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Extraction And Comparative Analysis Of Melon Seed Oil (Colocynthis Citrullus L) Using Different Extraction Methods

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Abstract: ***Melon seed is of the family of Cucurbitaceae and its oil is used in cooking and frying in some African countries. This research aims at comparing the traditional and laboratory (chemical) methods of extraction of the oil: Oil was extracted from melon seed and immediately analyzed for iodine value, peroxide value, free fatty acid, saponification value, specific gravity, refractive index, smoke point, flash point, melting point and fire point. Oil yield was 37.5% and 49.4% for traditional method and chemical method respectively. Chemical analyses result for traditional method was 6.12±0.01, 0.52±0.02, 193.5±1.05, 115.50±3.98 for peroxide, free fatty acid, saponification and iodine value respectively, while the result for chemical method was, 7.79±0.21, 0.63±0.02, 187.90±1.60, 127.20±0.90 for peroxide, free fatty acid, saponification and iodine value respectively. The results indicate that peroxide, free fatty acid and iodine values were lower in samples extracted using traditional methods as compared to the chemical method whereas the saponification value was higher in samples extracted using traditional methods as compared to the chemical method. The chemical method of extraction yields more oil, whereas the oil yield using traditional extraction methods is of better quality.***

Keyword: Extraction, Melon seed oil, Comparative analysis, Free fatty acid

I. INTRODUCTION

Melon seed is a member of the *cucurbitaceae* family. It is generally a grayish white hand shell with a white inner kernel, which is soft and oval in shape. The seed of melon are rich in protein, omega-3 fatty acid, vitamins. Nigeria is a country with variety of oil seed such as groundnut, palm fruit, soybean, melon seed and cotton seed. The economic importance of oil crops has made it necessary that they be properly investigated to ascertain their oil quality parameters since these parameters are the basis for marketing and processing seed oil. Vegetable oil is used mostly as shortening, margarines, salad and cooking oils and also in the manufacture of soap, detergents, paints, varnishes and for a variety of other industrial items. Oil is found in large amount in seeds of plants and occasionally in the fleshy part of the fruits like in olive and oil palm. Seed may contain 1-60% oil (Higgings, 2003).

Edible seed oils are important common food ingredients and fatty acid is primarily the nutritional component in it. There is growing evidence to support the different roles fatty acid play to support human health (Parry, 2004). However, this research aimed at extracting oil from melon seed (*Colocynthis citrullus l*) using both traditional method and chemical method, evaluation of the quality of the extracted oil and comparing the quality of both oil extract.

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II. MATERIALS AND METHOD

Melon seed (*Colocynthis citrullus L*) was obtained from the Owode market, Offa-Kwara State. Damaged and unhealthy seeds were removed and discarded followed by removal of contaminants: sand, stone and other extraneous materials. The seeds were dried before use. Quality parameter analysis was carried out using chemicals and solvents of analytical grade according to the method described by AOAC (1997).

OIL EXTRACTION

TRADITIONAL METHOD

Melon seed was de-hulled and weighed. The seed was roasted in open fire and winnowed to remove lighter coat. Then the seed was grounded using a mortar and pestle into a smooth paste. The paste was kneaded and hand-pressed to extract the oil. Boiling water was added in a little quantity, following each pressing operation. This process was repeated several times over a period of an hour to obtain the maximum oil yield. The oil obtained was boiled for 45 minutes to remove excess moisture and then cooled at room temperature, after cooling the oil was filtered using muslin cloth and packaged in an air tight container.

SOXHLET EXTRACTION

The dehulled and weighed melon seed was grounded using mortar and pestle and defatted using a soxhlet apparatus. The extraction was carried out using petroleum ether as a solvent. The process continued for 6hours. The oil obtained was boiled for 45minutes in order to enhance the evaporation of leftover solvent and then cooled at room temperature, after cooling the oil was filtered using muslin cloth and packaged in an air tight container.

ACID VALUE, % FREE FATTY ACID

The acid value of the oil was determined by dissolving 2g of oil sample in 50ml of solvent (25ml ethanol + 25ml ether) and titrated with 0.1M NaOH solution with the addition of 2drops phenolphthalein as indicator. The titration was carried out until a faint pink colour was observed.

$$\% \text{ FFA} = \frac{V \times M \times 2.82}{\text{Weight of sample}} \times 100$$

V= Volume of NaoH
M= Molarity of NaoH
2.82= Conversion factor for Oleic acid

SAPONIFICATION VALUE

The saponification value was determined by dissolving 1g of oil sample in 50ml of alcoholic KOH. Then a reflux condenser was attached to it and heating was done in boiling water for 1 hour with frequent shaking. After heating, titration was done with 0.5NHC and 2 drops of phenolphthalein indicator.

$$\text{Saponification value} = \frac{(b-a) \times M \times 56.1}{\text{Weight of sample}}$$

a= Titre value of oil
b= Titre value of blank
M= Molarity of HCL
56.1=Molecular weight of KOH

IODINE VALUE

Oil sample of 0.2g was weighed into a glass stopper bottle and 25ml of wijs solution was added with 25ml of 15% of KI solution. The bottle was agitated properly and then titrated with 0.1N OF $Na_2S_20_3$ solution, followed by constant shaking until the yellow color of iodine disappeared. The process was then terminated followed by vigorous shaking.

$$\text{Iodine value} = \frac{(B-S) \times N \times 0.1259}{W} \times 100$$

S = Volume of standard used
B = Volume of standard $Na_2S_20_3$, used for sample
N= Normality of the standard of $Na_2S_20_3$
W = Weight in (g) of the sample

PEROXIDE VALUE

Oil sample of 5g was weighed out and 50ml of glacial acetic acid and 40ml of chloroform was added with 1ml of distilled water and starch. The mixture was titrated with 0.1m of $Na_2S_20_3$ while shaking the flask until the blue colour of iodine was completely removed.

$$\text{Peroxide value} = \frac{(S-B) \times M \times 12.69}{\text{Weight of the sample}}$$

A = Titre value
B = Blank titre value
M = Molarity of $Na_2S_20_3$

REFRACTIVE INDEX

One gram of each oil sample was placed on the sample hold prism, of Abbe Refractometer (lovibond) and it was read through the eye piece. This was carried out as the refractometer light was put on to measure the amount of beam of light deflected when beam of light was passing through the oil sample under standard condition.

SPECIFIC GRAVITY

The empty bottle was weighed and recorded and water was put into the empty bottle weighed then recorded. The oil sample was put into empty bottle and the weight was also taken and later the difference between the weights was observed and recorded as the specific gravity of the oil sample.

$$\text{Specific gravity} = \frac{\text{weight of oil}}{\text{Weight of water at } 20^0\text{c}}$$

MELTING POINT

About 200ml of oil sample was frozen then heated and the temperature at which the last trace of solid melts was recorded.

SMOKING POINT

Oil sample of 200ml was measured into an open pan and heated over a glowing fire, until the oil gave off a thin bluish smoke. The thermometer was then used to measure the very cloudy smoke.

FLASH POINT

Oil sample of 200ml was measured into an open pan and heated over a glowing fire. Then the temperature at which the oil sample ignited and catches fire was determined with the thermometer.

FIRE POINT

Oil sample of 200ml was measured into an open pan and heated over a glowing fire. The temperature at which the oil sustained combustion was taken as the fire point and it was determined with the use of thermometer.

STATISTICAL ANALYSIS

Each parameter was determined in triplicates for each sample and the average values for each were expressed as mean±standard deviation.

III. RESULTS AND DISCUSSION

Sample	Weight of the materials(g)	Weight of the cake(g)	Volume of the oil extract(ml)	Percentage oil extract
A	1000	872	375	37.5
B	1000	511	494	49.4

A=Chemical B=Traditional

Table 1: Percentage oil yield

Type of test	Test	A	B
Chemical	Peroxide value	6.12±0.01	7.79±0.21
	Free fatty acid	0.52±0.02	0.63±0.08
	Saponification value	193.50±1.05	187.90±1.60
	Iodine value	115.50±3.98	127.20±0.90
Physical	Refractive index	1.4733	1.3233
	Specific gravity	0.914	0.902
	Flash point	148^0C	135^0C
	Melting point	8.0^0C	7.0^0C

Table 2: Physiochemical parameters of oil melon seed using two extraction methods

IV. DISCUSSION

OIL YIELD: Table I shows the percentage oil yield after extraction using the two methods to be 37.5 and 49.4% respectively. Sample B obtained using the chemical method had higher yield than the traditional method of extraction. The result agrees with the research conducted by Mirjana and Ksenija, (2005) which was ranging from 22.1-53.5%.

PEROXIDE VALUE (PV): Sample B had a higher PV than sample A as seen in the bar chart above and the result obtained i.e 6.12±0.01 and 7.79±0.21 agrees with that obtained by Mirjana and Ksenija (2005) which was 8.3±4.6. However, Dimberu, 2012 reported that high PV is an indication of the oxidative level hence the lower the PV, the better the oil which means that sample A is better than B in terms of quality. Also, deterioration due to oxidative rancidity will set in faster in sample B.

FREE FATTY ACID (FFA): Sample A and B both had low FFA values. This suggests low levels of hydrolytic and lipolytic activities. However, sample B will still undergo faster deterioration than sample A because of its higher values. Results obtained were lower than that reported by Oluba *et al. 2008* and Obasi *et al.* 2012 which was 3.2-3.8 and 1.03-3.18 respectively.

SAPONIFICATION VALUE: The result above indicates high saponification value in both samples. i.e 193.50±1.05, 187.90 ±1.60. However, sample A had higher saponification value than B. Results obtained agrees with the research conducted by Oluba *et al.*, (2008) and Obasi *et al* .,(2012) had higher values. The higher the saponification value, the higher the level of alkali required to neutralize the available free fatty acid liberated by the oil. Sample A will contain high amount of higher fatty acids than B.

IODINE VALUE: Higher iodine values were observed in sample A and B i.e 115.50±3.98 and 127.20±0.9. Oluba *et al.*, (2008) and Mirjana and Ksenija, 2005 reported similar result. The higher the iodine values, the more the unsaturated bonds and therefore high susceptibility to oxidative rancidity and deterioration. Therefore, sample A is of better quality than B.

REFRACTIVE INDEX, SPECIFIC GRAVITY, SMOKE POINT, FLASH POINT, AND MELTING POINT AND FIRE POINT: Results indicates very close refractive index and specific gravity between both samples. Similar result was reported by Oluba *et al.* (2008) ie (0.93 and 1.45 for specific gravity and refractive index respectively). The values for smoke point, flask point, melt point and fire point were also close for both samples.

V. CONCLUSION

Melon seed is a viable source of oil based on the oil yield from this study. Among the quality parameters evaluated sample A had lower values as compared to B except for saponification value, where sample B had higher values. The chemical method of extraction gave a higher yield but oil extracted using traditional method was of better quality judging from results obtained. This study provides more evidence on the quality of oil from melon seed using tradition method of extraction that is easy to come by as compared to the chemical method and this could encourage more of small scale production of oil using the traditional method.

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