Journal of Applied Sciences 11 (13): 2467-2469, 2011
ISSN 1812-5654 / DOI: 10.3923/jas.2011.2467.2469

Innovative Integrated Wet Process for Virgin Coconut Oil Production

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Abstract: During the recent years, increased interest on the development of the Virgin Coconut Oil (VCO) has been observed. This is to maximize the benefit of the multifunctional traditionally used coconut. VCO is rich in the Medium Chain Fatty Acids (MCFAs) that have been shown to speed up the metabolism. Almost 50% of the fatty acid in virgin coconut oil is in form of lauric acid. This fatty acid has wide application as wide spectrum of antimicrobial substances against fungi, bacteria and viruses. Moreover, the fatty acid profile of coconut oil shares the similar characteristic with breast milk. The MCFAs in coconut oil are not stored in the body cells but rather processed directly in the liver where they are converted immediately into energy. The present study describes the process for VCO production through integrated wet process. The novel features of this process is the production of virgin coconut oil itself which can minimize the time, cost, energy and man power as well as can maximize the yield and improve the quality of coconut oil. The VCO obtained by this process contribute about 30-40% wt/wt of yield which is 10-20% higher than conventional method. The physical characteristics of VCO along this process shows that the VCO is colorless, retain fresh coconut aroma and sweet coconut taste with the highest content of lauric acid (49.85%). Besides that, the result also indicates the presence of vitamin E VCO. In general, the overall results for sensory analysis were acceptable in terms of aroma and taste of the product.

Key words: Virgin Coconut Oil (VCO), Medium Chain Fatty Acids (MCFAs), integrated wet process, antimicrobial

INTRODUCTION

The Philipine National Standard (PNS) (Bureau of Product Standards (BPS, 2004) defines Virgin Coconut Oil (VCO) as the oil obtained from the fresh and mature kernel of the coconut by mechanical or natural means without the use of heat and chemical refining. PNS also describes VCO as colorless with natural coconut scent and free from out flavor and odor. The moisture in VCO must be at least 0.1% or less. VCO also should contain minor components such as tocopherols and tocotrienol, polyphenols, sterol and others (Kabara, 2000). Benecial effects of MCTs on weight control and glucose as well as on lipid metabolism were observed (Marten *et al*., 2006). This may prove the usefulness of natural foods containing relatively high amounts of MCFAs as well as the usefulness of functional foods supplemented with MCTs (Marten *et al*., 2006). Since coconut oil is higher in medium chain fatty acids it is likely that a greater proportion of the fatty acids are taken up by the portal blood system and delivered to the liver prior to peripheral tissues (Hargrave *et al*., 2005). This would allow for greater hepatic oxidation of the fatty acids and less lipid available for storage as adipose tissue, as has been proposed for medium chain triglycerides. Additionally, oxidation rate decreases with increasing chain length and the adipose tissue of fat free and coconut oil-fed mice had reduced average chain length (Hargrave *et al*., 2005).

In the production of VCO, the yield and the retention of minor components are very important. In general, there are two types of process to obtain VCO; the dry and wet process. At Chemical Engineering Pilot Plant (CEPP), an integrated wet process has used to produce high quality of VCO. The integrated wet process offer shorter production time, higher yield oil retention of the minor components in the final product.

MATERIALS AND METHODS

Samples: Fresh coconut meat was procured from local supplier. The process begins with the mechanical pressing of coconut grated to obtain coconut milk. The coconut milk was then chilled to 10°C to break the emulsion for easier water and coconut butter separation.

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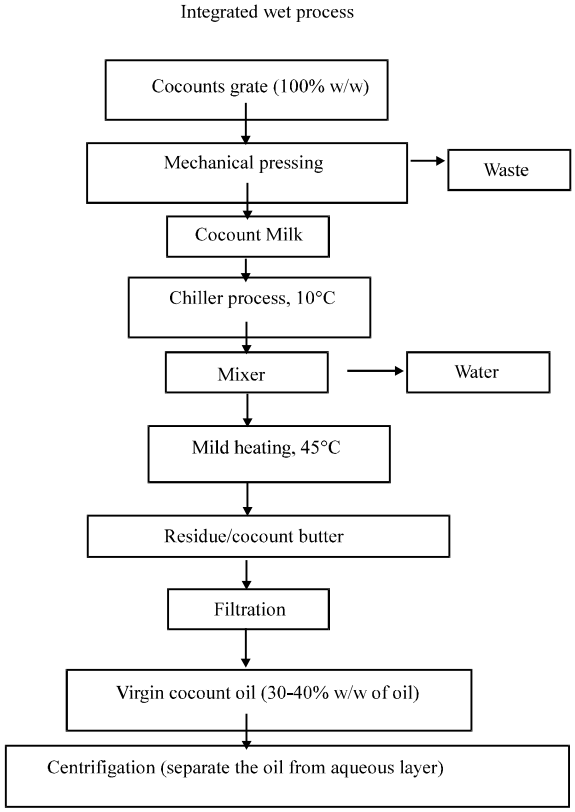

Fig. 1: Flow diagram of integrated wet process

The chilled coconut milk was transferred to a mixing vessel where it was churned until coconut butter was heated to 45°C followed by centrifugation to separate the non-oil fraction from the product VCO. Finally the product was filtered to remove any suspended solid Fig. 1.

RESULTS AND DISCUSSION

According to the fatty acids composition analysis, the results obtained as shown in Table 2 indicate that lauric acid (12:0) is the highest component in the virgin coconut oil which is 48.92%. The result is clearly shows the effectiveness of the process which can maximize the lauric acid content. On the other hand, Table 1 shows that VCO is an ideal food to be consumed due to the highest energy value of food while Table 3 indicate that there was no microbe or fungal were found in the virgin coconut oil.

Table 4 represents the result for sensory evaluation test. The test was conducted at Chemical Engineering Pilot Plant, Faculty of Chemical Engineering and Natural Resources Engineering, Universiti Teknologi Malaysia. The result obtained shows that the VCO from this process are acceptable and comparable with the commercial sample. In general, the average points for sensory analysis score about 7.58 out of 9.0 which is stated as like

Table 1: Proximate analysis

Parameter	Result
Ash (%)	0.05
Fibre (%)	0.00
Protein (%)	0.33
Fat (%)	98.00
Moisture (%)	0.10
Carbohydrate (%)	1.34
Energy value of food (kcal/100g)	888.68

Table 2: Fatty acid composition

Parameter % (w/w)	*HPLC test result
C6:0 Caproic	0.47
C8:0 Caprylic	7.32
C10:0 Capric	6.29
C11:0 Undecanoic	0.02
C12:0 Lauric	48.92
C13:0 Tridecanoic	0.03
C14:0 Myristic	18.30
C16:0 Palmitic	8.62
C18:0 Stearic	3.23
C18:1n9C Oleic	5.65
C18:2n6C Linoleic	0.94
C18:3n6 Linolenic	0.10
C20:1 Eicosenoic	0.04
C20:3n6 cis-8, 11, 14-Picosatricnoic	0.08

*HPLC = High performance liquid chromatography

Table 3: Microbiology analysis

Test parameters	Units	Results	Method References
Aerobic plate count		ND (<10)	AOAC 990.12
Escherichia coli count	cfu g^{-1}	ND (<10)	AOAC 991.14
Total yeast and mold count		ND (<10)	AOAC 997.02
Salmonella	Absent/Present	Absent	FDA BAM Chapter 5
Staphylococcus aureus		ND (<10)	FDA BAM Chapter 12
Enterobacteria	cfu g^{-1}	ND (<10)	BP 2002

ND: Not determined

Table 4: Final result from the correspondent, response in sensory evaluation

Test	Result
Colour	7.69
Consistency	7.58
Dispersibility	7.70
Solubility	7.73
Taste	7.58
Aroma	7.22
Average points	7.58

Table 5: Comparison data of integrated wet process and fermentation

	Integrated wet process	Fermentation process
Colour	Colourless	Colourless to Yellowish
Aroma	Fresh coconut aroma	Sour coconut aroma
Taste	Sweet coconut taste	Natural coconut taste
Lauric Acid	48.92%	39.0%

very much in the hedonic scale rating. These results determine that the integrated wet process contributes to the fresh and sweet coconut aroma due to the shorter time in processing compared to the fermentation process. Table 5 shows the comparison data between integrated wet process and fermentation process of VCO.

CONCLUSION

The virgin coconut oil obtained from integrated wet process give much more benefits especially in saving the processing time and cost (due to the shorter time) as well as improving the quality of virgin coconut oil. Furthermore, the use of a virgin coconut oil nowadays is becoming increasingly important in the developed countries due to health benefit and it's nutritionally wholesome. This research will lead to a new finding on developing the process especially in producing of virgin coconut oil.

REFERENCES

BPS, 2004. Philippine national standards: Virgin coconut oil. Bureau of Product Standards, Department of Trade Industry, Philippines.

Hargrave, K.M., M.J. Azain and J.L. Miner, 2005. Dietary coconut oil increases conjugated linoleic acid-induced body fat loss in mice independent of essential fatty acid deficiency. Biochim. Biophys. Acta Mol. Cell Biol Lipids, 1737: 52-60.

Kabara, J.J., 2000. Health oils from the tree of life (nutritional and health aspects of coconut oil). Indian Coconut J., 31: 2-8.

Marten, B., M. Pfeuffer and J. Schrezenmeir, 2006. Medium-chain triglycerides. Int. Dairy J., 16: 1374-1382.