Biochemical characteristics of the hemp (*Cannabis sativa*) seed oil

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Abstract

The *Cannabis sativa* seed (India hemp) used for this work were obtained in a farm land at Ogbese in Owo Local Government Area of Ondo State Nigeria. The seed were prepared for use by decorating, and milling and sun drying. A soxhlet 0.01%), acid value (9.75±0.025), saponification value (2.65±0.15 mg/g/KOH), peroxide value (85±0.01 mg/kg), iodine value (110.00±0.25 wij) and the yield percentage is 35/05% respectively. The extractor was used and hexane was used as solvent, which was recovered by simple distillation. The residue oil was investigated for physicochemical parameters, antimicrobial activities, and phytochemical screening. The results of the investigation show that, refractive index (1.47±0.03), specific gravity (1.45), PH (3.8±0.02), color (24 unit), smoke, flash and fire points (120, 210, 240-degree cencius) respectively. All these values were within the acceptable standard. The chemical parameters determined include free fatty acid (2.6±antibacterial activity evaluated were klebsiella pheumonia with zone of inhibition 0f 0.45±0.060mm, staphylococcus aeurus 0.55±0.01mm), streptococcus cereus 0.6±0.25mm, salmonella pypii 0.25±0.05 while *E. colli* were not susceptible to the oil. The phytochemical screening of the oil shows that phytate was highly present while oxalate, saponnin, flavonoid and steroids were moderately present; tannin and cyanogenic glycoside were slightly present while alkaloid was completely absent. The yield indicates that the *Cannabis sativa* seed oil is a good source of oil. Also, the assessment contains essential fatty acid needed in the body. Finally, the oil possesses some inhibitory characteristic.

Keywords: *Cannabis sativa*, hemp, phytochemical, smoke, flash, distillation

Introduction

Vegetable oil is essential in meeting global nutritional demands and is realized for many foods and other industrial purposes (Idouraine *et al*, 1996) [12]. Despite the broad ranges of sources for vegetable oil, the world consumption is dominated by soya beans, palm, rape seed and sunflower with million consumed per year (Stevenson *et al*, 2007) [20]. These conventional sources of vegetable oil no longer met the ever-increasing demand of domestic and industrial sectors (Idouraine *et al*, 1996) [12]. There the need exists to look for other sources to supplement the supplies from this point of view. Non-conventional oil seed are of much concern to cope with this challenge. (Esuoso *et al*, 1998) [9]. *Cannabis sativa* is an angiosperm belonging to the cannabaceae family and cannabis genus. Hemp plants itself is easy to grow in temperate climate and require good soil fertilizer and water but no pesticide nor herbicide (Sofowora, 2008) [18].

A hemp crop is usually harvested in 120 days after reaching the height of 10-15 feet. *Cannabis sativa* seed is one of the best sources of essential fatty acids with perfect 3:1 ratio of omega-3-linoleinic acid and omega-6-linoleic acid, good for strengthening the immune system. It is also a good source of gamma linoleic acid. The high content of omega-6and omega-3 fatty acid and the relatively high phytosterol content of *Cannabis sativa* make it beneficial to cardiovascular health, polyunsaturated fat that can reduce the risk of sudden cardiac arrest and fatal cardiac arrhythmia as well reducing blood cholesterol level (Ylone *et al*, 2003) [22]. it is also a good source of gamma linoleic acid and vitamin D of hemp is beneficial in preventing and treating osteoporosis while the essential fatty acid has been found capable of reversing scaly skin disorder, rheumatism, inflammation, diabetes, excessive epidermal water loss (Willson and Nicoll, 2002) [21].

The seed oil is also used in paints, shampoo and soap. Oil is also used in cosmetic and body care products, antimicrobial, anti-inflammatory and anti-ageing balances, skin pit and moisture level (Callaway *et al*, 2000) [7]. *Cannabis sativa* seed oil is valued primarily for its nutritional properties as well as for the health benefit associated with it. Although its fatty acid composition is most often noted with oil content ranging from 25-35% and additional comprises of 20-25 protein, 20-30% carbohydrate and 10-15% fibers along with trace materials (defame and pate, defame, 2000). Cannabidiol has been found to be present in *Cannabis sativa* seed oil as well. Although not explicitly produced within the seed, traces of cannabinoid contaminating have been reported to result from the passing of the oil (Groten hermen *et al* 2008) [10].

Even though the existing data on *Cannabis sativa* seed oil clearly demonstrate its functional value, this additional compound do add a marketable value and need to be examined, further additional quality and characterization. Therefore, the aim of this work is to find use for the seed of cannabis which were being wasted by extracting the oils and investigate the quality of the oil extracted, in order to know the best way, it can be utilized. The objective of the study is to investigate the potential use of the seed oil from *Cannabis sativa* in food production and pharmaceutical product to certify that the oil has good antimicrobial effects against the selected microorganisms for creative purpose and also to serve as eye opener to the consumption of oil from *Cannabis sativa* for its

health benefits.

Materials and methods

The seed (*Cannabis sativa*) used for this work were obtained in a farm At Ogbese in Owo Local Government Area of Ondo State. They were prepared for use by decoating, sun drying and millings. The soxhlet extractor used for the solvent extraction of the oils. The solvent used was hexane and it was recovered by simple distillation. The residue oil was collected and used for analytical work. The extracted oil was stored in a dark brown colored glass bottle as this will; prevent oxidation pending the analytical work. The PH, moisture content, specific gravity, flash, smoke and fire point were determined according to (AOAC, 2005) [5]. Refractive index of the oil sample was measured by the angle through which beam of light is bent when passing through a film of method fat or oil. This was determined by Abbey refractometer, couple with thermometer calibrated specimen and light source. The color was determined using lovibond tintometer and inche cell. The color which is in unit was calculated based on this formula (5RYY-B). Where R is the red pigment, Y is the yellow pigment and B is the blue pigment (Carson, 1991) [8]. The chemical properties of oil samples were determined by official methods of analytical chemist (AOAC, 2005) [5]. The chemical properties include free fatty acids, acid value, saponification value, peroxide value and iodine value. The antimicrobial activities if the oil samples were determined using the agar well techniques (Pelczer and black, 1993) [17]. The assay for antibacterial activity was carried out with klebsielle pheumonia staphylococcus aurenus, E. coli, streptococcus cereus, and salmonella typhi while the phytochemical screening was determined as described by (Habone 1973) [11] and (Sofowora 1980) [19].

Results and discussion

Table 1: Physical characteristic of (*Cannabis sativa*) seed oil

Parameter	Results
Specific gravity	1.45
Refractive index (25®C)	1.47±0.03
Moisture content (%)	1.40±0.04
PH	3.80±0.02
Flash point (®C)	210±0.01
Smoke point (®C)	120±0.20
Fire point (®C)	240±0.12
Color (unit)	24.00±0.00
Oil content (%)	35.05±0.02

Mean ± standard deviation of triplicate determination

The physical characteristics of *Cannabis sativa* seed oil were shown in table 1. The specific gravity of 1.45 indicating that it is denser water. The refractive index of *Cannabis sativa* of 1.47+0.03 was not in the same agreements with the value of 1.54+0,01 obtained for Garcinia kola which shows that the oil is very tick compare with most drying oil whose refractive index were between 1.15 and 1.49 (Aladekoyi and Jide, 2019) [4]. The oil yield was found to be 35.05%. This high yield makes the industrial practice of the oil recovery a profitable venture and will reduce the level of waste. In fact, the positive economic implication stated that the other deduction can be made by careful look at the parameter available (Nwobi *et al*, 2006) [14]. The PH of the oil sample was determined to be 3.80, the low level is indicative of the presence of a reasonable amount of a fatty acid in the oil. (Abitigun and Jide (2009) [2]. The flash, fire and smoke of oil have a linear relationship with the content of the free fatty acid present. The values are 210C, 240C and 120C respectively. So, the oil has a linear relationship with the content of free fatty acid (AOAC, 2005) [5]. The moisture content of the oil was 1.40+0.04 was a little bit higher than that of Shea butter of 1.2+0.43 reported by (Abitogun *et al*, (2011) [1]. The presence of moisture in the oil might be as a result of traditional method of extraction. The color was determined to be 24.00+0.00 lovibond unit. This was calculated based on the expression (5R+Y-B) where R is the red pigment, and Bis the blue pigments while Y is the yellow pigment respectively.

Table 2: Chemical characteristic of (*Cannabis sativa*) seed oil

Parameter	Results
Free fatty acid (%)	2.65±0.01
Acid value (%)	9.75±0.02
Saponification value (mg/KOH)	185.00±0.15
Peroxide value	110.00±0.25
Iodine value (wij)	85.00±0.11

Mean ± standard deviation of triplicate determination

Table 2 shows the chemical characteristics of *Cannabis sativa* seed oil. The low level of free fatty acid of 2.65±0.01 of the oil is higher than that of tangerine seed oil of 0.82 reported by (Abitogun and Jide, (2009) [2]. This is an indication that the oil sample will be good for human consumption.

The saponification value of 185.00±0.15 obtained for the sample suggests that the sample may be of high molecular weight fatty acid glyceride. Thus, it may find application in soap and shampoo and cosmetics industries. Since this higher than 182mg/KOH/g reported for Shea butter by (Abitogun *et al*, (2011) [1]. The peroxide value of the oil was found to be high, as 110.00±0.25 mg/kg even higher than that of sweet orange of 90.84 mg/kg as reported (Abitogun and Jide (2008) [3]. This measures the peroxide contain in the oil. The peroxide value can be used to assess the degree of rancidity or oxidation stability of oil (Pearson (1976) [16]. The high peroxide value of the oil indicate that the oil sample is prone to rancidity those less stable, however the result within and acceptable values. The iodine value of the oil was 85.00±o.11. This shows that it is dry oil. And the oil is more saturated fatty acid than unsaturated fatty acid.

Hence the greater the liquidity of the oil (Morris Jacob, (1999) [13]. however the iodine value is higher than 37.30 reported from cashew nut oil.

Table 3: Show the antimicrobial activities of (*Cannabis sativa*) seed oil

Sample	Organism	Zone of inhibition	Control
Oil extract of *Cannabis sativa* seed	*Klebsiella pneumonia*	0.45±0.60	20
	Staphylococcus aureus	0.55±0.45	15
	Escherichia coli	No ZONE-	14
	Streptococcus cereus	0.60±0.25	16
	Salmonella typhi	0.25±0.05	17

Mean± standard deviation of triplicate determination

Table 3 shows the antimicrobial activities of *Cannabis sativa* seed oil. The result for each organism was Klebsiella Pneumonia (0.45±0.60mm), Staphylococcus aureus (0.55±0.45), Escherichia coli (No zone- of inhibition), Streptococcus cereus (0.60±0.25mm) and Salmonella typhi (0.25±0.05mm) respectively. The highest activity was recorded in Streptococcus cereus while there is no effect on Escherichia coli. The inhibitory characteristic of the oil is as a result of bioactive component of the oil (Ashidi *et al*, 2005) [6]. The antimicrobial activity can be considered less active when compared with commercial and antibiotic such as gentamycin. Other pathogens are susceptible to the oil extract.

Table 4: Phytochemical screaning of (*Cannabis sativa*) seed oil

Parameters	Results
Oxalate	++
Phytate	+++
Tannin	+
Saponnin	++
Alkaloid	-
Flavonoid	++
Steroids	++
Cyanogenic glycoside	+

Note: + (slightly present), ++ (moderately present), +++ (highly present), - (absent)

Table 4 shows the phytochemical screening of *Cannabis sativa* seed oil the phytochemical screening shows that the oil is very rich in phytate, moderately rich in oxalate, saponin, flavonoid, and steroids while the oil is slightly rich in tannin and cyanogenic glycoside. Flavonoid, saponnin and tannin are known to have antimicrobial activity as well as physiological activity (Evans, 2005) [23].

Conclusion

The result of the investigation revealed that *Cannabis sativa* seed oil is a good source of oil. The result of the physicochemical analysis confirmed the suitability for industrial application and for human consumption. However, the oil justifies the use in traditional medicine practice as a therapeutic agent. The oil has inhibitory characteristic over some bacterial strain.

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