ISSN: 0976-3031

*Available Online at http://www.recentscientific.com*

**CODEN: IJRSFP (USA)**

*International Journal of Recent Scientific Research*
*Vol. 9, Issue, 7(D), pp. 27979-27982, July, 2018*

**International Journal of Recent Scientific Research**

**DOI: 10.24327/IJRSR**

**Research Article**

# COMPARISON OF SOME PHYSIOCHEMICAL PARAMETERS BETWEEN MARKETED AND VIRGIN COCONUT OILS AVAILABLE IN BANGLADESH

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**DOI: http://dx.doi.org/10.24327/ijrsr.2018.0907.2370**

**ARTICLE INFO**

***Article History:***
Received 4th April, 2018
Received in revised form 25th May, 2018
Accepted 23rd June, 2018
Published online 28th July, 2018

***Key Words:***

Coconut oil, Quality, Parameters, APCC standard

**ABSTRACT**

Coconut (Cocos *nucifera*) is a very popular fruit in Bangladesh. It is used extensively for edible and non-edible purposes all over the world. Coconut has high oil content. Extraction of oil was carried out by soxhlet apparatus using n-hexane. Coconut oil has distinct yellow color, perceptible aroma. The main goal of this study was to investigate some physicochemical parameters of virgin coconut oil & some marketed refined coconut oils (e.g. Jui, Cute, Parachute and Gondhraj) and to make a comparison among these. The results shown that all the physicochemical data of the virgin coconut oil met with the APCC standard (APCC 2009). So, virgin coconut oil (VCO) can be used as a good source of purified natural oil.



## INTRODUCTION

Oil is the world most important fuel and underpins our high standard of living. The origin of the oils may be animal, vegetable or petrochemical and volatile and non –volatile nature (Oil 2005).Almost all vegetables oils are obtained from beans and seeds and are categorized into two types; oil and protein rich meal. The coconut oil is the highest most important edible oil in all over the world (Gunstone F. D. 2011).The oil contains 92% of saturated fatty acids (Gopala *et al*. 2010).Fresh coconut kernel contains: moisture (50%), oil (34%), carbohydrate (7.3%), protein (3.5%), fibre (3.0%)andash (2.2%)(Hui Y. H. 1996).

Commercial refined coconut oil (RCO) is educted from dried copra, and the producing crude oil is processed on an industrial scale (Gunstone F. D. 2011). Virgin coconut oil (VCO), on the other hand, is extracted from fresh mature coconut meat and processed using only physical and natural means (Hena Lu *et al*. 2009).The fatty acids in virgin coconut oil contain shorter carbon chain (Nielson SS 1994).The decay of VCO lowered the lipid components compared to copra oil (CO) by reducing total cholesterol, triglycerides (TG), phospholipids, low density lipoprotein (LDL) and very LDL levels and increase the high density lipoprotein in serum and tissues. Besides many oils are available in the market with different brand name. However it is needed to ensure the quality of different branded marketed refined coconut oil (Senthil kumar K. L. 2011). In near future it's expected that VCO will gain a significant importance and consumption growth in the market due to increase in public awareness of health (Lawson H. W. 1985).

## MATERIALS & METHODS

### *Sample collection*

Shelled coconut (*Cocos nucifera*) was collected from the rural area of Shatkhira district and also some marketed coconut oils like Jui, Gondhraj, Cute and Parachute were collected from the local market of Khulna, the southern part of Bangladesh (details shown in table below). The collection was done in July, 2017 and kept in room temperature of 30□C and brought to the laboratory for analysis.

### *Extraction of oil from Cocos nucifera*

A certain amount of sample was placed in a porous cellulose extraction thimble of the soxhlet apparatus. The lower end of the soxhlet was attached to the mouth of a 500 mL round bottom flask containing 300-350 mL n-hexane (B.P: 40-60$^0$C) as extractive solvent and the upper end was attached to a condenser.

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| Brand Name | Manufacturer Name | Ingredients Name (expressed by producer) |
|---|---|---|
| Jui | Square Toiletries LTD, Bangladesh | Coconut oil |
| Cute | Mousumi Industries Limited, Bangladesh | Refined coconut oil, vitamin-E, preservative |
| Parachute | Marico Bangladesh Limited | Finest coconuts |
| Gondhraj | Lalbagh Chemical & Perfumery Works LTD., Bangladesh | Coconut oil , mineral oil ( L. L. P), Kernel olin, Flavours ( M. O. S) |

The solvent was evaporated by heating with a heating device. The apparatus was left to run for 6 hours and the solvent was evaporated using the rotary evaporator (model: HS-2005V).The extraction was continued for 6 hours and calculated the total oil content of *Cocos nucifera*(Adeyanju J. A. *et al*. 2016).

Weight of total sample = 70.00 g and weight of total oil = 52.89 g.

$$\text{Percentage of oil content} = \frac{\text{Weight of total oil}}{\text{Weight of total sample}} \times 100$$

$$= \frac{52.89}{70} \times 100 = 75.55\ \%$$

***Determination of Saponification value***

The saponification value is expressed as the number of milligram of KOH required to completely saponify 1g of fat or oil. It gives an idea about the molecular weight of fat or oil. The smaller the saponification value, the higher the molecular weight. The saponification value is determined by taking 1 g of oil sample in a round bottom flask to which is added 25 ml 0.5 N alcoholic KOH heated under a reflux condenser for 1h with occasional shaking. While the solution was still hot,phenolphthalein indicator was added and the excess potassium hydroxide was titrated with the 0.25 M hydrochloric acid until pink end point was reached. A blank experiment (without oil) was performed with the same conditions (Odom W. *et al*. 2015 & AOCS 2017).

The saponification value was calculated using the following formula:

$$\text{Saponification value} = \frac{(A-B)\times S\times 56.1}{W}$$

Where, S = Molarity of HCl acid used, A = Volume of HCl in mL (for blank), B = Volume of HCl in mL (for sample), W = Weight of oil used in gram.

***Determination of Iodine value***

Iodine value (iodine no) is related to the fatty materials specially fixed oils and measures the degree of unsaturation of an oil, fat or wax. It is the amount of iodine in grams that is taken up by 100 gram of the oil, fat or wax. Iodine value helps in finding the adulteration in a fat or oil and judging its suitability for making soap. The iodine value is determined by taking 1g oil sample in a conical flask to which is added 10mL of $CHCl_3$ shaken till the oil was dissolved completely. 20 mL of Hanus solution was added into the solution. The flask was covered and was kept in the dark for 30 minutes with occasional shaking. Then 10 mL of 10% KI solution was added and stirred and then 100 mL of distilled water was added and washed down any free iodine on the stopper. The iodine solution was titrated with 0.1M $Na_2S_2O_3$ solution using starch solution as indicator. A blank experiment (without oil) was performed in the same way as above. The iodine number was calculated by using the following law (Odom W. *et al*. 2015):

$$\text{Iodine value} = \frac{(A-B)\times S\times 127\times 100}{1000\times W}$$

Where, A = Volume of $Na_2S_2O_3$ solution in mL (for blank), B = Volume of $Na_2S_2O_3$ solutionin mL (for sample),S = Molarity of the $Na_2S_2O_3$ solution used, W = Weight of oil used in gram

***Determination of Acid value and Percentage of free fatty acid***

Acid value is defined as the number of milligrams KOH required to neutralize the free organic acid present in 1 g of fat or oil. It indicates the amount of free fatty acids present in an oil or fat. The acid value is determined by taking 1g of oil sample in a dried conical flask. 25 mL of absolute ethanol and 2-3 drops of phenolphthalein indicator were added into it. The mixture was shaken in water bath at about $65^0$C for 15 minutes. Then the mixture was cooled and was titrated against 0.1M KOH solution. The acid value (AV) and free fatty acid (%FFA) were calculated using following laws (AOAC 1984):

$$\text{Acid value (AV)} = \frac{V\times M\times 56}{W}$$

Where, V= Volume of KOH solution in mL, M= Molarity of KOH solution used, W= weight of oil used in gram.

$$\%\ \text{Free fatty acid(as lauric acid)} = \frac{V\times S\times M}{10\times W}$$

Where, V= Volume of KOH in mL, S= Molarity of KOH used, W= Weight of oil in gram, M= Molecular weight of the free fatty acid

***Determination of Ester value***

The ester value is the number of mg of potassium hydroxide required to saponify the esters contained in 1 g of oil or fat. The ester value was calculated using the following formula (Odom W. *et al*. 2015):

$$\text{Ester value} = \text{Saponification value} - \text{Acid value}$$

***Determination of moisture content***

Moisture content was determined by weighing 1 g of the sample and placed it in a crucible that had already determined for its blank weight. The sample was heated 105℃ for 2 hours in an oven (Model: BSO-500D, Taiwan) and cooled it for approximately 15 min and weighed again (Oseni N. T. *et al*. 2017).

$$\text{Moisture content} = \frac{A-B}{A}\times 100\%$$

Where,A= Weight of the sample, B= Weight of the dry sample

***Determination of Insoluble Impurities***

Insoluble impurities was determined by weighing 1 g of the oil sample into a 250mL conical flask and 20mL of 1:1 solvent mixture (petroleum ether + diethyl ether) was added. The flask was then shaken vigorously and allowed to stand for 30 minutes at 30℃. The liquid was then filtered through a dried and weighed Whatman number-1 filter paper. The increase in weight represented the weight of impurities and was expressed as a percentage of the initial sample as follows(Odom W. *et al*. 2015):

$$\%\ \text{impurity} = \frac{a}{w}\times 100$$

Where, a = increase in the weight of filter paper, w = weight of sample

## RESULTS & DISCUSSION

### *Saponification value*

In a sample saponification value is inversely proportional to the average molecular weight or chain length of the fatty acids present in the fat or oil. The saponification value of the Virgin coconut oil was found to be 255.25 mg KOH/g which met both Codex and APCC Standards. Besides Jui, Cute, Parachute and Gondhraj oils met nearly with APCC Standards (Table-1& Figure-1). Its indicates that Virgin coconut oil is better than the marketed coconut oils. Because higher the saponification value, it is better for making soap.

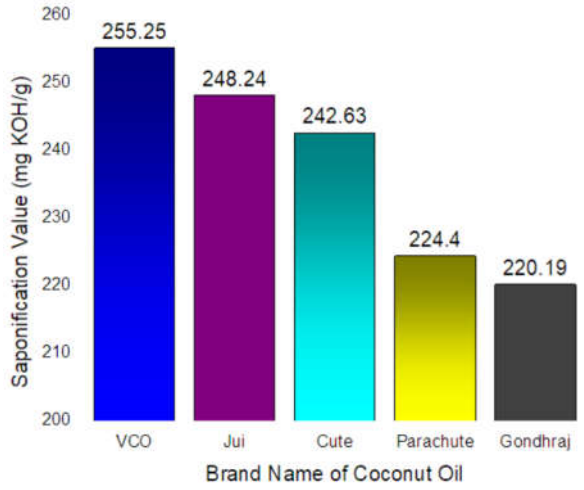


**Figure 1**The Saponification value of different collectedcoconut oils

**Table 1** Physicochemical properties of some coconut oils available in Bangladesh compared with APCC standard

| Name of physiochemical analysis | Value of different collected Coconut oils | | | | | APCC Standard Value |
|---|---|---|---|---|---|---|
| | Virgin (VCO) | Jui | Cute | Parachute | Gondhraj | |
| Saponification Value (mg KOH/g) | 255.25 | 248.24 | 242.63 | 224.40 | 220.19 | 248.0~268.0 |
| Iodine Value (g/100g) | 7.62 | 9.02 | 9.91 | 7.36 | 9.39 | 4.1~11.0 |
| Acid Value (mg KOH/g) | 3.92 | 3.36 | 5.04 | 6.72 | 4.48 | Below 6.0 |
| % of fatty acid | 1.40 | 1.20 | 1.80 | 2.40 | 1.60 | 0.5 max |
| Ester value (g/100g) | 251.33 | 244.88 | 237.59 | 217.68 | 215.71 | No standard |
| % of moisture content | 0.06 | 0.11 | 0.08 | 0.08 | 0.08 | 0.5 |
| % of insoluble impurities | 0.16 | 0.18 | 0.84 | 0.20 | 0.51 | 0.1~0.5 |

### *Iodine value*

The iodine value or iodine number is the generally accepted parameter expressing the degree of unsaturation, the number of carbon-carbon double bonds in fats or oils. It is also reported that the higher the amount of unsaturation, the more iodine is absorbed; therefore, the higher the iodine value the greater the degree of unsaturation. The iodine value of the virgin coconut oil was found to be 7.62 g/100g and indicates a lower degree of unsaturation which met with APCC Standards (Table-1& Figure-2). It can be classified as nondrying, stable and most edible oil with a comparison of other marketed oil.

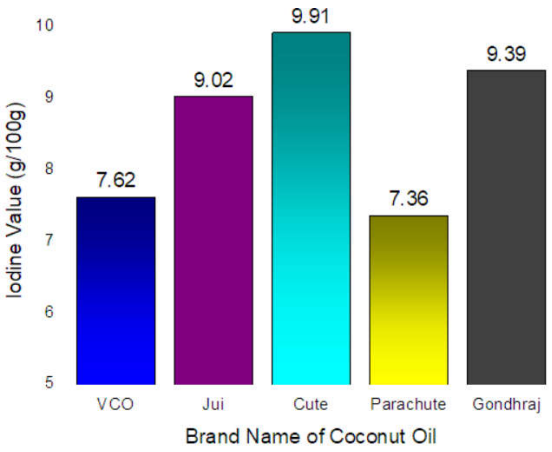


**Figure 2** The Iodine value of different collected coconut oils

### *Acid value and percentage of free fatty acid*

According to the APCC Standards, the acid value of virgin coconut oil should be less than 6.0 mg KOH/g and the percentage of free fatty acid should be 0.5. A low percentage of free fatty acid is an indication of suitability for edible purpose. It is clear that virgin coconut oil can be used as edible purposes (Table-1).

### *Ester value*

The ester value is the number of mg of potassium hydroxide required to saponify the ester contained in 1 g of oil or fat. The ester value indicates characteristics odor of different oils (Table-1).

### *Moisture content*

Water is very slightly soluble in oils and fats, and its presence is confined only to very small amount. According to APCC standards, the maximum moisture content of virgin coconut oil should be 0.5%. So we can see that all the collected coconut oil fulfilled the criteria (Table-1).

### *Percentage of insoluble impurities*

The term refers to extraneous substances such as dirt, debris and fibers. They are defined as those substances which remain insoluble and can be filtered off after the oil is dissolved in a specific solvent such as petroleum. The APCC standard range for insoluble impurities is in the region of 0.1-0.5%.Virgin, Jui& Parachute oil had fewer impurities than other oils and met the APCC standards (Table-1).So virgin coconut oil is quite good for edible purposes and for cosmetic industry.

## CONCLUSION

The present study shows the comparison between virgin coconut oil and some marketed coconut oils. From this study, we can say that virgin coconut oil is quite better for edible purpose than the marketed coconut oils. Besides it can play an important role in the manufacture of large number of industrial products and food items. Due to the using in cooking, beauty tips, natural remedies oil is the super food. Present study provides information for further chemical investigations of virgin coconut oil and some nutritional values and anti-oxidant properties can be conducted. It is desired that VCO will experience a dramatic growth in the Bangladeshi local market.

**Acknowledgement**

The authors are grateful to the Chemistry Discipline, Khulna University, Bangladesh, for the cooperation & providing financial support to carry out this research work.

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**How to cite this article:**

Md.Kamrul Hasan *et al.* 2018, Comparison of Some Physiochemical Parameters Between Marketed and Virgin Coconut Oils Available in Bangladesh. *Int J Recent Sci Res.* 9(7), pp. 27979-27982. DOI: http://dx.doi.org/10.24327/ijrsr.2018.0907.2370

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