AMERICAN JOURNAL OF FOOD SCIENCE AND TECHNOLOGY (AJFST)

ISSN: 2834-0086 (ONLINE)

VOLUME 3 ISSUE 2 (2024)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Food Science and Technology (AJFST)

Volume 3 Issue 2, Year 2024
ISSN: 2834-0086 (Online)
DOI: https://doi.org/10.54536/ajfst.v3i2.2878
https://journals.e-palli.com/home/index.php/ajfst

Blending Insights, Wadding the Nutritional and Physiochemical Gaps of High Omega-3 Peony Oil and High Omega-6 Safflower Oil

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Article Information

Received: June 24, 2024

Accepted: July 27, 2024

Published: July 31, 2024

Keywords

Peony Seed Oil, Safflower Seed Oil, GC-MS, Fatty Acids Composition, Oil Blending

ABSTRACT

Oil blending is known as a sustainable solution in development of vegetable oils with reliable storage stabilities and optimum fatty acids compositions. This novel study was done to spot the most effective oil blends in terms of the nutritional and the physiochemical properties between high omega-3 peony seed oil (PSO) and high omega-6 safflower seed oil (SSO) blended at different ratios of 5:95, 15:85, 50:50 and 70:30. All the blended samples showed improvement in their physiochemical properties means they can be kept at low temperature (below 5°C) without crystallization. Crude oils were extracted by standard Soxhlet extraction method using N-hexane as the solvent and purified through centrifuge method. Identification and quantitative measurement of oil blends for fatty acids were carried out by gas chromatography coupled with mass spectrometry (GC-MS). Results show that all the samples had significantly improved their polyunsaturated fatty acid profiles especially AB-70:30 (peony oil: Safflower oil) with n-6 (49.16%), n-9 (2.33%) and n-3 (39.03%) respectively which not only promote health but also lead to many useful changes in the physiochemical properties. This blended oil also shown noteworthy highest iodine value of 127.24 g I2/100g, significantly lower peroxide of 6.07 meqO2/kg and lowest free fatty acid of 0.122% compared to the other blended samples. Therefore, it is recommended for the daily use, deep frying and it can be kept in storage over a long period of time.

INTRODUCTION

Modem problems need modern solutions and oil blending is a modern solution regarding many problems surrounding the nutritional and physiochemical properties of oils, this sustainable technique improves every parameter of oil without use of potential chemicals or chemically complicated processes like fractioning, hydrogenation and interesterification. This approach is not only capable of improving the physiochemical properties of edible vegetable oils but it can also significantly improve the polyunsatured fatty acid profiles (ratio of omega 3 and omega 6) as per the recommended consumptions by different health regulatory organization like WHO (Ali & Li, 2021).

Somewhat recently the interest for food quality, dietary fats and their impact on human wellbeing has significantly expanded. It's best-known that a blended fatty acids diet is mostly healthier, except for growing and correct development and performance, the physical body desires a precise quantity of fats. Consumption of foodstuff containing an oversized quantity of saturated fatty acids (1:1 and 1:2) is related to cardiopathy, diabetes, cancer; so, the diet should contain fairly good amount of unsaturated fatty acids (Harris, 2018). Medical research on lipids also reveals that enhanced intake of polyunsaturated and unsaturated fats can reduce the possibility of coronary heart diseases and improves immunity in battling against novel viral diseases (Ali *et al.*, 2024; Ramsden *et al.*, 2013). Additionally, polyunsaturated unsaturated fats (PUFA), especially ω-3 unsaturated fats (DHAdocosahexaenoic acid, EPA-eicosapentaenoic acid) are fundamental dietary supplements for human wellbeing, they're outlined as "essential" fats since they can't be synthesized by the body and subsequently they should be given from the eating routine. Recent findings have also shown their utilization in food systems with significance focus being given in the production of functional foods and nutraceuticals(N. C. *et al.*, 2024) All aforementioned understandings are pivotal to understand pathways to incorporate a balanced n3/n6 diet for which oil blending can be utilized that not only upgrade the physiochemical parameters but also improve their nutritional significance (Kamińska *et al.*, 2023),

The component analysis results showed that peony seed oil was rich in unsaturated fatty acids present at (92 %), mainly α-linolenic acid (42 %), significantly higher than other edible vegetable oil and it is a highly nutritional vegetable oil (Gribbestad *et al.*, 2005). Similar study discovered that the preponderance of fatty acids within

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peony oil consists of α-linolenic acid (ALA) and linoleic acid, with ALA constituting an exceptional proportion ranging from 33.8% to 67.1%. Such elevated levels of n-3 UFAs are atypical in plant-derived oils, with notable exceptions being flaxseed and perilla seed oil which led to its designation as a novel resource food by the Ministry of Health of China in 2011 (J. H. Su, 2016). Furthermore, PSO has exhibited diverse bioactivities, including antibacterial, antidiabetic, hypolipidemic, and sun-screening effects. Its safety has been validated through a series of experiments encompassing acute toxicity, subacute toxicity, long-term toxicity, and sperm abnormal genetic toxicity. These collective findings underscore the potential advantages of PSO as an emerging resource for dietary supplementation. Typically, marine organisms (fish, seafood, and algaes) are known to be naturally accompanying PSO in its nutritive values (mainly EPA and DHA) with fish oil is taken into account to own the best amounts of ω-3 PUFA (Rubio-Rodríguez *et al.*, 2010).

In safflower oil, approximately 90% of the total fatty acids are composed of oleic and linoleic fatty acids. Their distribution is governed by a recessive allele, and a negative correlation exists between the content of linoleic acid and that of oleic acid (Arslan, 2007). Traditionally categorized as a linoleic type, safflower oil boasts a polyunsaturated composition, with linoleic acid constituting 71–75% of its fatty acid profile, rendering it an edible oil. This significantly fills all the nutritional gaps when blended with peony seed oil. Another complication in a variety of oils is their stability and the reason behind this to be, photo-oxidation and auto-oxidation which usually takes place during storage and processing. The fact that oils are unstable can lead to deterioration of not only the flavor and taste but also affects its nutritional profile as it produces a few compounds that are toxic. Apart from this, unsaturation is also an issue in oils.

Blending of oils becomes necessary when an oil contains high quantity of polyunsaturated and unsaturated fatty acids, which are more susceptible to oxidation for example: linolenic and linoleic acid. Betterment in the physiochemical properties in oil blends is revealed via multiple research findings for example 20% or less virgin olive oil when mixed with palm oil, it increases its thermal stability considerably (De Leonardis & Macciola, 2012). It was found earlier that blending may also potentially reduce partial and cloudy crystallization in palm olein. Customers require oils that have low melting point, density and viscosity, which can be achieved by blending. It also provides sustainable viscosity, without any addition of chemicals and maintains the quality of oils (Siddique, 2010).

During this study, we tend to report the utilization of gas-chromatography plus mass spectrometry (GC-MS) for the estimation of total fatty acids in the oil blends of safflower and peony oil. Individual fatty acids were known and measured exploitation the GC-MS methodology. Physiochemical properties were accessed via the AOAC official methods of oil analysis.

MATERIALS AND METHODS

Materials and Reagents

Two kinds of oils were taken for the analysis. 100% pure safflower seed oil and Peony seeds were purchased from local market of Anhui province. Samples were stored at room temperature (22 ± 1 °C) in airtight bags. Constant temperature magnetic stirrer S10-3, high speed refrigerated centrifuge Zonkia HC-3108R, cold press SITUVU-D-01, 7890B GCMS system, vaccume evaporator Chemtronstrike-250 were used in different phases of experimentation. All the chemicals used to conduct this study i.e., N-hexane, isopropanol, sodium hydro oxide, phenolphthalein, anhydrous sodium sulfate, petroleum ether, ethyl ether, KOH, CH3OH, cyclohexane and acidic acid solutions were of analytical grade.

Oil Extraction

peony seeds were dehulled and oven dried (>8%), seeds were crushed to course particles before subjected to oil recovery. Peony oil subjected to the current study was extracted via 2 methods, one with the Soxhlet protocol using analytical grade N-hexane and other part of oil was extracted at Anhui grain testing and grading laboratory using the SITUVU-D-01 oil press. For solvent extraction, pre-dried and crushed peony seeds were filled in filter paper and loaded into the soxhlet extraction thimble and the extraction was carried out at boiling temperature for 3 hours using N-hexane. Finally, the hexane was separated by vacuum evaporation to obtain peony oil.

Moisture / volatile matter = W1 x 100 % by weight W

In equation, W1 = Loss in weight (mg) of material on drying

W = Initial weight of material taken for analysis

Oil purification

50-gram crude oil containing impurities was transferred into purifying vials of equal sizes and then racked into the centrifuge. Centrifuge speed was maintained at 4000rmp, after 30 minutes all the impurities were settled at the bottom of the container forming a bulk of solid mass. Upper portion of clear oil was separated and stored in special bottles for analysis.

Preparation of Blends

Four samples were made with non-uniform oil percentage AB 5:95, AB 15:85, AB 50:50 and AB 70:30 (see figure 2.c). The samples were made by mixing the two types of oils together by constant temperature magnetic stirrer S10-3 operating at 40°C until uniformity is observed in color and texture as shown in the process flow diagram 1. The low temperature processing of oil samples was implemented to enhance mixing and at the same time reduce the undesirable changes.

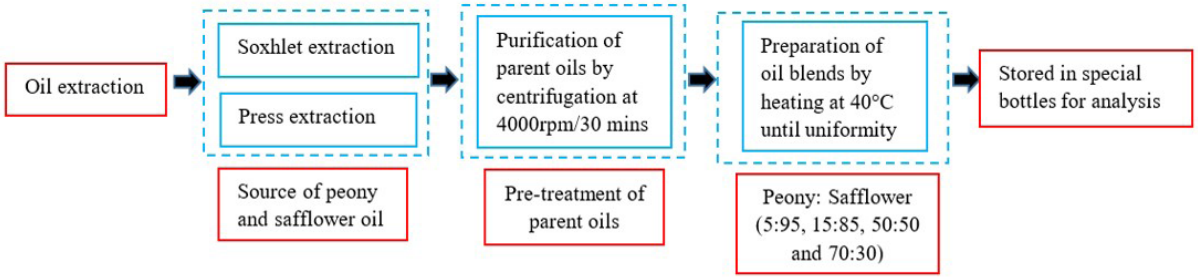

Figure 1: Process flow diagram of oil blending model

Fatty Acid Analysis

FAME's analysis (formed through prior esterification reaction) was carried out with GCMS using Agilent technologies 7890B Gc system with HP5 (30 m × 0.25 mm × 0.25 µm) capillary column. Four different samples were analyzed for fatty acid composition AB (5:95, 15:85, 30:70, and 50:50). For the analysis of fatty acids, first we need to convert the fatty acids into FAME fatty acid methyl ester also called the methylation. The method used by He and Xia (He & Xia, 2007) with a slight modification was used to convert the fatty acids into their respective methyl esters. 0.2g oil blend was weighed in a 10 mL volumetric flask with volume added. The ratio of 1:1 ether to petroleum ether is 2 mL to dissolve it fully. Then add 1 mL KOH-CH3OH solution with concentration of 0.4 mol. L-1. Shake well and then stand for 20 minutes. Add distilled water to the scale line and lay down. Remove the upper liquid and add 2mg anhydrous sodium sulfate. After standing overnight any fragments of water was absorbed. 0.25ml sample was taken through syringe and 12.25ml (50times) petroleum ether was added to dilute it 50 times. Filtered through 0.45 micro porous membrane into vials. BF3 method has also been successfully used in the past research to convert oil samples into FAME using NaCl, methane and hexane for GCMS analysis (Hadaruga *et al.*, 2008).

Formula (% FA= Peak area of individual FA / sum of peaks of all FA × 100) was used to determine the individual contents of each methyl ester

GC-MS Protocols

Chromatography column specification: HP-5 (30 m × 0.25 mm × 0.25 µm) capillary column; carrier gas: high purity helium with 99.999% purity; column flow rate: 1 mL · min-1; column temperature program: initial temperature 100℃, hold for 3 min, rise to 190℃ at a rate of 7℃ · min-1, hold for 15 min, then increase to 260℃ at a speed of 10℃ · min-1, hold for 8 min; split ratio 10: 1; The sample port temperature is 260℃, the interface temperature is 260℃; the injection volume is 1.0 µL. Mass spectrometry conditions: electron source (EI) ionization energy source: 70 eV; EM voltage: 1788 V; ion source temperature: 230°C; quadruple temperature: 150°C; mass scan range: 27-600 amu (Hadaruga *et al.*, 2008).

Approximately 15-20 g of each blend was heated to 130 degrees Celsius, cooled in ice water with continuous stirring. After the blends reach at a temperature of 10°C over the cloud point, mixing was done consistently and quickly in roundabout movement to forestall super cooling and hardening of fat crystals on sides or the base of the bottle. Now, the container was keenly checked for the presence of any kind of clouds (thermometer will no longer be visible) (AOCS Official Method Cc 6-25) (AOCS, 1993).

Cold Stability Test

About 15-20 g of mixed oil were filtered and then transferred to separate clean bottles with tags. The bottles were totally full of the sample and lid closed tightly. The bottles were then immersed in ice bath at 7 degrees centigrade. After 2 and 5.5 hour, all the samples were determined for their clarity. The clarity in the oil samples indicate that the oil is stable at cold storage (AOCS Official methodology Cc 11-53)(AOCS, 1993).

Iodine Value

Around, 0.130 g of all the blended oil were weighed accurately into separate 500 ml round shape flask closed with glass stoppers. A flask containing no oil (blank) was prepared. Around 15 ml of cyclohexane and acidic acid solutions were added and completely mixed in a portion of 1:1, then added into the sample and blank flask. Then, 25 ml of Wij's solution was poured to each flask and that they were tightly closed with glass stopper and appropriately shaken to blend. All sample flasks were then left to stand in dark for around 60 minutes. Then, 20 ml of potassium iodide and 150 ml of distilled water were poured to release the iodine from un-reacted iodine monochloride. Eventually, the samples were carefully titrated with sodium thiosulphate till yellow colour was almost disappeared before 1-2 ml of starch solution was added as an indicator and titration was proceeded. Analysis was completed once blue shade of starch solution was totally vanished. (AOCS method Cd 1d-92, 1993b)(AOCS, 1993).

Peroxide Value

Roughly 5 g of all the blended oil were gauged and place into 250 ml round shape flask. Firstly, a no oil containing blank flask was prepared. A 30 ml blend of solvent acetic acid chloroform was added to each flask and left to stand for 60 seconds with occasional swirling. At this point, accurately weighed 30ml of distilled water was added.

Prepared mixture was then titrated with 0.1N of sodium thiosulphate till brown colour is acquired and 0.5ml of 1 chronicles starch solution was added and titration went on till the grey/bluish colour was disappeared. The blend ought to be vivaciously shaken all through titration to ensure all the iodine is freed from the chloroform layer (AOCS method Cd 8-53, 1993c)(AOCS, 1993).

Free Fatty Acid Value (FFA)

According to the research work of (McClements, 2007), the presence of free fatty acids (FFA) will accelerate the adverse processes affecting the quality of fats, i.e., they will contribute to rancidity and deteriorate oil quality. The acid value is analyzed directly through titrating the oil/ fat in an alcoholic Medium against standard potassium hydroxide/sodium hydroxide solution. Roughly 28.2 g of all the blends were weighed and put into 250 ml conical flask. Then, the oil sample was mixed with 50 ml 99% isopropanol and completely dissolved. In the end, the mixture was titrated with 0.1N sodium hydroxide solution. Phenolphthalein was then used as an indicator. The last drop was found when the Color of our indicator was changed to Pink and lasted for at least 30 second. The results are calculated using the equation: Acid value = [(A-B) (0.1) (56-.1) / W

Here, A= Titrant volume used to change the Color

B= Titrant volume used in blank

N= Titrant normality (0.1N)

56.1= mol. weight of KOH

W= sample weight in grams

RESULTS AND DISCUSSIONS

Fatty Acid Analysis

According to table 1, fatty acid assessment via GCMS method detected 17 fatty acids in all the oil blends however not every fatty acid plays role in the formation of healthy oil except those placed in the polyunsaturated category. Our analysis via figure 2 (a) and 2 (b) shows that sample AB 15:85 peaks the percentage of oleic acid at 29.86% followed by AB 50:50 (24.77%), AB 5:95 (20.15%) and AB 70:30 (2.33%) respectively. Concerning with linoleic acid, AB 5:95 shows the highest content at 58.18% and AB 70:30 has the lowest with 49.16%. AB 70:30 shows highest improvement in linolenic acid with 39.03% and lowest of which was noted in AB 15:85 with 3.59 %. Surge in the content of linolenic acid in AB 70:30 is due to the fact highest ratio of peony oil (70%) was blended in this sample; peony seed oil naturally contains high levels of linolenic acid which is reflected in the results. Sample AB (5:95) contains high proportions of dietary linoleic acid (omega-6) 98% due to the fact that this sample contains 95% of the safflower oil. The overall profile of fatty acids was thus modified after blending.

For an ideally healthy vegetable oil blend, WHO has proposed three major guidelines including the ratios of SFA, MUFA and PUFA were set as 1:1.5:1, antioxidant presence and 5-10:1 of omega-6 and omega-3 fatty acids (WHO. Interim summary, 2008). Nutritional value of individual peony seed oil and safflower oil lacks certain health promoting fatty acids which are met by blending technique. Recent studies have shown an elevated deviation in the intake levels of SFA and omega-6 fatty acids among the population deficient in one of more essential fatty acid resulting in health issues like obesity, diabetes and cardiovascular disease (Rabail *et al.*, 2021; Simopoulos, 2004) . From this perspective, our results shown tremendous improvement in the modification of PUFA attaining the healthy oil status.

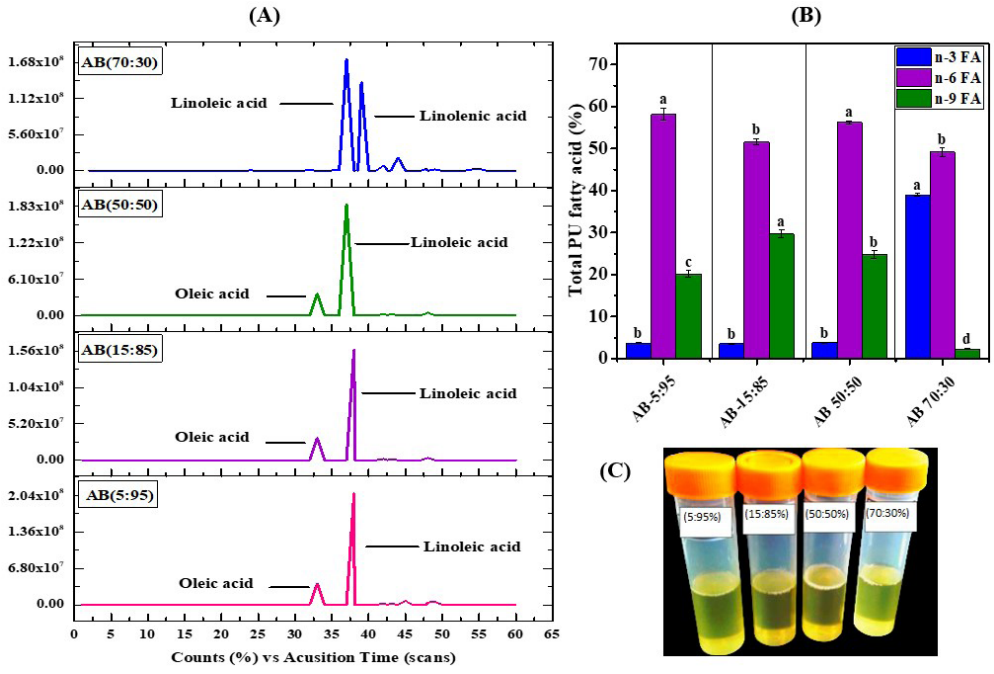

Figure 2: (a) GCMS chromatogram of total fatty acids in the oil blends, (b) ratio of polyunsaturated fatty acids (PUFA, omega-3, omega-6 and omega 9) at different blendding ratios, (c) physical apperance of oil blends at 5:95, 15:85, 50:50 and 70:30

Table 1: Total fatty acids in sample AB 5:95, 15:85, 50:50 and 70:30

Oil blend	Fatty acid methyl ester	Retention time	Peak area	CAS number
AB 5:95	Methyl tetradecanoate	24.072	541199	124-10-7
	9-Hexadecenoic acid, methyl ester, (Z)-	32.884	362210	1120-25-8
	Hexadecanoic acid, methyl ester	33.671	39818405	112-39-0
	Linoleic acid, methyl ester (ALA)	38.013	208079162	1000336-44-2
	9-Octadecenoic acid, methyl ester, (E)-	38.101	72071910	1937-62-8
	Linolenic acid, methyl ester	38.108	13438928	112-61-8
	cis-13-Eicosenoic acid, methyl ester	42.056	2753323	1000333-52-1
	Eicosanoic acid, methyl ester	42.594	2676298	1120-28-1
	9-Octadecenamide, (Z)-	43.419	7459411	301-02-0
	13-Docosenoic acid, methyl ester	47.092	4196320	56630-69-4
	Methyl 20-methyl-heneicosanoate	47.833	6242189	1000336-47-4
AB 15:85	9-Hexadecenoic acid, methyl ester, (Z)-	32.87	170916	1120-25-8
	Hexadecanoic acid, methyl ester	33.657	31906002	112-39-0
	Linoleic acid, methyl ester (ALA)	37.985	158143075	1000336-44-2
	9-Octadecenoic acid (Z)-, methyl ester	38.087	90965710	112-62-9
	9-Octadecenoic acid, methyl ester, (E)-	38.174	4915274	1937-62-8
	Linolenic acid, methyl ester	38.104	11021318	112-61-8
	cis-13-Eicosenoic acid, methyl ester	42.051	1894740	1000333-52-1
	Eicosanoic acid, methyl ester	42.59	1672228	1120-28-1
	13-Docosenoic acid, methyl ester	47.084	2164436	56630-69-4
	Methyl 20-methyl-heneicosanoate	47.825	3558276	1000336-47-4
AB 50:50	Methyl tetradecanoate	24.062	471065	124-10-7
	Methyl hexadec-9-enoate	32.87	231619	10030-74-7
	Hexadecanoic acid, methyl ester	33.662	36538110	112-39-0
	Heptadecanoic acid, methyl ester	36.507	184353	1731-92-6
	Linoleic acid, methyl ester (ALA)	37.995		1000336-44-2
	9-Octadecenoic acid, methyl ester, (E)-	38.091	82214057	1937-62-8
	Linolenic acid, methyl ester	38.105	12561088	112-61-8
	cis-13-Eicosenoic acid, methyl ester	42.051	2497378	1000333-52-1
	Eicosanoic acid, methyl ester	42.59	2405171	1120-28-1
	13-Docosenoic acid, methyl ester	47.084	3221531	56630-69-4
	Methyl 20-methyl-heneicosanoate	47.825	4971794	1000336-47-4
AB 70:30	Methyl tetradecanoate	24.053	648373	124-10-7
	Methyl hexadec-9-enoate	32.87	1100899	10030-74-7
	cis-10-Heptadecenoic acid, methyl ester	35.941	382814	1000333-62-1
	Heptadecanoic acid, methyl ester	36.503	451089	1731-92-6
	Linoleic acid, methyl ester (ALA)	37.99	173518073	1000336-44-2
	Linolenic acid, methyl ester	38.105	137762442	301-00-8
	9-Octadecenoic acid, methyl ester, (E)-	38.183	8240079	1937-62-8
	Methyl stearate	38.556	20453087	112-61-8
	cis-13-Eicosenoic acid, methyl ester	42.046	3114290	1000333-52-1
	Eicosanoic acid, methyl ester	42.59	2047920	1120-28-1
	13-Docosenoic acid, methyl ester	47.084	1924651	56630-69-4
	Docosanoic acid, methyl ester	47.825	3289072	929-77-1

Cold Test Analysis

From the table 2 and figure 3, all the four samples AB (5:95, 15:85, 50:50 and 30:70) passed the cold test analysis. The parent sample oils safflower oil and peony seed oils also passed the test, the results in clarity of samples shows efficient centrifuge and purification method which led to a stable storage life of the oil. The resistance against the oxidation was seen to be improved in all the samples due to newly formed polyunsaturated ratios and blending caused enhancement in many useful traits linked to nutritional quality and stability against oxidation. Results show that all the oil samples have reliable storage capabilities and can withstand low temperature without forming the ice.

Table 2: Cold test analysis results of blends

Percent Oil	Results
Safflower oil	Passed
Peony oil	Passed
5:95	Passed
15:85	Passed
50:50	Passed
30:70	Passed

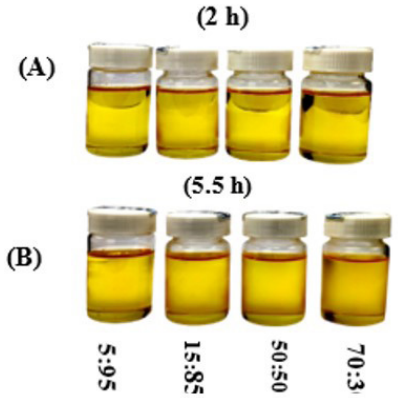

Figure 3: Physical appearance of oil blends exposed to cold setting. (a) blends observed for clarity after 2 hours, (b) blends observed for clarity after 5.5 hours. No signs of crystals were observed

Cloud Point Analysis

Cloud point is a measure of resistance against the cloudiness, it is a point at which oil is no longer fully soluble to find out its natural resistance towards a low temperature. Figure 4 (b) illustrates the cold points of parent oils and post blended oil mixtures. Findings uncover that safflower oil has the lowest cloud falling around -4.16 ± 0.2 while peony oil's cloud point temperature was recorded as highest at 5.0 ± 0.4 in comparison to other blends. However, the post blending values were significantly enhanced with an increasing trend of cloud point temperature with the increase in peony oil. Among the blended oils, AB 5:95 shows the lowest value -2.0 ± 0.1 and AB 70:30 peaks the cloud point value at 4.5 ± 0.5 shown in figure 4 (a).

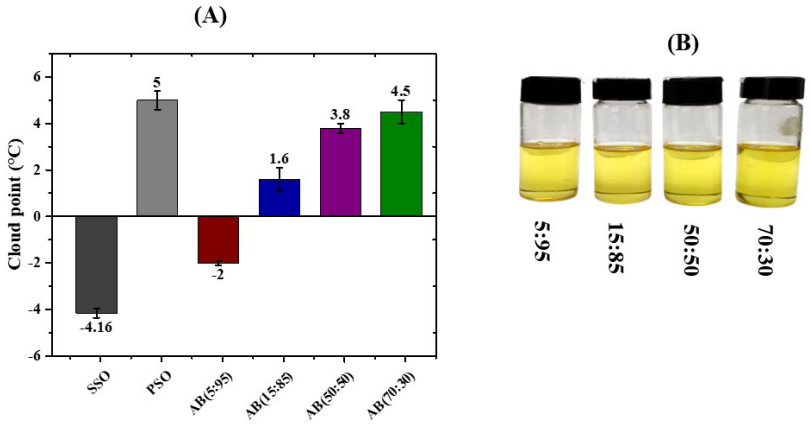

Figure 4: (a) Cloud point temperature of oil blends, (b) physical appearance of oil blends examined at 10°C above the cloud point for visible hardening of fat crystals

Table 3: Iodine value, Peroxide value and free fatty acid values of oil blends

Oil samples	Iodine value (IV) (gl_2/100g)	Peroxide value (PV) ($meqO_2$/kg)	Free fatty acid value (FFA %)
Safflower seed oil	130.583 ±1.45[a]	5.742 ±0.17[ab]	0.389 ± 0.03[a]
Peony Seed oil	113.634 ±2.92[c]	1.568 ±0.45[d]	0.141 ±0.07[c]
AB 5:95	113.230 ±4.01[c]	3.109 ± 0.37[c]	0.271 ± 0.04[b]
AB 15:85	116.810 ±5.11[c]	3.181 ±1.18[c]	0.150 ±0.00[c]
AB 50:50	119.974b ±8.73[c]	4.808 ± 0.92[b]	0.140 ±0.00[c]
AB 70:30	127.248 ± 2.62[ab]	6.078 ±0.31[a]	0.122 ±0.00[c]

All these values are shown as mean ± standard deviations (n = 3)

**All small letters (a, b, c and d) are indicators of significant different (p <0.05) among blended samples*

Peroxide Value (PV)

Peroxide value or PV is a useful tool helps in the assessment of oxidation of lipids in the early stages as a result peroxide are formed which gives the degree of oxidation of lipids. MUFA and PUFA present in the oils are highly prone to the process of oxidation leading to the formation of undesirable taste and odor (Marina *et al.*, 2009). From the table 3, peony oil showed the highest peroxide value 29.909 meqO2 /kg and lowest PV value is shown by sample AB 5:95 with 11.367 meqO2 /kg. In the present research, it was noted that increase in linolenic acid would increase the peroxide value due to the reason peony seed oil has notable content of linolenic acid. Research work of (Abdulkarim *et al.*, 2010) also indicated that oils with raised contents of linolenic acid should have higher peroxide values. PV values in the present study also increased with the increase in peony oil content in the blends. Higher the percentage of safflower in blend lower will be the peroxide value indicates the presence of natural antioxidants which assist the oils to combat against the oxidation. Furthermore, the past study by (Freeman, 2005) found that peroxide values of oils gradually rise after they come in contact with the atmospheric oxygen. The presence of traces of heavy metals in oils will also notably enhance the peroxide value in oils(Siddique, 2010).

Free Fatty Acid Value (FFA)

Total free fatty acid or FFA is estimated by amount of alkali added to oil sample in order to render it quite neutral. FFA value is measure of rancidity already imparted in the oil samples. When the glycerol are further converted into fatty acids is known as hydrolytic rancidity. Reference to table no 3, FFA values of Parent safflower oil and peony oil were found to be (0.389 ± 0.0 %) and (0.141 ±0.0 %). Acid value shows considerable improvement in the physiochemical properties of the blends and all samples passed the FFA test (value>0.5). Blend AB 70:30 containing lowest content of sunflower oil has the least FFA value recorded (0.122 ±0.0) among the oil mixtures while AB 5:95 with highest value of safflower oil has shown the highest value (0.271 ± 0.0). Samples experience an overall increment in their FFA values when the percentage of safflower is raised among them. Small difference in FFA among oil samples is an indication of significant degree of refining process exhibiting good keeping quality and suitable for frying purpose. Overall, the results reflect success in carrying out this research and by data it is proved that peony seed oil and safflower if blended at an appropriate percentage, have tendency to provide modified results with enhanced physiochemical properties.

CONCLUSION

Our findings enabled the integration of merits of two oils in a single blend with balanced ratio of different fatty acids while retaining the natural flavor and nutritive value. Outcomes of this research show that blending high omega 3 peony seed oil with high omega 6 safflower seed oil at AB 30:70 had significantly improved their polyunsaturated fatty acid profiles with n-6 (49.16%) and n-3 (39.03%) and n-9 (2.33%) respectively which not only promote health but also lead to many useful changes in the physiochemical properties. This blended oil showed noteworthy highest iodine value of 127.24 g I2/100g, substantially lower peroxide of 6.07 meqO2/kg, and lowest free fatty acid of 0.122% in contrasted with other blends. Therefore, it is recommended for daily usage for frying and can be kept in storage over a long period of time.

Acknowledgements

The authors express their gratitude to the Department of Tea and Food Science & Technology at Anhui Agricultural University in China for their assistance and support in conducting this research. The author extends special thanks to Anhui grain processing and grading laboratory for granting the permission to use their lab equipment during the extraction process.

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APPENDIX

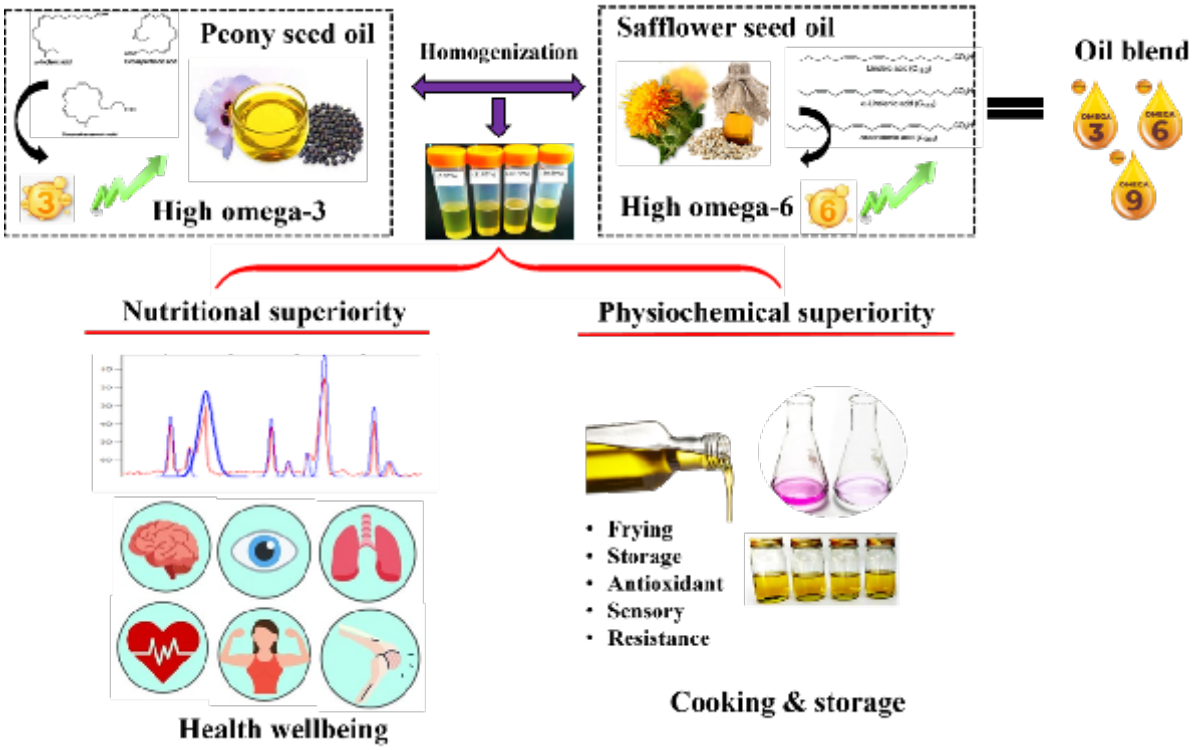

Figure 1: Study findings of high omega-3 PSO and high omega-6 SSO blends shows superiority in nutritional and physiochemical attributes