

Extraction Of Ocimum Gratissimum Using Different Distillation Techniques

S. C. Ibeh, O. D. Akinlabi, I. Asmau, J. Audu, A. M. Muritala

Abstract: In the recent years, there have been growing interests on *Ocimum gratissimum* in Nigeria due to its significance. Many research studies have been carried on *Ocimum gratissimum* in regard to its preparation, health benefits, nutritional values, pharmacognostic and phytochemical study of the oil. Despite numerous studies on the botanical leaf and its oil, there is no report or comparative study on its extraction. This study centred on the extraction of *Ocimum gratissimum* using hydro distillation, steam distillation and micro wave distillation method. Extraction parameters (extraction time, percentage oil yield) were used to determine which of the extraction techniques is suitable or recommendable for optimum extraction of sample oil. It was established that with the use of microwave distillation an optimum production/extraction of *Ocimum gratissimum* is achievable as it shows a shorter extraction time, higher percentage of oil extracted, saves energy compared to other distillation method used.

Keywords: *Ocimum gratissimum*, Essential oil, Steam-distillation, Hydro-distillation, Microwave distillation.

1 INTRODUCTION

This article pinpoints issues concerning the optimum extraction of essential oil from *Ocimum gratissimum* nationally known as "scent leaf" with the use of steam distillation, hydro distillation and microwave distillation techniques. The significance of *Ocimum gratissimum* oil in Nigeria local industries has increased in geometry progression recently because it is readily available and of its usefulness medically, biologically. In this research study, botanical leaves of *Ocimum gratissimum* were used. *Ocimum gratissimum* is a plant that is active throughout the year. In Nigeria, it is popularly known as 'Ntonng' in Ibibio, 'Efinrin' in Yoruba, 'Daidoya' in Hausa and 'Nchanwu' in Igbo. West African countries like Nigeria, Ghana and Cameroon use *Ocimum gratissimum* (scent leaf) for not only as food but also for medicinal treatment of cough and catarrh when heated and inhaled, it can be used as a cure for stomach disorders such as gastroenteritis [1]. It is locally used in treatment of diarrhoea and chronic dysentery. Oil within the scent leaves contains a high level of anti-fungal, antiseptic and antibacterial properties that are capable of repelling mosquitoes and other insects [1], [2], [3]. There are several methods in the extraction of oil. Conventionally, in the production/extraction of essential oil, steam distillation and hydro distillation has been recognised as the most advanced process in distillation due to its high sensitivity to heat [4]. It is specially used for temperature sensitive materials like resins and oils that are not miscible with water and possibly give way when attaining their boiling point [5], [6]. Microwave extraction technique is taken the lead in the extraction industries. The major edge of these three distillation methods over other distillation methods is that its mode of processes is relatively frugal to operate [7], [8], and properties of oils obtained with the method remained unaltered.

As steam decreases the boiling point of a particular component of the oil and never decomposes when using this process. Apart from being economical, it is safe and energy efficient when compared to other distillation methods [9]. Series of studies have been reported on essential oil of *Ocimum gratissimum*, there has not been any report in relation to the extraction of this oil with the use of hydro distillation, steam distillation and microwave distillation methods. Therefore, this study is aimed at bridging this gap by employing steam distillation, hydro distillation and microwave distillation method in the extraction of essential oil from *Ocimum gratissimum*.

2. MATERIALS AND METHODS

2.1 Plant material

Samples of botanical leaves of *Ocimum gratissimum* were collected in a little farm land located within the premises of Scientific Equipment Development Institute (SEDI) Minna, Niger state-Nigeria, which lies within the coordinates of 09° 37'N and 06° 30'E [10], in November 2016. The identity of the *Ocimum gratissimum* was attested by a plant taxonomy specialist from the Micro-biology department, Federal University of Technology Minna-Niger State Nigeria. The botanical leaves were then made to get dried in a dark room under ambient conditions (20-30°C) for five days placed on a large transparent tray. It was packaged in a polyethylene bag, kept for further work.

2.2 Hydro distillation

Samples of the botanical leaves were cut into pieces less than 2x2cm, weighed sample of 100gm was placed in a round bottom flask (2000mL) containing 1000mL of distilled water which was attached to a Clevenger type-apparatus. Hydro distillation was carried out with a laboratory heater. The heat was permitted to go through the herb samples filled with water. The both liquid (immiscible liquids) were fed through the condenser having an inlet and outlet water ways to the 3-way tap where each liquid is separated by skimming it off the top. The oils were then kept in a dark glass bottle and weighed on a portable digital weighing balance (AND EK-610J). At the end of 2hrs 45minutes of operation the extraction of oil came to a cease.

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2.3 Steam distillation

Steam distillation was performed in a similar method as hydro distillation. In the case of steam distillation, the sample material (100gm) was housed in a still round bottom flask that was perforated and steam (containing 1000mL of water) is forced over the perforated part of the flask to the material. At an end of 1hr 42minutes of operation the extraction of oil come to a ceased. Weight of oil extracted was obtained as hydro distillation.

2.4 Microwave distillation

In the microwave method, the same quantity of leave sample (100gm), distilled water (1000mL) was used. The botanical sample was placed in a Clevenger – type apparatus and was placed within a modified microwave oven and heat was introduced by the microwave for 52minutes to extract the oil completely. With the use of microwave heat energy, botanical leave sample was able to reach its boiling point at a short period of time interval. This resulted to a short distillation time compared to other distillation methods used. Weight of oil extracted was obtained as hydro distillation and steam distillation.

3 RESULTS

In this study, Ocimum .g was extracted using three different extraction methods or techniques; hydro distillation, steam distillation and microwave extraction method. Various techniques in the extraction of leaf sample so as ascertain better alternative for an optimum oil extraction of the sample in study. The table below summarizes the extraction parameters (percentage oil extracted and time taken for extraction) with the use of three different extraction techniques.

Table 1: Extraction parameters using three different distillation methods

Extraction Method	Hydro distillation	Steam distillation	Microwave distillation
Weight of leave used (g)	100	100	100
Weight of oil yield (g)	0.92	1.33	1.84
Percentage oil yield (%)	0.92	1.33	1.84
Time of extraction (min)	165	102	52

The weight of oil extracted was calculated based on the equation (1)

$$W_{og} = W_1 - W_o \quad (1)$$

Where:

W_{og} = weight of extracted Ocimum .g leave oil (gm)

W_o = initial weight of bottle (gm)

W_1 = final weight of bottle (bottle + oil) (gm)

The percentage extracted oil yield is the amount of oil extracted in percentage [11] and was calculated as given below:

$$\text{Yield (\%)} = \frac{W_{og}}{W_i} * 100 \quad (2)$$

W_i = weight of leave sample (gm)

4 DISCUSSION

From Table 1, a 100gramms of botanical leaves sample were used for the three different extraction or distillation methods used. Distillation method with the use of hydro distillation show low in the percentage oil yield of 0.92% at a longer extraction time of 165 minutes. Steam distillation exhibits a percentage oil yield of 1.33% at corresponding time of extraction of 102min. Microwave distillation show better extraction parameters of 1.84% of oil yield at shorter extraction time of 52min. Higher percentage oil yield of Ocimum .g with the use of steam and microwave distillation method when compared to hydro distillation method indicates that the botanical leaves sample is heat sensitive (oil yield increases with decrease in extraction time).

5 CONCLUSION

The following conclusion(s) can be drawn:

- The botanical leave (Ocimum gratissimum) is heat sensitive which give rise in higher oil yield at short extraction time using steam and microwave distillation when compared to distillation with the use of hydrodistillation.
- Comparison of these extraction methods in the extraction of Ocimum gratissimum oil, it is established that with the use of microwave distillation an optimum production/extraction of Occimum gratissimum is achievable as it shows a shorter extraction time, higher percentage of oil extracted, saves energy compared to other distillation method used.

NB: Further experimental work in the comparison of oil compositions after extraction using the three distillation methods is on-going.

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