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Extraction and characterization of Syzygium cumini (Jamun) seed oil

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Abstract

This paper deals with the extraction and characterization of Syzygium cumini (Jamun) seed oil using petroleum ether as solvent. The seeds were found to contain10% oil .The physicochemical characteristics like refractive index, specific gravity, saponification value, Iodine value, acid number was determined. The extracted oil has saponification value 180 indicates moderate cleansing ability. The high iodine value suggests that the oil is more susceptible towards atmospheric oxidation, further confirmed by acid number.

Keywords- Syzygium cumini, Jamun seed oil, solvent extraction, physicochemical properties, saponification value.

I. INTRODUCTION

Jamun seed oil is a yellowish brown semi viscous liquid derived from the seeds of the plant *Syzygium cumini* from family myrtaceae, commonly known as jambul, black plum, Indian blackberry, jamblang or black cumin. Jamun tree was first originated in India which has now been spread to in many countries of South western Asia and Eastern Africa .It is found and grown for various products in many countries ^[1].

The tree is large in size. The fruits are berries and sweetish sour to taste. The tree fruits once in a year. The ripe fruits are used for health drinks making preservatives, squashes, jellies and wine ^[2].

All parts of the tree are used to treat a range of ailments, especially the seeds in diabetes mellitus. It has been reported antioxidant, anti-allergenic, radio protective, anti-inflammatory, neuropsycho pharmacological and anti-microbial activities. The seeds have been reported to contain 3-10 % fixed oil, out of which the major fatty acids reported in earlier studies are meristic acid and oleic acid ^[3]. A wide range of phyto steroids such as beta sistosterol are also present.

In Goa and the Philippines the Jamun are an important source of wine, resembling Port. Brandy and distilled liquor called "jambava" have also been made from the fermented fruit. Jambolan vinegar is attractive, clear purple pleasant aromatic liquid made throughout India^{[4]-[8]}.



FIGURE 1. JAMUN TREE



FIGURE 2. MATURE FRUITS ON TREE



FIGURE 3. FRUITS



FIGURE 4. DRIED SEEDS



FIGURE 5. SEED POWDER

II. MATERIAL AND METHODS

2.1 Raw Material processing

a. **Seed collection**- The seeds were purchased from local market of Jodhpur.

b. **Cleaning-** The seeds were washed with water to remove dust and dirt particles.

c. **Drying-** The cleaned seeds were dried in an oven at 60° C for 7 hours to reduce the moisture content. After drying the seeds were stored in air tight containers for analysis.

d. **Size reduction**- The seeds were crushed by Mortar and pestle into small pieces for effective extraction of the oil.

2.2 Determination of Physical Properties of the seeds^[9]

a. percentage of moisture

40 g of seeds were taken in a silica crucible and dried in an oven at 80^{0} C for 7 hours. The weight of crucible and seeds sample was recorded after every 2 hours using cooling in desiccators. This procedure was repeated till a constant weight is obtained. The moisture content was calculated by the formula

 $M\% = 100 (W_2-W_1)/M$

b. Determination of the percentage of Jamun oil Extracted

150 ml. of normal hexane was taken in a round bottom flask. 30 g of crushed seeds were filled in a thimble. The apparatus was heated at 60° C and allowed for three continuous extractions. The experiment was repeated with different amounts of samples and the weights of extracted oil were taken. From these values the % oil was calculated.

2.3. Extraction of oil in Soxhlet Extract

300 ml of petroleum ether $(40-60^{\circ}\text{C} \text{ range of boiling point})$ was taken in round bottom flask. 10 gram of crushed seeds was taken in a thimble and it was placed in apparatus. The soxhlet was heated at 60° c. The extraction process by Soxhlet was carried out for 30 minutes. The thimble was removed from the tube, dried in oven, cooled in desiccators and the weight was noted. This process was repeated to get the maximum extract. 5 g of sample seeds were taken and same procedure was repeated. After complete extraction the resulting micelle/resulting mixture was taken for solvent recovery. The oil thus obtained was cooled and filled in a viol.

2.4. Characterization of the Extracted Jamun seed oil

a. Determination of Boiling point of oil

The boiling point of oil was obtained by heating it on heating mantle to form the bubbles. The temperature of oil was obtained using a thermometer in it.

b. Determination of Refractive Index

Adobe Refractometer was used to determine the refractive index of the oil. The values were taken at 30° C.

c. Determination of Specific gravity

Density bottle was used for specific gravity determination. The weight of 25 ml. capacity bottle was taken and it is filled with oil sample. The weight of oil and bottle was noted. The same process was repeated with water as reference standard.

d. Determination of Saponification value

ISO 3657 (1988) indicator method ^[10] was applied to determine Saponification value. 2g (M) of oil was weighed in a conical flask and 25 ml. of N/10 ethanolic KOH is added to it. A reflux condenser was fixed on it and allowed to heat for 1 hour. A few drops of phenolphthalein indicator was mixed to warm mixture and titrated against M/2 HCl (N) to get the colorless solution. The volume of HCl used was noted as V₁. The same steps was repeated with blank simultaneously also and volume was taken (V₀). S.V. (Saponification value) was calculated by following formula.

 $S.V. = 56.1 \text{ N} (V_0 - V_1)/M$

e. Determination of Acid Value ^[12]

25 ml of diethyl ether and 25 ml of ethanol was mixed in a beaker of 250 ml. capacity. This mixture was added to 10 g (W_0) of oil filled in a 250 ml conical flask and a few drops of phenolphthalein indicator were mixed to it. The mixture was titrated against M/10 NaOH with continue shaking to get dark pink color at volume of NaOH V_0 . The free fatty acids were calculated as

FFA=2.82x100xV₀/W₀

The acid value was calculated as FFA/2.

f. Determination of Iodine value

ISO 3961 (1989) method ^[11] was used to determine the Iodine value. 0.4 g oil (M) was weighed into a conical flask with 20 ml. of carbon tetra chloride to dissolve it. 25 ml. of Dam's reagent was added in fume chamber. The flask was swirled vigorously after inserting topper. It was placed in dark for 2.5 hours. After that 20 ml of 10% aqueous KI and 120ml of water were added to the contents. It was titrated with M/10 sodium thiosulphate solution to get a pale yellow solution. 1% starch indicator was added to get blue color. It was again titrated till disappearance of blue color (V₂ ml). The same procedure was repeated with the blank solution (V₁ml). The iodine value (I.V.) was calculated by the expression:

I.V. =12.69C (V_1 - V_2)/M

g. Determination of Viscosity

Redwood viscometer no.1 was used to determine the viscosity of oil sample. It was recorded as redwood second at room temperature. 50 ml of oil was allowed to flow through orifice. The time to flow of oil is noted in redwood seconds.

h. Determination of pH value

2g sample was taken into a clean dry beaker and 13ml of hot distilled water was added to it and stirred slowly. It was then cooled in a cold water bath to 25° C. The pH electrode was standardized

and the electrode immersed into the sample and pH value of sample was read.

III. Results and Discussion

The results obtained for above mentioned analysis are shown in the table 1 and table 2.

Table1.PHYSICOCHEMICALPROPERTIESOFSEEDS

Sr.no.	Property of seeds	details
1	Seed morphology	Poly embryonic up to 4
		embryos, 3 are
		germinative,20-80% of
		fruit weight
2	Moisture content	5.65%
3	Oil content	10.0%
4	Protein content	4.99 % (NX6.25%)

TABLE 2 PHYSICAL PROPERTIES OF CRUDE OIL

Sr. no.	PROPERTY	OBSERVATION
1	Appearance	Yellowish
2	Refractive Index at room	1.481
	temperature	
3	Specific gravity	0.9432
4	Acid value (mg NaOH/g	1.711
	of oil)	
5	Saponification value (mg	180
	KOH/g of oil)	
6	Iodine value (g I ₂ /100 g	97.12
	of oil)	
8	pH	6.22

IV. Results and Discussion

The present content of moisture in the matured seeds was found as 5.65% which may vary from sample to sample and on the time of storage of seeds and fruits. The oil content was found as 10% in the selected sample. This percentage is an effect of variety, environmental and climatic conditions, also on the mode of extraction. In earlier reports it has been found in the range of 3-10%. The protein content on the selected sample was found as 4.99(NX6.25%).

Table 2 represents the physicochemical properties of seeds. The crude oil is yellowish in color. The refractive index of crude oil was found as 1.481 at room temperature. The specific gravity of oils was recorded as 0.9432 .The acid value was found as 1.711 (mg NaOH/g of oil). Saponification values (mg KOH/g of oil) were calculated as 180. The Iodine values (g $I_2/100$ g of oil) were found as 97.12. As a result of their agreement with standard categories the oil is classified as a non-drying oil. The pH of oil was found as 6.22.

V. Conclusion and Scope

The percentage of oil was fount as 10%, which is quite satisfactory for industrial consumption. Since the oil is a non-drying oil so it can be used in manufacturing of soap. In addition to its medicinal values the oil can also be used as a binding material of natural drugs. The yield of seeds and their oil percentage are affected by a number of factors like environmental conditions, variety of plant, age of plant, collection timings, storage etc. Out of them many parameters can be controlled for better results.

A number of fields could be tried on the basis of present results and previous research to seek the applications of Jamun seed oil in specific manner.

In summarized form it can be concluded that Jamun seed oil should be studied further and the products should be standardized for better applications.

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