

Evaluation of the Industrial and Medicinal Values of Oil Extracted From Neem Seed

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Abstract

Neem seed (Azadirachta indica) is a medicinal plant which is exclusively tropical in distribution. Traditionally India medicine regards the plant in high esteem. The fatty acid composition of Neem seed oil were: Myristic acid (C14:0) (64.5842) as the highest saturated fatty acid, Oleic acid (C18:1) (5.3124) as the only highest monounsaturated fatty acid, Linoleic acid (C18:2) (2.6041) and Linolenic acid (C18:3) (0.9938) as the only polyunsaturated fatty acid present. Physicochemical properties of the extracted oil were investigated and their physical characteristics indicated that Oil extracted from Azadirachta indica is light green in color with bitter taste, percentage yield of 43.500%, Specific gravity of 0.8943 and Refractive index of 1.4610 respectively. The chemical characteristic of oil from Neem seed were Acid value (mg/g), (6.7320±0.01), free fatty acid (% oleic) (1.8984±0.01), saponification value (mg/g), (58.9050±0.02), Iodine value (mg/g), (16.2432±0.01), and peroxide value (mmoI/kg) (104.0000±0.02) respectively. The antibacterial activity of the oil from Azadirachta indica was tested against five pathogenic organism and their zone of inhibition indicated that the oil was susceptible to Klebsiella pneumonia, Pseudomonas spp, Staphylococcus aureus, Escherichia coli and resistance to Proteus spp. The values in millimeter were Escherichia coli (2.00±0.01), Staphylococcus aureus (5.00±0.02), Pseudomonas spp (7.00±0.02), Klebsiella pneumonas (2.00±0.01) and no zone of inhibition against Proteus spp. This study revealed that the oil extracts from neem seed is a useful source of drug for the treatment of pathogenic organism like Pseudomonas spp and Staphylococcus aureus which are most resistance to some antibiotics drugs.

Keywords: Neem Seed, Oil, Physico-Chemical, Fatty Acid, Antibacterial,

Introduction

Seed oils are important source of nutritional oils used as industrial raw materials and nutraceuticals. The characteristics of oils from different sources depend mainly on their composition; on oils from a single source can be suitable for all purposes thus the study of their constituents is important. Many consumers are looking for variety in their diets and aware of the health benefits of fresh fruits and vegetables are of special interest as food sources rich in antioxidants [1].

Seeds have nutritive and calorific values, which make them necessary in diets. They are also good sources of edible oil and fat, [2]. In addition, seed oils were found to be of nutritional, industrial and pharmaceutical importance [3]. Various vegetable oil are usually obtained from various sources. These include the common seed vegetable oils such as soybean oil, cotton oils such as peanuts oil, etc. Other less common but equally importance vegetable oils include rice brain oils, application is largely determined by the yield, composition, physical and chemical properties of the oil [4].

Neem (*Azadirachta india A. Juss*) is a plant of the melicease family belonging to the india subcontinent [5]. It was later introduced into

many tropical countries of America and Africa including Senegal with a population of 18 to 30million trees. Since that time neem plant had been very useful, particularly in traditional medicine [6]. Nevertheless in Senegal, their properties and composition are still poorly understood and their potential is under – exploited. From the point of view of the added value, the neem seed is the most important part of the plant given its content in oil and its many active molecules, that is why special attention is paid to the seeds. However, research on the seeds has increased since the isolation of azadiractin as a natural insecticide [7]. Thus, many works have carried out notably on their characterization. Studies have shown that the lipids content of the neem seed varies from 52 to 80%. The average azadirachta content of neem seed kernel can vary from 2.05 to 6.10kg [5]. The proteins content of the seeds and its amino acids composition have also been reported [8]. Neem oil is generally light to dark brown, bitter and has a rather strong odour that is said to combine the odours of peanut and garlic. It comprises mainly triglycerides and large amounts of triterpenoid compounds, which are responsible for the bitter taste [9]. Its acute toxicity was documented in rats and rabbits by oral rout and dose related pharmacotoxicity symptoms were noted [10]. It is hydrophobic in nature and in order to emulsify it in water for application purposes, it must be formulated with appropriate surfactants [11]. Neem has been found to have a potential biopesticide as reviewed by [12].

Neem oil also contains steroids (campesterol, beta-sitosterol, stigmasterol) and a plethora of triterpenoids of which azadirachtin is the most well-known. The azadirachtin content of neem oil varies from 300ppm to over 2500ppm depending on the extraction technology and quality of the neem seeds crushed [13].

The present study aims at carrying out the fatty acid composition, physical characteristics and chemical composition oil extracted from neem seeds. This will provide information about its edibility, industrial and pharmaceutical application. The results obtained can also be compared with other edible seed oils. To achieve this, the following objectives are considered; the oil from matured, dried and milled Neem seeds (*Azadirachta indica A. Juss*) was extracted by soxhlet extraction process and evaluated for its fatty acid composition, the oil for its physico-chemical properties like percentage yield, specific gravity, refractive index, viscosity, iodine value, peroxide value, saponification value, acid value were characterized and the results obtained were evaluated against the already existing results from other convectional oil normally consumed.

Collection and identification of plant material

Neem seeds (*Azadirachta indica A. Juss*) were bought from local farmer in the suburb villages in Owo town, Owo local government area and identified from Agricultural Technology Department, Rufus Giwa Polytechnic, and Owo in Ondo state.

Preparation of seed samples

The samples were manually dehulled from different point source in the site and kept inside clean buckets. It was sorted to remove the dirt and immature ones, sundried for two weeks and the samples were reduced to fine powder with the aid of a mechanical grinder to pass through 40 mesh sieves to increase the surface area for proper analysis. The milled powder samples were collected and stored in glass jars, tightly covered and kept for analysis

Characterization of the Extracted Oil

In evaluating the quality of the extracted oil, the percentage yield, refractive index, specific gravity, saponification values, acid value, iodine value, free fatty acid value, peroxide value of the oil were determined using [14]. The Fatty Acid composition was obtained by Chromatographic method (fatty acid methyl ester method)

Antibacterial Activity

Source of Microorganisms

Proteus, *E. coli*, *Staphylococcus aureus*, *Pseudomonas Spp* and *Klebsiella pneumonia* were collected from department of microbiology, Federal Medical Centre Owo, Ondo state of Nigeria.

Antibacterial Test of Neem seeds oil (*Azadirachta indica A. Juss*)

The oil was tested for its antibacterial properties using the agar – well technique. The assay for antibacterial activities was carried out with *Proteus*, *E. coli*, *Staphylococcus aureus*, *Pseudomonas Spp* and *Klebsiella pneumonia*. Triplicate plates of media for each organism were inoculated with the appropriate suspension of bacteria. Agar well was aseptically made in the media with a sterile 6.0mm diameter cork borer. The different concentrations of the test solutions of extracts were dispensed (0.5ml) aseptically into the wells. The plates were kept in sterilized inoculation chambers for two hours to facilitate diffusion of solutions. The plates were then inoculated at 37°C for 24hours for the bacteria. The diameters of the zones of inhibitions of bacteria growth were measured in the plates and the

mean value and standard error for each organism was recorded.

Results and discussion

Table 1: Physical Parameters of Oil from Neem seed (*Azadirachta indica A. Juss*)

Parameters	Results
Refractive Index	1.4610
Specific Gravity	0.8943
Colour (Unit)	Light green
Taste	Bitter
Oil Yield (%)	43.500

Table 2: Chemical Parameters of Oil from Neem seed (*Azadirachta indica A. Juss*)

Parameters	Sample A
Acid Value (mg/g)	6.7320±0.01
Free Fatty Acid (% oleic	1.8984±0.01
Saponification Value (mg/g)	58.9050±0.02
Iodine Value (mg/g)	16.2432±0.01
Peroxide Value (mmol/kg)	104.0000±0.02

± SDV of triplicate results

Table 3: Fatty acid composition of oil from Neem seed (*Azadirachta indica A. Juss*)

Parameter (%)	Values
Arachidic Acid (C20:0)	2.3736
Palmitic Acid (C16:0)	12.3968
Arachidonic acid(C20:4)	0.0080
Palmitoleic Acid (C16:1)	0.0103
Margaric Acid (C17:1)	0.0107
Myristic Acid(C14:0)	64.5842
Stearic Acid (C18:0)	8.1607
Oleic Acid (C18:1)	5.3124
Linoleic Acid (C18:2)	2.6041
Linolenic Acid (C18:3)	0.9938
Erucic Acid (C22:1)	0.0033
Behenic Acid (C22:1)	0.0060
Lignoceric acid (C24:0)	3.5240

Note: C: 0= Number of Carbon atoms and level of saturation or unsaturation

Table 4: Antibacterial Activity of Oil from Neem seed (*Azadirachta indica A. Juss*)

Sample	Organisms	Zone of Inhibition(mm)
Neem Seed Oil	<i>Proteus</i>	No Zone
	<i>Escherichia Coli</i>	2.00 ± 0.01
	<i>Staphylococcus aureus</i>	5.00 ± 0.02
	<i>Pseudomonas Spp</i>	7.00± 0.02
	<i>Klebsiella pneumonia</i>	2.00± 0.01

Discussion

Table 1 showed the results of physical parameters of oil extracted from Neem seed. The result indicated that % yield was 43.500 and had bitter taste. Refractive index (1.4610), specific gravity (0.8443), and has light green in colour. The refractive index which is the ratio of the velocity of light in a medium is an indication of the level of saturation of the oil [15].

Table 2, this show the result of chemical characteristic of oil from Neem seed which includes peroxide value with the greatest point (104.000), acid value (mglg), (6.7320), Iodine value (mglg), 16.243, saponification value (58.9050), and has the lowest value of 1.8984 of free fatty acid.

Acid value represent free fatty acid content due to enzymatic activity, and is usually indicative of spoilage. Its maximum acceptable level is 4mglg oil, for recommendation international standard for edible arachis oil Iodine value is a measure of the degree or unsaturation in an oil and it is an identity characteristic of native oil [16]. A good drying oil should have iodine value of 180 [17].

The high peroxide value in crude oil may also cause the spoilage of oil easily as a result of the concentration of peroxide in the resulting from oxidative rancidity giving the oil an unpleasant odour or flavor [18, 19].

The result for the antibacterial analysis of the Neem seed oils is presented in Table 3. It is a measure of the extent to which the oils are susceptible to the bacterial tested or whether they were resistant to the oils. Growth of eschemical coil is $2.00 + 0.01$, *staphylococcus aureus* $5.00 + 0.02$, *pseudomonas spp* $7.00 + 0.02$, *Klebsiella pneumonia* $2.00 + 0.01$ and protein with No Zone of inhibition. These indicated that *pseudomonas spp* has the highest Zone of inhibition and it was an indication that the oil can resist the growth of the organim than the rest. These results showed that Neem seed (*Azadirachta indica A.*) is susceptible to most of the pathogenic organism under test except *proteus*.

Conclusion

In conclusion, this research has projected on the extraction of oil from Need seed by carried out the analysis base on physical parameter, anti-microbial activity and chemical parameter. The high saponification value the percentage yield indicated that the oil is good in soap making. The higher peroxide value indicated that the oil is prone to oxidation rancidity.

Recommendation

It is recommended that the oil should be used for curative purposes by pharmaceutical industries due to its high susceptible to many pathogenic organisms.

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