Extraction and Characterization of Edible Oil from *Presea americana* Mill (Avocado Pulp)

Mya Mya Sainn[1], Thae Eain Si Soe[2], Hnin Hnin Than[3]

Abstract

This research work performed studies on the extraction of oil using the cold pressed method from *Presea americana* Mill. The maximum percent yield of oil that could be extracted from the fully ripened fruits (561.2 g) was found to be 23.7%. The chemical, physical, and antioxidant properties of the avocado pulp and extracted oil have been investigated. The preliminary phytochemical tests of the avocado pulp (before and after extraction of oil) and extracted oil were carried out by the reported test tube method. The organic constituents of the extracted oil were characterised by the GC-MS spectroscopy method, and nine constituents were identified.

Keywords: Persea americana Mill, Antioxidant properties, GC-MS spectroscopy, edible oil

Introduction

Persea americana Mill. (avocado) was domesticated in Mesoamerica, where archaeological sites in Cuscatlán (in the region of Tehuaca´n, Puebla State, Mexico) document human consumption as far back as approximately 8000–7000 BC (Wolstenholme and Whiley, 1999). The avocado was cultivated and domesticated by the first Mesoamerican cultures (The Mokayas), who must have transmitted this practice to later cultures such as the Mayas and Olmecs (Galindo-Tovar *et al*., 2007). The avocado (Persea americana) is a tree native to Central America and Mexico, commercially valuable, and cultured in humid and Mediterranean climates throughout the world, family Lauraceae and Persea genus (Koller, 1992). The avocado is assumed to have originated in Mexico and Puebla. They have a green-skinned, fleshy body that may be pear shaped or spherical-egg-shaped. The avocado fruit is widely regarded today as an important fruit for its nutritional value, as it is rich in vital nutrients for the human body. There has recently been an increasing demand for antioxidants, given their beneficial effects on human health. Avocado fat consists predominantly of monounsaturated oleic acid, which has been found to reduce harmful low-density lipoprotein cholesterol, while maintaining beneficial high-density lipoprotein cholesterol, and to perform better than typical low-fat diets (Fulgoni *et al*., 2013). Avocado fruit has a multipurpose value as food, medicine, a source of high-quality oil, and numerous industrial uses (Bergh, 1992). The edible fleshy part of avocado is among the most nutritious of all salad fruits. Although avocado is primarily consumed fresh, a substantial increase in the use of avocado based products (e.g., guacamole) and oil for cosmetics and culinary purposes also suggests further market growth (Bost *et al*., 2013). The aim of the present research is to find out the chemical and physical properties of the extracted oil from the pulp of avocado fruits intended to be used as edible oil. This is accomplished by analysing the avocado pulp extracts and edible oil for antioxidant activity, figuring out the physicochemical properties of the extracted edible oil, and identifying the chemical compounds in the edible oil.

[1] Dr, Associate Professor, Chemistry Department, Dagon University
[2] MSc Student, Chemistry Department, Dagon University
[3]Dr, Professor & Head, Chemistry Department, Dagon University

Materials and Methodes

Collection and Preparation of samples

The sample collected from the local market originally came from Taunggy Township, Shan State. The collected samples were cleaned thoroughly with water, cut into small pieces, and air dried at room temperature. The dried samples were ground into a fine powder by using a grinding machine. Then, this powder sample was stored in an airtight container. The dried, powdered sample was used for chemical and biological investigations. The well-ripened avocado fruits are chosen for the extraction of edible oil.

Extraction of oil from *Persea americana* Mill. Pulp by the cold-pressed Method

The well-ripened avocado fruits were used to extract the oil. Fruit was washed, dried, and de-stoned, and the weight of the pulp was noted. The pulp was then mashed until a smooth paste was obtained, and it was left to dry naturally for two to four days in a well-ventilated area. Cold pressing is used to extract the avocado oil from the dry avocado paste at room temperature. The oil samples were weighed, stored in brown bottles, and used for the determination of physicochemical properties and composition.

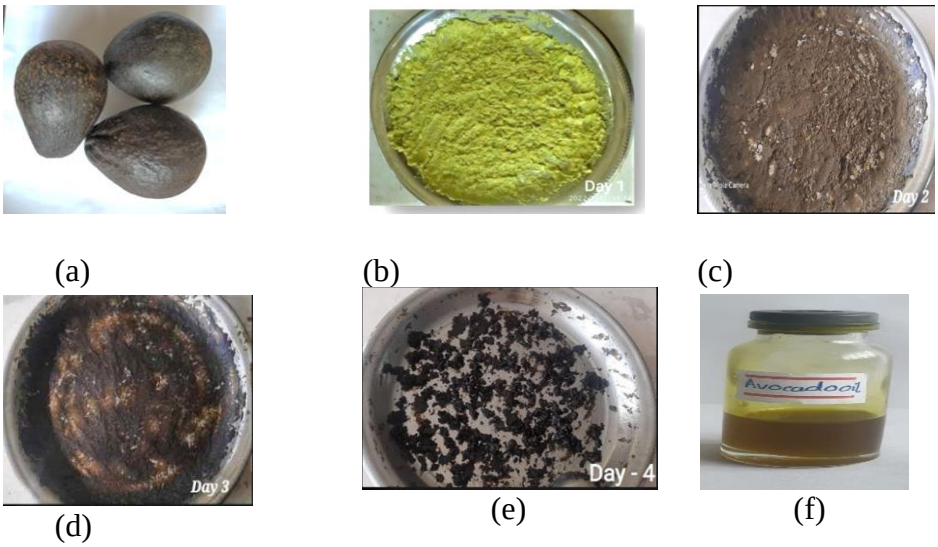


Figure 2. Extraction process of avocado oil from *Persea americana* Mill. pulp: (a) well-ripened fruits paste dried (b) at first day (c) at second day (d) at third day (e) on the fourth day in a well-ventilated area, and (f) the extracted oil

Preliminary Phytochemical Investigation of *Persea americana* Mill. Pulp and Extracted Oil

The air-dried powder sample, the extracted oil, and the pulp powder after extraction of oil were subjected to preliminary phytochemical tests to find out the types of phyto organic constituents present in the samples. A preliminary phytochemical test for *Persea americana* Mill. pulp was carried out by the reported methods to investigate the presence and absence of phytochemical constituents such as alkaloids, α-amino acids, carbohydrates, cyanogenic glycosides, flavonoids, glycosides, organic acids, phenolic compounds, reducing sugars, saponins, starch, steroids, tannins and terpenoids (Harborne, 1993).

Determination of Physicochemical Properties of Extracted Oil from *Persea americana* Mill. Pulp

The AOAC method was used to determine the physicochemical properties of the oil extracted from *Persea americana* Mill. (Avocado), including moisture

content, saponification value, average molecular weight, acid value, free fatty acid, density, iodine content, and peroxide value. All the parameters determined were to meet the requirements for the physicochemical properties of edible oil.

Determination of Antioxidant Activity of *Persea americana* Mill. Pulp and Extracted Oil by DPPH Free Radical Scavenging Assay

The radical scavenging activity of DPPH is widely used to assess antioxidant efficacy within a very short time and is considered a good in *vitro* model. In this experiment, the antioxidant activity of ethanol and watery extracts of *Persea Americana* pulp and extracted oil was determined by DPPH free radical scavenging assay (Basma *et al*., 2011). DPPH free radical scavenging activity was determined by the UV-visible spectrophotometric method at 517nm. The method for determining the antioxidant activity of edible oil is identical to the methods used to determine the pulp's ethanol and watery extracts; the only distinction is that acetone is used as the solvent in place of ethanol. Ascorbic acid was used as a standard antioxidant. The radical scavenging activity (RSA) was calculated as a percentage of DPPH discolouration. The antioxidant activity (IC_{50}) is expressed as the test substance concentration (µg/mL) that results in 50% oxidative inhibition of the substance.

Characterization of Edible Oil from *Persea americana* Mill. Pulp by GC-MS Spectrometry Method

Gas chromatography-mass spectrometry (GC-MS) is a method that combines the features of gas chromatography and mass spectrometry to identify different substances in a test sample (Robert and Webster, 1998). For the identification of organic constituents in *P Americana* M. pulp oil, GC-MS is one of the hyphenated analytical techniques. Organic constituents in the edible oil of *P Americana* were detected by the GC-MS Spectrometric Method (PerkinElmer Clarus 680 GC and Clarus 600 MS) at the Department of Research and Innovation, National Analytical Laboratory.

Results and Discussion

Extraction of oil from *Persea americana* Mill. Pulp By Cold Pressed Method

The oil was extracted from the well ripened avocado fruits by cold pressing at room temperature. The fruit's maturity had a significant impact on the yield percentage of oil. In an evaluation with 670 g of fresh, well-ripened avocado paste, the highest yield percentage of extracted oil was found to be 23.7% (158.79 g). The oil was a yellowish green colour when extracted, which was attributed to a high level of chlorophyll and carotenoids. The extracted oil has a pronounced flavour and aroma of avocados. The extracted oil was found to have characteristics that were like those of avocado extra virgin oil and virgin oil in terms of flavour, colour, and aroma.

Preliminary Phytochemical Investigation of *Persea americana* Mill. Pulp and Extracted oil

Preliminary phytochemical tests were carried out using the reported test tube method. The results of these investigations revealed that whereas tannins and starch were absent from the pulp samples (both before and after oil extraction), alkaloids, amino acids, carbohydrates, flavonoids, glycosides, phenolic compounds, reducing sugar, saponins, and terpenoids were all present. The phytochemical components in the pulps before and after oil extraction are identical. The extracted oil contained alkaloids, flavonoids, glycosides, phenolic compounds, reducing sugar, saponins, and

terpenoids. Absent from the sample were starch, tannins, amino acids, and carbohydrates. The extracted oil from avocados is free of carbohydrates and amino acids, in contrast to the pulp.

Determination of Physicochemical Properties of Extracted Oil from *Persea americana* Mill. Pulp

The physicochemical properties of the extracted oil were performed by standard AOAC method. The moisture content of oil was found to be 0.11 %, like that of extra virgin oil and virgin oil. The saponification valve of oil was observed at 199.15 mg KOH/g oil, which corresponded to the range of avocado oil in AOCS. The average molecular weight of oil was 845 g/mol. The acid value and free fatty acid percentage of extracted oil were observed as 1.91 mg KOH/g oil and 0.96%, which correspond to the free fatty acid of avocado virgin oil (0.8–1.0%). The extracted oil had a density of 0.89 g/mL, which is comparable to that of olive oil and its properties are like the density of avocado virgin oil (0.8639g/mL). Following the measurement of the iodine value, 74.4 gI_2 was found in the extracted oil. This outcome is in line with avocado oil's iodine value range of 65–95gI_2/100g of oil. The iodine value reflects the degree of unsaturation of the fatty acids in oils, and the results of the analysis indicated that the extracted oil has a high degree of unsaturation. The extent of oxidative activity in oil must be estimated by the peroxide value. In the determination of peroxide value, the extracted oil was found to have 2.67 meq/kg of peroxide value. A lower number of peroxide values gives better oxidative stability, a good quality of oil, and a good preservation status. All the standards are based on the AOCS standard. All factors indicated that the quality of the extracted oil must be said to be that of fresh virgin oil and can be utilised as edible oil.

Determination of Antioxidant Activity of *Persea americana* Mill. Pulp and Extracted Oil by DPPH Free Radical Scavenging Assay

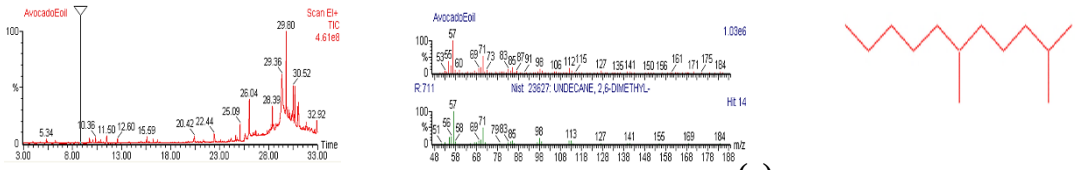
In antioxidant activity determination, the IC_{50} values were found to be 31.25 µg/mL for ethanol extract, 67.78 µg/mL for watery extract, and 27.98 µg/mL for extracted oil in *Persea americana* Mill. Pulp was given in table1. Among these results, the antioxidant activity of the extracted oil has been more effective than that of ethanol and watery extracts of avocado pulp. However, the antioxidant activity of the extracted oil did not surpass that of standard ascorbic acid (1.02 µg/mL). This study revealed that the extracted oil had good antioxidant activity.

Table 1. % Radical Scavenging Activity (% RSA) of Ethanol, Watery Extracts and Extracted Oil from *Persea americana* Mill. Pulp

Teste Samples	% RSA ± SD at Different Concentration (µg/mL)						IC_{50} (µg/mL)
	6.25	12.5	25	50	100	200	
Ethanol extract	35.0± 0.019	41.37± 0.005	49.61± 0.002	51.14± 0.004	52.29± 0.005	54.02± 0.005	31.25
Watery extract	4.67± 0.014	35.44± 0.003	37.73± 0.002	45.97± 0.007	57.27± 0.001	62.10± 0.002	67.78
Oil	5.18± 0.017	44.71± 0.083	46.56± 0.025	75.39± 0.026	84.65± 0.021	91.00± 0.013	27.98

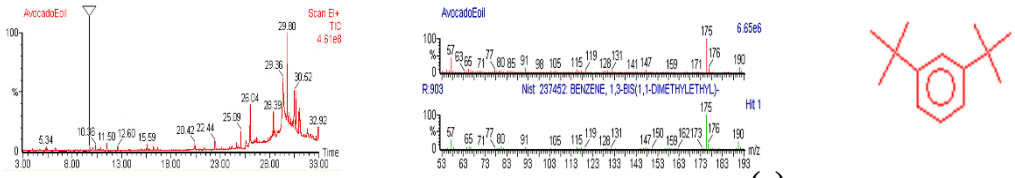
Characterization of Edible Oil from *Persea americana* Mill. Pulp by GC-MS Spectrometry Method

The organic constituents of extracted oil were characterised by the GC-MS spectroscopy method. The GC-MS analysis showed the presence of numerous compounds in the extracted oil of the *Persea americana* Mill. pulp by comparing their retention times (RT) and by interpreting their mass spectra. However, the Undecane, 2,6-dimethyl (MW = 184, RT = 8.83 mins), 1benzene 1,3 –bis (1,1-dimethylethyl) (MW = 190, RT = 9.74 mins), phenol 2.4-bis (1,1-dimethylethyl) (MW = 206, RT = 10.07 mins), dodecane 2,6,10-trimethyl (MW = 212, RT = 10.36 mins), and hexadecanoic acid (MW = 256, RT = 16.670 mins), 5-eciosene MW = 280, RT = 21.37 mins), 9.12-octadecadienic acid (MW = 280, RT = 22.44 mins), oleic acid (MW = 282, RT = 10.07 mins), and hexadecenoic acid methyl ester (MW = 270, RT = 10.07 mins) were identified in extracted oil. This analysis revealed that the extracted oil had a high concentration of unsaturated fatty acids.



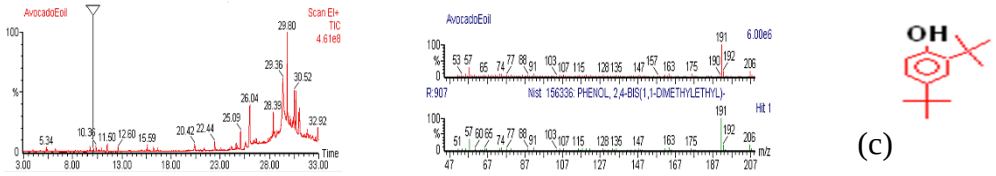
(a) (b) (c)

Figure 3. Identification of undecane (a) GC chromatogram (b) MS spectra and (c) structure of undecane of extracted oil at RT = 8.83 minutes



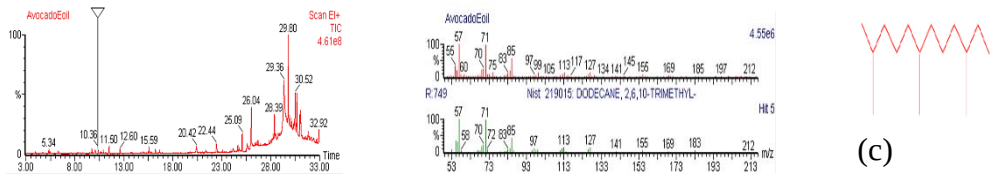
(a) (b) (c)

Figure 4. Identification of benzene 1,3-bis (1,1- dimethyl ethyl) (a) GC chromatogram (b) MS spectra and (c) structure of benzene 1,3-bis (1,1-dimethylethyl) of extracted oil at RT = 9.74 minutes



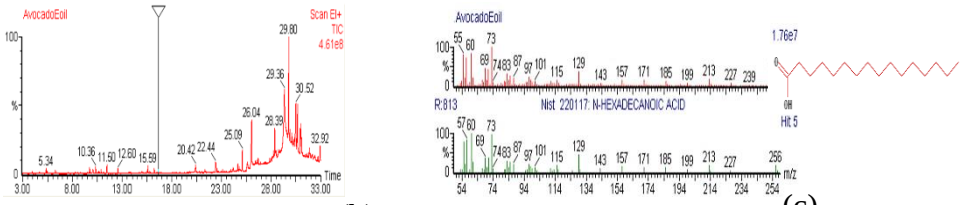
(a) (b) (c)

Figure 5. Identification of phenol 2,4-bis (1,1- dimethylethyl) (a) GC chromatogram (b) MS spectra and (c) structure of phenol 2,4-bis (1,1- dimethylethyl) of extracted oil at RT = 10.07 minutes



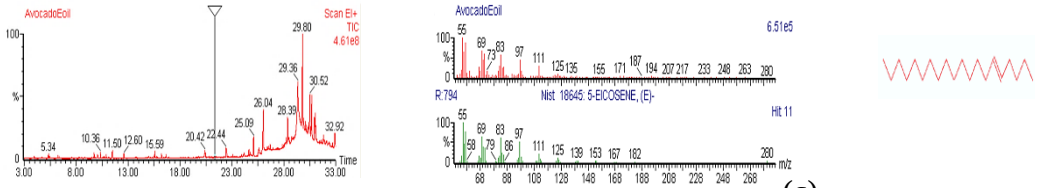
(a) (b) (c)

Figure 6. Identification of dodecane 2,6,10- trimethyl (a) GC chromatogram (b) MS spectra and (c) structure of dodecane 2,6,10- trimethyl of extracted oil at RT = 10.36 minutes



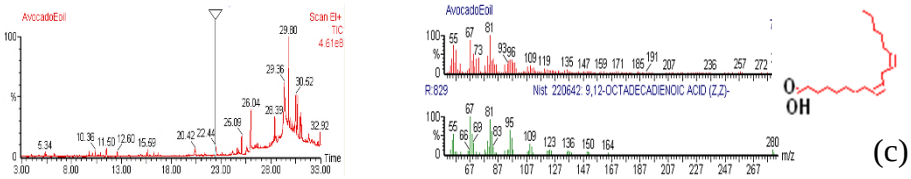
(a) (b) (c)

Figure 7. Identification of hexadecanoic acid (a) GC chromatogram (b) MS spectra and (c) structure of hexadecanoic acid of extracted oil at RT = 16.67 minutes



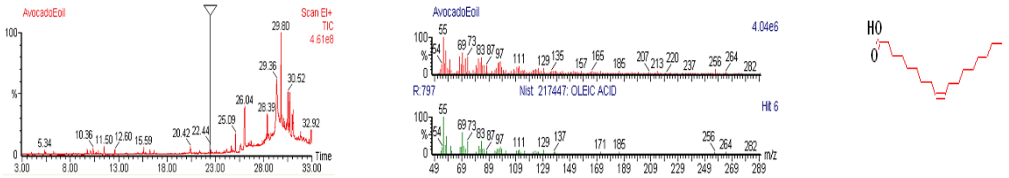
(a) (b) (c)

Figure 8. Identification of 5- eicosene (a) GC chromatogram (b) MS spectra and (c) structure of 5- eicosene of extracted oil at RT= = 21.37 minutes



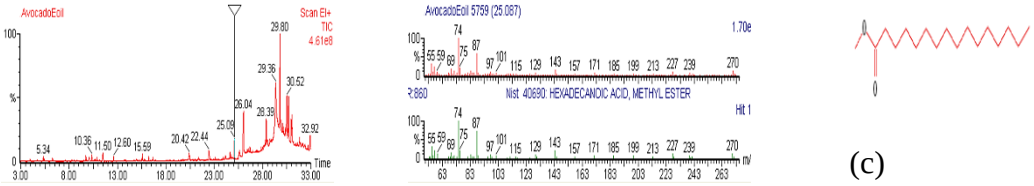
(a) (b) (c)

Figure 9. Identification of 9,12- octadecadienoic acid (a) GC chromatogram (b) MS spectra and (c) structure of 9,12- octadecadienoic acid of extracted oil at RT= 22.44 minutes



(a) (b) (c)

Figure 10. Identification of oleic acid (a) GC chromatogram (b) MS spectra and (c) structure of oleic acid of extracted oil at RT= 22.49 minutes



(a) (b) (c)

Figure 11. Identification of hexadecanoic acid methyl ester (Palmitic acid methyl ester) (a) GC chromatogram (b) MS spectra and (c) structure of hexadecanoic acid methyl ester (Palmitic acid methyl ester) of extracted oil at RT = 22.49 minutes

Conclusion

The avocado pulp is rich in phytochemical constituents, and it has been found that the extracted oil is a good, healthy type of oil free from carbohydrates. The extracted oil has good antioxidant activity, and its physicochemical parameters meet AOCS standards. Avocado pulp produced 23.7% of its weight in oil, proving that it is a reliable source of vegetable oil. The extracted oil from avocado pulp contains a lot

of unsaturated fatty acids, according to GC-MS analysis. Avocado pulp oil is a rich source of essential fatty acids and is safe and nutritionally beneficial for human consumption due to its high content of unsaturated fatty acids. The avocado oil is marketed in markets in many nations, and the avocado plants are already abounding in many states in Myanmar and can be produced as commodities.

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