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ESTIMATION OF MESOCARP OIL FROM OIL PALM FRUITS

A MODIFIED METHOD FOR LARGE NUMBER OF SAMPLES

National Research Centre for Oil Palm

ESTIMATION OF MESOCARP OIL FROM OIL PALM FRUITS A MODIFIED METHOD FOR LARGE NUMBER OF SAMPLES

Introduction

Estimation of oil content in the mesocarp of oil palm is an integral part of evaluation of oil palm. In case of oil palm, each palm needs to be evaluated and hence, thousands of mesocarp samples are subjected to oil estimation every year. Usually oil content in a bunch is estimated by a stepwise analysis called 'Bunch Analysis'. During the last phase of this process, dry mesocarp is used for oil estimation by Soxhlet apparatus. Usual process of estimation of oil from dry mesocarp involves weighing of dry mesocarp and putting into a filter paper thimble, which is placed in the extraction unit of the Soxhlet apparatus and the oil is extracted by a suitable solvent (Petroleum ether/ Hexane / Carbon tetrachloride etc.). Solvent and oil mixture is collected in the round bottom flask of the Soxhlet apparatus and oil is estimated after evaporating the solvent. Though this method of estimation is accurate, it is very expensive in terms of labour, time and solvent requirement. In large selection programme, where a large number of samples need to be analyzed daily, the total capital outlay for oil estimation can be very high. Hence, a speedy and economic method for estimation of oil from mesocarp was the requirement.

A method has been standardized at this centre and the same has been validated after analyzing fifty mesocarp samples by the conventional and modified method, which did not show any significant difference. The data and analysis result of the experiment is presented at the end.

Detailed Procedure

- Oil palm mesocarp should be scraped from the fruits sampled for oil estimation. Mesocarp should be scraped manually with a sharp knife as thin flakes of 1-2 mm thickness for uniform drying during the subsequent step.
- Scraped mesocarp should be mixed thoroughly and a representative sample should be weighed (as early as possible to avoid moisture loss) and dried either in a hot air oven at a temperature of 105°C for 24 hours or in a micro-wave oven in full power for 10 min., keeping mesocarp sample preferably in a glass container. Weight should be recorded after drying the mesocarp.
- Whatman No. 3 filter paper is cut into 6" X 6" pieces and each piece is folded from three sides and stapled to form a pouch (packet). After recording the weight of empty pouch, dried mesocarp samples were inserted inside each pouch and stapled at the other end of the pouch. It should be ensured that there is no gap formation so that no mesocarp can come out through the pouch during extraction process. Three to five grams of dry mesocarp can be inserted in each pouch. Each stapled pin weight need to be accounted during the calculation process.
- Several samples in pouches can be placed in the extractor of a large sized Soxhlet apparatus. Number of samples vary depending upon the size of the extractor and the apparatus. For example, for a two litre extractor, 50 samples can be placed at a time. After fitting the extractor with the round bottom flask in the Soxhlet apparatus, solvent can be poured from the top of the extractor. Usually a two litre

extractor is fitted with a five litre round bottom flask and 3.5 liters of solvent is required. It should be ensured that all the pouches are dipped in the solvent in the extractor unit before siphoning starts.

- After connecting the condenser and water tubings, the heating mantle should be adjusted to a temperature of 75-80°C. However, higher temperature up to 100-120°C would not matter if the cooling is sufficient. Usually it is observed that under the tropical Indian condition (especially in the State of Andhra Pradesh, India) the tap water is quite hot and goes up to the temperature of 50°C during summer. In such case, condensing the solvent vapour would not be efficient. Hence, the temperature of the heating mantle should be adjusted according to the running water temperature, which is connected to the condenser.
- The extractor should be operated for 14 hours, and after that the pouches should be removed from the extractor unit and dried in a hot air oven at about 60-70°C for 10 min. and the weight of the pouches should be recorded. Oil content should be calculated from the difference in weight between before and after extraction of the oil from the pouches.

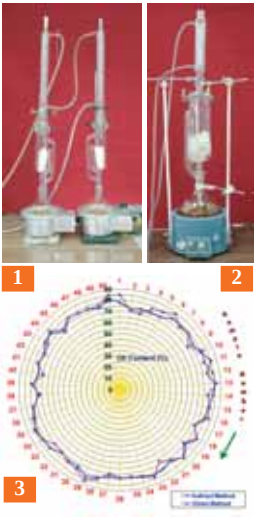
Advantages

- A comparison was made for cost and time benefit between a Soxhlet apparatus having the 2.0L extractor, which can hold 50 packets ('modified method') and the individual Soxhlet apparatus having 150mL extractor ('direct method').

1 'Direct method' of oil estimation

2 'Modified method' of oil estimation

3 Graphical Comparison Between the Direct and Modified Methods of Oil Extraction by Using Soxhlet Appartus



SAMPLE PROFORMA FOR OIL ESTIMATION FOR LARGE NUMBER OF OIL PALM MESOCARP SAMPLES

Parameters to be recorded		Code	Values
Drying of mesocarp for estimating moisture content in mesocarp	Weight of container/petriplate (g)	A	
	Initial weight (mesocarp + container) (g)	B	
	Dry weight (mesocarp+ container) (g)	C	
Mesocarp oil estimation by Modified Method	Filter paper pouch weight (g)	D	
	Initial weight (Pouch + mesocarp) (g)	E	
	Weight after oil extraction (Pouch+mesocarp) (g)	F	

CALCULATION FOR OTHER PARAMETERS			
Parameters to be calculated	Code	Formula	Values
Moisture in mesocarp (%)	G	[(B-C)/(B-A)]*100	
Oil/Dry mesocarp (%)	H	[(E-F)/(E-D)]*100	
Oil/fresh mesocarp (%)	I	[H x (100-G)]/100	

Minimum 10L solvent would be required in the 'direct method', in comparison to maximum 3.5L in the 'modified method'.

- After extraction by the 'modified method', the solvent could be easily recovered up to 80%. In the 'direct method', individual round bottom flask required to be weighed after oil extraction and hence, distillation and recovery of the solvent becomes very difficult, and in most of the cases the solvent is evaporated in oven causing loss of solvent and pollution of the atmosphere.
- Approximate time required by 'direct method' for the Soxhlet assembly of six soxhlet units is 14 hours for each set, where as 50 samples can be estimated during the same period by 'modified method'.
- With a bigger Soxhlet apparatus, more number of samples can be analyzed at a time. Hence, more efficient would be the extraction in terms of time and cost.

Stastical analysis of the data obtained by 'Direct' and 'Modified' methods of oil estimation using Soxhlet apparatus

Parameters	Method of extraction	
	Modified	Direct
Number of samples analysed	50	50
Mean	78.237	78.486
Variance	10.47	17.78
Standard Deviation	3.236	4.217
Correlation coefficient	0.699	
F-Test		
F-Value		1.698
Probability		0.067
t-Test		
Variance of the difference between the means		0.184
Standard deviation of the difference		0.429
t-Value		-0.451
Effective degrees of freedom		49
Probability of t		0.654
Confidence limit for the difference of the two methods (for alpha = 0.01)		0.193 = 1.149 (-0.956 through 1.342)
Difference between the two methods is non-significant		

Comparative advantages of modified method of oil extraction

Parameters	Method of extraction	
	Modified	Direct
No of sample	50	50
Minimum volume of solvent	2.5 L	10L
Time required	15 hours	125 hours*
Solvent recovery	Up to 80%	Very difficult

* In case of a Soxhlet apparatus assembly with six Soxhlet units

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