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Physico-chemical properties of Trichilia emetica seeds oil and its comparison with some selected oilseed oils

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The physico-chemical properties of trichilia emetica seeds have been studied for their domestic and commercial applications. The color of the oil was yellow and it was solid at room temperature. The seeds have been found to have good oil yield of 65.81% which is comparable to the oil yield of some selected commercial seed oils such as cottonseed, safflower, soybean and olive oil. Iodine value (60.15mgI_2/100g), peroxide value (0.56mgO_2/g), saponification value (180.09mgKOH/g), acid value (8.13mgKOH/g), kinematic viscosity (49.85mm^2/s), refractive index (1.47) and unsaponifiable matter (1.79) of the oil were determined by A.O.A.C. High saponification value guarantees the use of the oils in cosmetics and soap making industry. The acid value of the trichilia emetica seeds is higher than the maximum permissible acid level of 4mgKOH/g fat or oil required for edible virgin fats and oils and therefore it is necessary to purify the oil to make suitable for consumption. However the oil recorded low iodine values suggesting trichilia emetica seeds oil is highly saturated and may not be susceptible to rancidity. This study shows that, trichilia emetica seeds oil is a good source of edible oil for the local community after purification.

Keywords: Trichilia emetica seeds oil, physico-chemical properties,

INTRODUCTION

Woodland mahogany (Trichilia emetica) is a large, much branched evergreen reaching 8-25m high with a dense rounded crown. This species is in great demand in rural areas of Africa because it provides edible oil, medicine, timber, fuel wood and is used in agro forestry systems. Bark grey-brown or red-brown with fine, shallow striations and smallish scales. Branches erect or partly spreading, producing a pyramid-shaped crown when young, oval to rounded and dense when mature with a diameter sometimes exceeding 15m. Leaves up to 50cm long, unevenly compound with 3-5 pairs of leaflets plus a terminal one, dark green and glossy above, covered with short brownish hairs below, margins entire, veins prominent on lower surface. The flowers form pear-shaped red-brown fruit capsules which dry and split into three segments revealing a bunch of vivid red seeds. In other words; fruit rounded, furry, red-brown capsules to 3cm across, split into 3 or 4 parts to reveal 3-6 shiny black seeds 14-18 mm in length, each with a fleshy scarlet or orange-red aril almost covering the seed. A clear neck to 1cm long connects the capsule to the fruit stalk. The trees are commonly found in Uganda, Ethiopia, Kenya and Tanzania, south to Mozambique. It prefers well-drained, rich soils and high ground water [1].

Fats and oils are an important food source for man, and are supplying essential fatty acids such as linoleic and arachidonic acids. Fats and oils are also used for producing drug dispersants in therapeutics [2]. Oils from seeds are both edible and non-edible depending on the type. These oils are often available as raw materials for chemical and industrial applications. Because of the high demand and economic importance of these oil seeds to the chemical industry, attention have therefore been focused on underutilized Trichilia emetica seeds for possible development and use.

The objective of this study was therefore to extract oil from Trichilia emetica seeds, assess the physical and chemical characteristics and suggest possible uses for the oil as a prelude to an investigation into the scientific basis for its use for edible purposes. Comparisons between Trichilia emetica seeds oil and other oils from other plant sources are also made.

EXPERIMENTAL

Collection of seeds and identification

Trichilia emetica seeds were purchased from local market Tepi, South-west of Ethiopia. The plant was identified and authenticated by Ethiopian institute of agricultural research Tepi national spice research center, Tepi, Ethiopia. Seeds were obtained by removing/ breaking/ external cover manually (Fig. 1 &2). These seeds samples were

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cleaned with water to remove the impurities and stored in chemistry laboratory for further analysis.

Fig. 1. Trichilia emetica seed before removing the husk (Directly collected from local market)

Fig. 2. Trichilia emetica seed after removed the external cover, cleaned with water & dried

Extraction of seed oil

A known weight of the seeds was grounded into powder using an electrical coffee mille grinder machine (Nima, Japan) to increase surface area for oil extraction processes. Thereafter oil was extracted from this trichilia emetica seeds powder with n-hexane using a soxhlet extractor. The solvent (hexane) and oil are separated using distillation at a temperature of slightly higher than the boiling temperature of hexane, which is recovered again for further extraction with fresh hexane (Fig.3). The oil was stored in the chemistry laboratory room for physico- chemical properties analysis.

Determination of the Physicochemical Properties of the Oil

Standard methods were used to determine the physical and chemical properties of the oil, which includes the kinematic viscosity, peroxide value, iodine value, acid value, insoluble impurity, saponification value, un saponification value, refractive index and moisture content [13]. All tests were performed in triplicate and average experimental results evaluated.

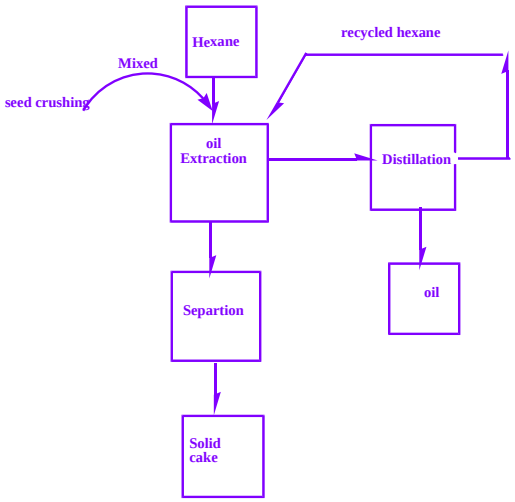

Figure 3 Oil extraction flow chart using hexane solvent

RESULTS AND DISCUSSION

Table 1 present the physicochemical properties of trichilia emetica seeds oil. The oil extracted from Trichilia emetica seeds has yellow color; solid at room temperature and agreeable odor. The oil content of Trichilia emetica seed in the present study was found to be (65.81%) which exceed that of some common edible oils such as cottonseed (22-24%), safflower (30-35%), soybean (18- 22%), rapeseed (40-48%), and olive (12- 50%) and unconventional oilseeds such as canarium schwenfurthii fruits (36.1%) and Balanites aegyptiaca almonds (48.3%) [4]. Therefore, the trichilia emetica seed can be considered as a potential source of vegetable oil for domestic and industrial purposes. Moisture content is another important quality characteristic for oils and fats. It is desirable to keep the moisture content low as it will increase the shelf life by preventing oxidation and rancidity processes. The moisture content of the oil is very low (4.81) compared with soybean seed oil (8.1), cotton seed oil (9.9), mustard seed oil (8.5) and linseed oil (6.5) and results shows that can be stored for a long time. Trichilia emetica seed oil has low iodin value (60.15) as compared with some conventional edible oils such as mustard seed oil (108), sunflower seed oil (128), linseed oil (174) and almond seed oil (96). But the IV of the present study was higher than some conventional edible oil like soybean seed oil (1.08), coconut oil (8.4), and cashew seed oil 41.3 [5]. The iodine value obtained is less than <100 suggesting the absence of unsaturated fatty acids and this places the oil in the non-drying groups.

Table 1. Physicochemical characteristics of the Trichilia emetica seed oil

Parameter	Value
Kinematic viscosity (mm^2/s)	49.854
Moisture & Volatile Matter (%)	4.81
Insoluble Impurity **(%)**	0.14
Peroxide Value	0.56
Acid Value(mgKOH/g)	8.13
Iodine Value (mgKOH/g)	60.15
Saponification Value (mgKOH/g)	180.09
Unsaponifiable Matter	1.79
Refractive Index	1.47
State at room temperature	Solid
Color	Yellow

The saponification value (180.09) obtained for Trichilia emetica seed oil is slightly lower than those of the common oils such as soybean (189-195), Peanut (187 - 196) and cotton seed oil (189-198) [6]. But the SV of Trichilia emetica seed oil is higher than Mustard Seed Oil (174), Persea gratesima seed oil (106), Telferia occidentalis seed oil (158). The relatively high saponification value recorded for Trichilia emetica the seed oils is indicative that they have potential for use in the industry. The peroxide values (PV) of the present studied oil is low (0.56) compared to the maximum acceptable value 10meq KOH/g set by the Codex Alimentarius Commission for groundnut seed . The low values of PV are indicative of low levels of oxidative rancidity of the oils and also suggest strong presence or high levels of antioxidant. The oil is thus stable and would not easily go rancid. Refractive index is used by most processors to measure the change in unsaturation as the fat or oil is hydrogenated.

The refractive index of oils depends on their molecular weight, fatty acid chain length, degree of unsaturation, and degree of conjugation [7]. The Trichilia emetica seed oil showed a refractive index of 1.47, which was similar to Linseed Oil (1.4736), Sunflower Seed Oil (1.4672) and Soybean Seed Oil (1.4658) seed oils. Pure oils have marked ranges of refractive index and density; thus, the degree of variation of typical oil from its true values may indicate its relative purity.

Acid value is an important index of physicochemical property of oil which is used to indicate the quality, age, edibility and suitability of oil for use in industries such as paint. The higher acid value of the Trichilia emetica seed oil when compared with that of soybean oil suggests that the Trichilia emetica seed oil is more susceptible to lipase action. This value (8.13KOH mg/g) for the Trichilia emetica seed oil is higher than the 0.6 mg/g proposed for edible vegetable oil [8]. The higher acid value of Trichilia emetica seed oil is due to the presence of free fatty acid in the oil. The seed oil requires refining to minimize their acidity before to envisage eventual food use.

The unsaponifiable matter obtained in this study was 1.47% however higher than those of other oils such cannarium schweinfuhil Engl (1.3%), sesame (1.2%), white melon (1.1%), corn oil (0.92%), palm kernel oil (0.22%), coco kernel oil (0.09%), rubber seed oil (0.7%) and castor seed oil (0.5%) [9].

CONCLUSIONS

The seed of trichilia emetica contains high level of oil, with a value of 65.81% (w/w). The value compares well with oil content of seed oils such as cottonseed, safflower, soybean and olive oil. The physico-chemical properties of trichilia emetica seeds oil viz., iodine value, peroxide value, saponification value, acid value, kinematic viscosity, refractive index, unsaponifiable matter have been studied for their domestic and commercial applications. The color of the oil was yellow and it was solid at room temperature. High saponification value (180.09mgKOH/Kg) guarantees for a variety of industrial applications such as cosmetics and soap making. The acid value of the trichilia emetica seeds is higher than the maximum permissible acid level of 4 mg KOH/g fat or oil required for edible virgin fats and oils and therefore it is necessary to purify the oil to make suitable for consumption. However the oil recorded low iodine values suggesting trichilia emetica seeds oil is highly saturated and may not be susceptible to rancidity. This study shows that, trichilia emetica seeds oil is a good source of edible oil for the local community after purification.

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ФИЗИКО-ХИМИЧНИ СВОЙСТВА НА МАСЛОДАЙНИ СЕМЕНА ОТ TRICHILIA EMETICA И СРАВНЯВАНЕ С НЯКОИ ИЗБРАНИ РАСТИТЕЛНИ МАСЛА

Б. Адиню

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(Резюме)

Физико-химичните свойства на семена *от trichilia emetica* са изследвани за техните битови и търговски приложения. Маслото е с жълт цвят и е твърдо вещество при стайна температура. Семената имат добър добив на масло от 65,81%, който е сравним с добива на масло на някои избрани търговски растителни масла като памучно, шафран, соя и зехтин. Стоността по йод (60.15mgI_2/100g), стойността по пероксид (0.56mgO_2/g), стойност на осапуняване (180.09mgKOH/g), киселинната стойност (8.13mgKOH/g), кинематичнrs вискозитет (49.85 mm^2/s), индекса на пречупване (1.47) и неосапуняемата материя (1.79) на маслото бяха определелени по AOAC Високата стойност на осапуняване гарантира използването на маслата в козметиката и сапунената индустрията. Киселинната стойността на emetica семена trichilia е по-висока от максимално допустимата стойност от 4mgKOH/g мазнини или масло, необходимо за ядливи прясно пресовани мазнини и масла и поради това е необходимо маслото да се пречисти за да се направи подходящо за консумация. Въпреки това регистрираните записва ниски стойности по йод, предполагат, че е силно наситено и не може да бъде податливо на гранясване. Това проучване показва, че маслото от семена на trichilia emetica е добър източник на хранителни масла за местната общност след пречистване.