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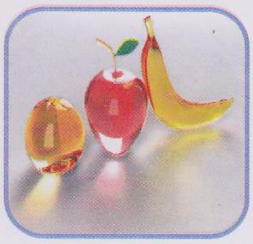

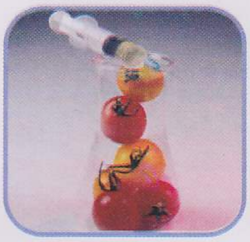

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A leading international science journal containing original research, peer scientific reviews of all basic and applied aspects of food science. The Editorial Mission of AJFST is to offer scientists, researchers, and other food professionals the opportunity to share knowledge of scientific advancements in the myriad disciplines affecting their work, through respected peer-reviewed publications.
The journal focuses especially on experimental or theoretical research findings that have the potential for helping the food industry to improve process efficiency, enhance product quality and, extend shelf-life of fresh and processed food products. Critical reviews on new perspectives to established processes, innovative and emerging technologies, and trends and future research in food processing. The journal also publishes short communications for rapidly disseminating preliminary results, letters to the Editor on recent developments and controversy, and book reviews.

Aims & Scope:
AJFST as the premier international publication of articles that publish cutting-edge high quality original papers concerning fundamental research in the fields of food Science, Food chemistry and Toxicology, biochemistry, food Microbiology and safety, Food Engineering and Physical Properties technology Sensory and Nutritive Quality of food from the beginning of the food supply source to the dinner table of the consumers.
These subject areas include food safety and quality, raw material composition of food, food laws and regulations, ingredients and ingredient functionality, nutraceuticals, product formulation, sensory science and strategies, quality assurance, statistical process control and its contribution to food processing operations, food chemistry and toxicology, food engineering, Food microbiology, food authenticity and food traceability, nutritive qualities of food, Food storage, food distribution and marketing that associated to practical experiments designed to improve technical processes and impact our understanding of health.
The work described should be innovative either in the approach or in the methods used. The significance of the results either for the science community or for the food industry must also be specified.

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The Effect of Homogenization Pressures on Extraction of Avocado Oil by Wet Method

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Abstract: Avocado tree usually planted by people of Indonesia in rural are small in scale. Mostly, in the modern and high scale industry especially company has a large avocado farm the extraction of avocado oil is extracted through vacuum drying in low temperature. However, in rural area avocado tree spread out in small number of tree, so it needs alternative method of avocado oil extraction. In this experiment, wet method of avocado extraction was applied similar to traditional extraction of coconut oil in rural area. Avocado meat was added some water and 0.05% of phosphate acid then homogenization pressure of 7 kg/cm^2, 71 kg/cm^2 and 176 kg/cm^2, then heated at 100°C until the emulsion of water-oil broken down and avocado oil, then, can be separated. Yield and characteristics of avocado oil were determined. The results showed when homogenization pressures increased from 7 kg/cm^2 to 71 kg/cm^2, the yield, Iodine value and Free fatty Acid of avocado oil were also increased, however, when homogenization pressures increased from 71 kg/cm^2 to 176 kg/cm^2 ($p>0.05$) there were no significant increased of Yield, Iodine value and Free Fatty Acid of avocado oil.

Keywords: Acid, avocado, emulsion, homogenization, vegetable oil, wet method extraction

INTRODUCTION

Avocado (*Perseaamericana* Mill.) is originally from Latin America. It is unusually high on oil, especially in its pulp. Later it was brought out of America to tropical and subtropical countries, becoming important crops in those parts of the world.

Avocado oil is obtained from its pulp (15 to 30% depending on the variety, (Hamzah, 2012). Almost all o the oil is concentrated in the pulp. There is very little oil in the seed, approximately 2% of its weight (Shahidi, 2005). Avocado oil contains oleic acid (C18:1, 69-74% of total FA-fatty acids), palmitic acid (C16:0, 9-13% of total FAs), palmitoleic acid (C16:1, 3-4% of total FAs), linoleic acid (C18:2, 10-14% of total FAs), linolenic acid (C18:3, 1-2% of total FAs), stearic acid (C18:0, 0.4-1% of total FAs), as well as desirable compounds like vitamins, phytosterols, chlorophyll and carotenes (Inturrisi, 2007; Choe and Min, 2006). Thus avocado oil is important high-oleic oil, making it as very good dietary cooking and salad oil. It is generally consumed in an unrefined state and therefore retains all of the natural unsaponifiable material, including valuable antioxidants. It is rich in chlorophyll, making it green before processing. After refining and bleaching, its color changes into emerald greenish-yellow (Swisher, 1988). Avocado oil plays positive roles in reducing risk of coronary heart disease, cataracts, diabetes, chemoprevention, prostate cancer and age-related macular disease (Ashton *et al*., 2006). Its use is not solely in food products, but also in cosmetics and personal care uses.

Due to its relatively high yield, avocado oil can be obtained by cold pressing the fruit pulp. Commercially, this method is the most economical way to extract the oil. But, solvent extraction is also able to get the oil out of its pulp, albeit not as good as cold pressing. The solvent has to be removed after extraction because its toxicity and odor. Another way to recover oil from the pulp is using centrifugation, but it is very expensive in small and medium scale, regarding amount of energy used to power the process (Swisher, 1988). Yet the oil is obtainable by using wet process, but researches related to this method are quite limited.

Avocado tree in Indonesia mostly spread over the land in small amount of plant. For a big scale of farm, most people like planting other than avocado. So it is hard to implement such a modern type of extractions. One of the methods of extraction is wet method which could be applied by the people that has some productive avocado tree.

The previous research showed that the yield of avocado extracted by wet method was lower than that by Soxhlet (Table 1). In the process of extraction by wet method, avocado slurry was heated at the temperature of 105°C. Relatively high temperature of 105°C was not enough to break down emulsion (Hamzah, 2012). In the avocado, there were not only water but also proteins and carbohydrates. Linkage of oil with proteins and carbohydrate made the emulsion and the linkage slightly hard to break down during heating.

By wet method and by Soxhlet of avocado extraction could get yield as following:

Table 1: The amount of avocado oil extracted by wet method and Soxhlet method

	Method of avocado oil extraction	
Yield (%)	Wet method	Soxhlet
	20.06	29.74

Table 2: Characteristics of avocado oil extracted by wet method and the Soxhlet

	Method of avocado oil extraction	
Characteristics	Wet Method	Soxhlet
Iodine value (Wijs),	78.0	76.4
Saponication Value	192	194
Acid value	1.72	1.77
Peroxide (milli-equivalents of peroxide per 1000 g oil)	3.3	3.5
Free fatty acid	0.84%	1.54%
Specific gravity at 25°C	0.918	0.917
Refractive index at 25°C,	1.493	1.499
Smoke point	181°C	181°C
Cloud point	-15°C	-15°C
Flash point	245°C	245°C
Unsaponifiable	1.58%	1.56%

In Table 2 there were not much differences characteristics of avocado oil between wet method extraction and the Soxhlet, except for free fatty acid. Free fatty acid of avocado extracted from wet method was higher than that from Soxhlet. The higher content of free fatty acid in avocado oil extracted from wet method probably due to hydrolysis of some fatty acid in which the process using relatively high temperature (105°C) (Hamzah, 2012).

METHODS AND MATERIALS

Wet method of extraction: Flesh part of avocado mixed with water with the proportion of 1:1 (w/w) and 0.05% of phosphate acid was added. The mixture then was homogenized by the use of blender (5000 RPM for 3 min) then homogenization pressure of 7 kg/cm^2, 71 kg/cm^2 and 176 kg/cm^2 were applied in order in the following processed to be much easier to break down water in oil emulsion. The homogenization mixture then was heated to 105°C until oil part significantly separated. And the data obtained could be used to determine the yield of avocado oil. After the oil has been obtained, yield was determined using the following Eq. (1). The oil then was characterized for Iodine value and Free Fatty Acid:

$$\%Y = \frac{W_{oil}}{W_{sample}} \quad (1)$$

%Y = Yield
W_{oil} = Percentage of oil obtained from the calculation that weight of oil
W_{sample} = Weight of avocado sample

RESULTS AND DISCUSSION

Yields: The data (Table 3) showed that the increased of homogenization pressure from 7 kg/cm^2 to 71 kg/cm^2, the yield also increased from 21.4 to 22.8% ($p<0.05$). However, there was no significant increased of yield when homogenization pressure applied from 71 kg/cm^2 to 176 kg/cm^2 ($p>0.05$).

Table 3: The effects of homogenization pressures on yield

	YLD[b] p>t	Comparison of all means		
HP[a] (kg/cm^2)	LSMEANS	1	2	3
7	21.4	-----	0.0001	0.0001
71	22.8		------	0.0624
176	23.2			-----

[a] Homogenization Pressure, [b]Yield (%)

Iodine value: The data (Table 4) showed that the increased of homogenization pressure from 7 kg/cm^2 to 71 kg/cm^2, the Iodine Value also increased from 21.4% to 22.8% ($p<0.05$). However, there was no significant increase of Iodine value when homogenization pressure applied from 71 kg/cm^2 to 176 kg/cm^2 ($p>0.05$).

Table 4: The effect of homogenization pressures on iodine value

	IOV[b] p>t	Comparison of all means		
HP[a] (kg/cm^2)	LSMEANS	1	2	3
7	79.3	-----	0.0001	0.0001
71	80.4		-----	0.0853
176	80.8			------

[a] Homogenization Pressure, [b]Iodine Value (Wijs)

The data (Table 5) showed that the increased of homogenization pressure from7 kg/cm^2 to 71 kg/cm^2, the Free Fatty Acid also increased from 21.4% to 22.8% ($p<0.05$). However, there was no significant increased of Free Fatty Acid when homogenization pressure applied from 71 kg/cm^2 to 176 kg/cm^2 ($p>0.05$).

Table 5: The effect of homogenization pressures on free fatty acid

	FFA[b] p>t	Comparison of all means		
HP[a] (kg/cm^2)	LSMEANS	1	2	3
7	1.28	-----	0.0001	0.0001
71	1.42		-----	0.0792
176	1.49			-----

[a] Homogenization pressure, [b]Free fatty acid

CONCLUSION

When homogenization pressures increased from 7 kg/cm^2 to 71 kg/cm^2, the yield, Iodine value and Free fatty Acid of avocado oil were also increased, however, when homogenization pressures increased from 71 kg/cm^2 to 176 kg/cm^2 ($p>0.05$) there were no significant increased of Yield, Iodine value and Free Fatty Acid of avocado oil.

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