamolein (50%)+ Mustard Oil (50%)	24.4	55.7	18.7	Tocopherol

Table 3
Characteristics Rice Bran Oil, Palmolein oil and their Blend (1:1)

Parameters	Oil	PFA Specification	Observed Value
Acid value (%)	RBO PLO Blend	0.5 0.34 0.1	1.1 0.5 0.2
Peroxide Value	RBO PLO Blend	0.8 1.0 ---	11.5 0.6 0.6
Iodine Value	RBO PLO Blend	90-105 59.3 ---	91.6 47.2 65.6-75.0
Saponification Value	RBO PLO Blend	180-195 204 --	187 -- --
Unsaponifiable matter (%)	RBO PLO Blend	3.1 0.3 ----	--- --- 2.5

Table 4
Characteristic Changes of Rice Bran Oil and Palmolein and their Blend (1:1)

Sample oil	Palmolein		Rice bran		Blended	
Duration of frying (hours)	0	24	0	24	0	24
Acid Value %	0.56	1.9	1.1	1.1	1.1	1.5
Peroxide value	0.61	4.2	11.5 7	8.48	5.45	6.66
Oryzanol g /100 g	---	---	1.56 3	1.20	0.747	0.73
Tocopherol content (mg %)	79.6	30	60	22	--	--
Iodine Value	47.3	48. 7	91.6	70.2	65.63	64.7 6

Table 5

Physical changes observed in oils and their blend

Sample oil	Palmolein		Rice bran		Blended	
Duration of frying (hours)	0	24	0	24	0	24
Viscosity CP	0.73 2	1.21 2	0.65 2	2.39 1	0.695	2.316
Colour reading (1 cm cell)	3.2Y +0.3 R+ 0.3B	22Y + 2.4 R	66.8 Y+ 2.2 R	61Y + 21R	12Y + 1R + 0.2B	30Y+ 12R

5. Conclusion

This experiment reveals that the combined effect of balanced fatty acid profile and the presence of micronutrients like tocopherol and oryzanol in the blend of palmolein and rice bran oil makes the oil blend very much stable at the high temperature of deep fat frying of potato chips. It shows the suitability of the oil blend for cooking and frying purpose. Thus the PLO and RBO (50:50) blend having health beneficial effects can be explored for commercial utilisation.

6. References

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