EXTRACTION AND CHARACTERIZATION OF OIL FROM GARLIC BULB

Akpan, U. G., Isah A.G., and Adesiyan, C.O.
Department Of Chemical Engineering. Federal Univesity Of Technology, Minna.Nigeria.

ABSTRACT

This paper studied the extraction and characterization of garlic bulb oil. Soxhlet apparatus was used for the extraction using hexane as the solvent. The percentage oil extracted from the bulb was 1.23%. Results of chemical analysis showed that the oil extracted is non-toxic. Infra red ray analysis revealed the presence of some components similar to those found in anti-hypertension drugs like Aldomet, Dopamet and Aldora. The pharmaceutical and medical importance of the oil is discussed.

INTRODUCTION

Garlic plant (*Alliums sativum*) is a common plant used as food in all part of the world. It is also used as ointment since ancient times (Stoll and Seeback, 1951). Garlic seed is a bulb bearing perennial plant. It is closely related to the onion group, which grows to a height of up to 30.48cm with narrow, sword shape leaves. During early summer, a rounded cluster ripens into the characteristic garlic head, composed of several separable parts called cloves. When the cloves are fully mature in the late summer or early autumn, they are gathered and used as culinary herb. Garlic is widely cultivated in many parts of the world in the same manner as onion. In the spring, the cloves are set into four to six inches apart in ordinary garden soil. Garlic thrives under a wide variety of soil and climate (Anonymous, 1980).

South west of Asia believes that the edible bulb of garlic plant composed of sugar rich food. The storage leaves are also source of pungent oil. Their long tubular, above ground leaves are also eaten (Griggs, 1990). Garlic plant is known to have migrated into the eastern Mediterranean region.

In the past decade, there has been a renewed research interest in the therapeutic uses of Garlic. Bodia Verma (1978) reported that Garlic has insectcidal, antibacterial, antifungal, and antitumour properties. In addition, Garlic has been reported to enhance the cure of hypertension and other related artery diseases. Ester, alcohol and amine containing group serve as the major ingredients in the hypertension drugs (NDI, 1991-1992) Thus, it has become necessary to extract oil from Garlic and characterize in order to reveal the predominant constituents of Garlic, which may have some medical value.

MATERIALS AND METHOD

The Garlic bulbs bought from Kaduna Central Market, Nigeria were decorticated and 450g was dried at 100^{o}C for 1hr in an oven to determine the moisture and other volatile contents of the bulbs.

292.9g of the dried garlic seed was crushed in a mortar and transferred in batches into the thimble of a soxhlet extractor. 250ml of hexane was added to extract the oil for 5hrs. The percentage garlic bulb oil extracted was then calculated.

Characterization of garlic bulb oil

The characterization of garlic bulb oil was undertaken through physical and chemical analysis.

Physical Analysis

Standard tests were carried out to determine the specific gravity, boiling point, refractive index, viscosity and of the oil.

Specific Gravity

An empty container was weighed on a weighing balance and the weight noted. Then it was filled-up with water and the weight also noted. The container was emptied and then refilled with garlic oil, and the weight noted. Therefore, the specific gravity of the oil was calculated by taking the ratio of the weight of the same volume of oil to the volume of water.

Boiling Point

The oil was heated in a container of which a thermometer was inserted until the first bubble was observed. The temperature was noted and recorded.

Refractive Index

Few drops of the oil were placed on the face of a refractometer and gently spread, then closed and tightened. An ample time was allowed for the oil and prism to attain an equilibrium temperature, thereafter that, the refractive index of the oil was read.

Density

The weight of an empty beaker was noted, then 2ml of the garlic oil was poured into it and the weight was also noted. The difference in weight gives the weight of the oil. The density was then calculated using the expression:

Density = Mass Volume

Chemical Analysis

Standard chemical analyses were also carried out to determine the free fatty acid (FFA), acid value, saponification value, iodine value and pH of the garlic bulb oil (Ajakaiye, 2001). In addition, infra red analysis was carried out to determine the chemical composition of the garlic bulb oil.

RESULTS AND DISCUSSION

292.9g of dried garlic used for the extraction yielded only 1.23% of oil. The physical and chemical properties of the oil are shown in Tables 2 and 3 respectively.

The colour of the garlic oil was observed to be dark brown. Specific gravity of 1.207 which is higher than that (1.045-1.060) reported by BPC (1934) for garlic. The oil has a boiling point of 142°c, and refractive index of 1.4470 at 29^{0}c. This refractive index is lower than that of groundnut oil (1.460) and Soya bean oil (1.470) reported by Isa (1992). The reflective index is useful in detecting adulteration of oil, which is achieved by comparing the value in literature which that of the test sample.

The percentage free fatty acid is 56.4%, the acid value of the oil was 1.28mg/KOH/g, while the saponification value, which is the measure of the mean molecular weight of fatty acid present in the oil was recorded as 224.40mg/KOH/g. The iodine value was 79.63, and it is of the properties of unsaturated organic compound and tells the reactivity of the double bond. The pH of the oil was found to be 5.6, showing that the oil is fairly acidic.

Infra red ray analysis of the oil (Fig.2 and 3), reveal the presence of ∝-keto ester (enolic) chloroformates, and conjugated and general halides, primary and secondary and other animoacids.other compounds present in the oil are esters, normal saturated and traces of ∝-unsaturated aryl ester. Most of these compounds are either base chemicals or used in one-way or the other in anti-hypertension drug (NDI, 1991 - 1992). Though the components responsible for the hypertension control may not be specified here, it is certain that the oil

contains some groups of esters, alcohols and amine, which may be responsible for the control of hypertension and other artery, related diseases.

CONCLUSION

The oil extracted by soxhlet apparatus using hexane as solvent has percentage yield of 1.23%. It is dark brown with unpleasant odour, though edible. Some physical and chemical properties of the oil are within specification, while there is a slight variation in the cases of specific gravity and refractive index. This could be due to impurities present in the oil as it was not in its refined state. The pH value shows that the oil is non-toxic. The oil contains some of the functional groups such as esters, amides and alcohol, which are major base materials contained in anti-hypertension drugs like Aldomet, Dopamet and Aldora. Therefore, the production of garlic oil should be encouraged. A further research work is on to determine these properties and others like % esters, % amide and % alcohol in a refined garlic oil.

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Table 1: Some standard properties of garlic oil

	Property	Description
1	Colour	Pale yellow
2	Odour	Characteristic
3	Specific gravity	1.045-1.060
4	Refractive index 25^0C	1.557-1.575
5	pH	5-7

Table 2: Physical properties of garlic oil

	Property	Description
1.	Color	Dark brown
2.	Odour	Pungent
3.	Specific gravity	1.207
4.	Boiling point	142^0C
5.	Refractive index at 29^0C	1.447
6.	Viscosity at 29^0C	3.65×10^{-3}kg/ms
7.	Density at 29^0C	1.353 g/cm^3

Table 3: Chemical Properties of garlic oil

	Property	Description
1.	Free fatty acid	56.4%
2.	Acid value	1.128mg/KOH/g
3.	Saponification value	224.40mg/KOH/g
4.	Iodine value	79.63
5.	pH	5.6

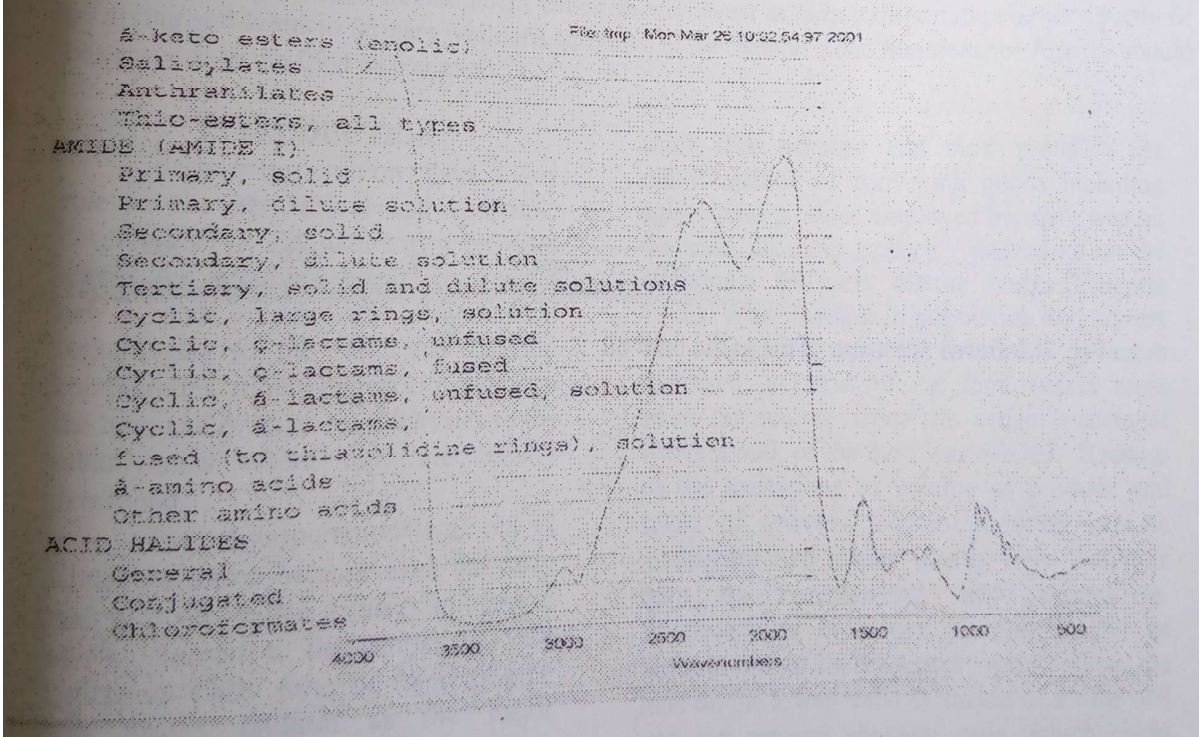

Fig.1 Infrared spectrum showing possible compound in the oil sample

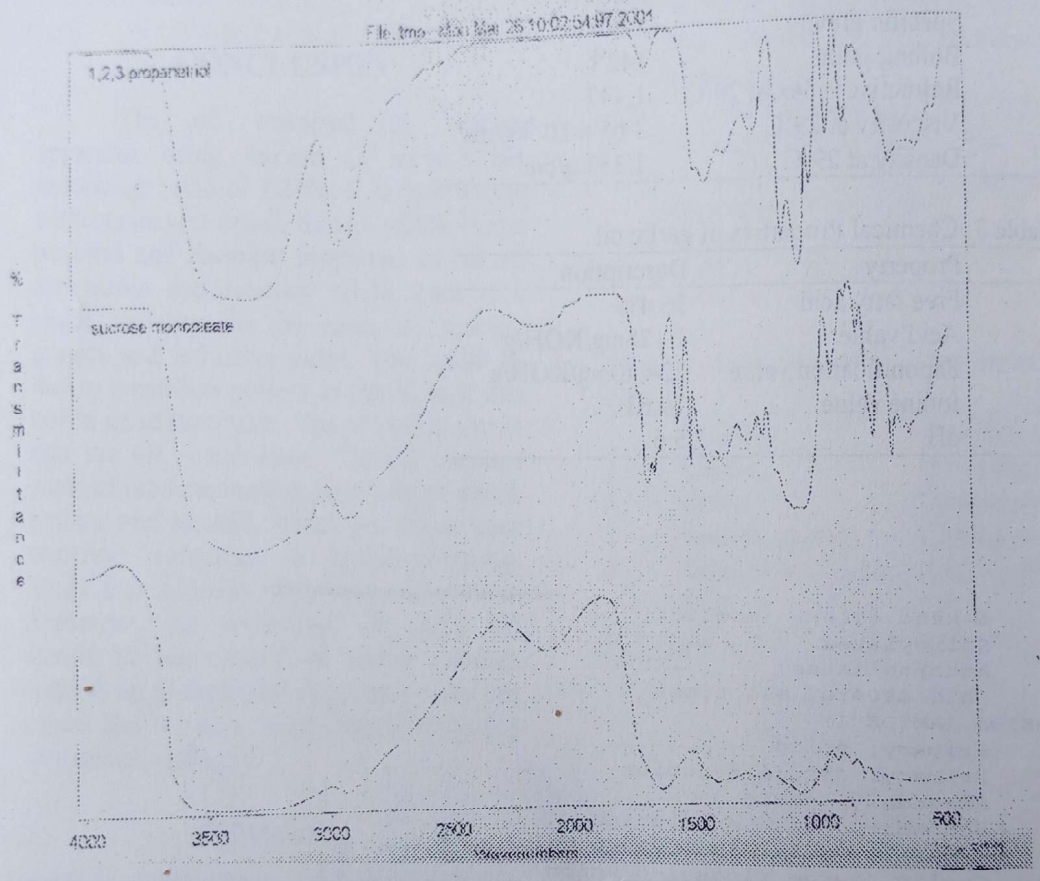

Fig. 2: Infrared spectrum of the garlic bulb oil