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STUDY OF PHYSICOCHEMICAL PROPERTIES OF SILK MIMOSA SEEDS OIL

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ABSTRACT

The present study was conducted to investigate physicochemical properties of silk mimosa seeds with seed cover. The sun dried powdered seed material of silk mimosa was extracted with hexane solvent and obtained filtered seed oil for experimental work and evaluated various physicochemical properties such as moisture content, color, pH value, viscosity, specific gravity, acid value, saponification value, unsaponifiable matter , TLC test, solubility and density etc. From this filtered seed oil it was found out that seed of silk mimosa contained 10.03% of oil (dry weight basis), 2.01% of moisture and 190.63% of saponification value which indicates that seed oil of silk mimosa is very useful in the production of liquid soap and shampoo. Acid value 6.28 and specific gravity 0.92 suggests that seed oil is suitable for edible purposes, paint manufacturing and varnish. It's P/S ratio 2.96 indicates its use in medicinal purposes, especially in the medicines to maintain low serum cholesterol levels, atherosclerosis and to prevent heart diseases. This study will also be useful in maintaining the quality and effectiveness of the oil in different fields. The characterization of silk mimosa seed oil indicates that this can be successfully used in the production of soap manufacturing, hair shampoos, soap printing, paints, protective coating, inks and as a raw material in the manufacturing of various chemicals.

KEYWORDS

P/S Ratio, TLC, Rf, Physicochemical, Acid Value, Specific Gravity, Silk Mimosa, Saponification, Unsaponifiable Matter and A. Julibrissin.

INTRODUCTION

Silk mimosa is a species of tree in the Family Fabaceae native of South Western Asia and Eastern Asia[1] also known as Albizia Julibrissin or pink silk tree.This tree is 5-16 meters tall. The species A. Julibrissin are widely distributed in Asia, Africa, Australia and Subtropical America[2,3]. This is a highly reputed medicinal and ornamental tree due to its flower staminal tube stamens which is starbursts of pink silky threads, that's why it is called as silk mimosa. Its epithetic name Julibrissin was a corrupted word of the Persian word gul-i-abrisham, which means 'gul' the flower and 'abrisham' the silk[4]. Its fruit is a flat brown pod 10-18 cm long and 2-2.5 cm

broad containing five or more brown oval shaped seeds which persist on the plant through the winter and seeds get ripen from September to November. It is used as a spiritual cleanser, good for dealing with depression and irritability, as well as in insomnia. It is also known to help in skin disorders and especially in skin irritations. It is not considered as edible[5]. The bark and flowers of A. Julibrissin are used in China as medicine[6]. Bark extract is a sedative and anti-inflammatory drug for treating swelling and pain of lungs, skin ulcers, wounds, bruises, abscesses, boils, hemorrhoids, fractures and has displayed cytotoxic activity[7,8,9]. The flowers have been commonly used to treat anxiety, depression and insomnia[10]. The seeds are a source of oil[11] and have shown to possess proteolytic enzymes which clotted milk readily without developing any bitterness in cheese after three months of ripening[12]. Silk mimosa oil is used in the production of paint, soap printing inks, oil cloth and as a protective layer. It is also used as a raw material in the manufacturing of various chemicals.

To our knowledge until now a physicochemical characterization of the seed oil of A. Julibrissin has not been reported. It is important scientifically to develop a standard monograph on the basis of physicochemical parameters and properties of filtered oil extract that was extracted from silk mimosa seed with its cover. This will provide a guideline for innovative uses of this in pharmaceutical and other industries.

MATERIALS AND METHODS

Seeds of silk mimosa were collected in February from two trees of Jhansi city and healthy seeds were directly isolated. Sun dried seeds were powdered in grinding machine and the powder was than dried in the oven at 40°C for six hours and stored in an air tight container for experimental purposes. Now seed oil was extracted from seed powder using hexane as a solvent. The powdered material was placed in a thimble of the soxhlet and extracted with hexane solvent. The extraction of the oil was completed in twenty eight hours. After removal of solvent, extracted seed oil was filtered with filter paper and was used for experimental work.

(i) Determination of Moisture Content:

5 ml oil sample of silk mimosa seed was thoroughly mixed by stirring. Lid of the dish was loosened and heated in the oven at 105 ± 1°C for one hour and then cooled in a desiccator. This was again heated for one hour and now after cooling it was weighed and the process was repeated until constant weight[13] was obtained.

Moisture and volatile matter = W_1 X 100/W

W_1= Loss in grams of the material on drying

W = Weight in grams of the material taken for the test

(ii) Determination of Color:

Traces of moisture of filtered oil sample was made absolutely clear and free from turbidity. Then the glass cell of desired size was rinsed with carbon tetrachloride and was then filled with the oil and placed in the tint meter. Colors were matched with red, yellow and blue. Oil in terms of units is as follows[14]:

Color reading = (a Y + 5 b R) or (a Y + 10 b R)

Where a and b = Sum of various yellow (Y) and red slides (R)

Y + 5 R is the mode of expressing color of light colored oils

and Y + 10 R is for the dark colored oils

(iii) Determination of pH Value:

2g of the sample was taken in a clean and dried 25ml beaker and 13ml of hot distilled water was added to the sample and was stirred slowly. Now this was cooled on a cold water bath up to 25°C. The pH electrode was standardized with buffer solution and was immersed into the sample. Now pH value was recorded.

(iv) Determination of Viscosity:

Viscometer with a flow time above 200 Sec. was elected. The sample was filtered through a sintered glass crucible to eliminate dust and other solid material in the liquid sample. The viscometer was charged with the sample by inverting the tube thinner arm into the liquid sample and suction force was drawn up to the upper timing mark of the viscometer, after which the instrument was turned off to its normal vertical position. The viscometer was placed in a holder and was inserted to a constant temperature, bath set at 30°C and was then allowed for 10 min., so that sample comes to the bath temperature at 30°C. The suction force was then applied to the thinner arm to draw the sample slightly above the upper mark. The time for the upper mark to the lower mark was recorded.

$$\frac{\eta_1}{\eta_2} = \frac{t_1 \cdot d_1}{t_2 \cdot d_2}$$

(v) Determination of Specific Gravity:

Cleaned specific gravity bottle was kept on water bath at 30°C for 30 minutes. Any oil that has come out of the capillary was wiped off carefully. Bottle was taken out of the bath and was cleaned and dried. Now removing the cap of the side arm, weighing was done immediately, ensuring that the temperature does not fall below 30°C[15].

$$\text{Specific Gravity at } 30^{o}C = \frac{A - B}{C - B}$$

A = Wt. of specific gravity bottle with oil in gm

B = Wt. of empty specific gravity bottle in gm

C = Wt. of specific gravity bottle with water in gm

(vi) Determination of Acid Value:

5 gm sample in a 250 ml in a conical flask was taken and to this was added 80 ml neutralized hot ethyl alcohol and 1 ml of phenolphthalein and was boiled for 5 min. and now the solution was titrated with KOH[16].

$$\text{Acid Value} = \frac{56.1\ N.V}{W}$$

W = Wt. of sample in gm

N = Normality of KOH solution

V= Vol. of standard KOH used in ml

(vii) Determination of Saponification Value:

Sample was filtered through a filter paper to remove any impurities and was completely dried and weighed (1.5 gm), now this was transferred to a 250 ml Erlenmeyer flask. 25 ml of alcoholic KOH solution was added to the flask. Blank determination along with the sample was also performed. Sample flask and empty flask were connected with air condensers and these were kept on the water bath and boiled gently but steadily until saponfication was complete. This was indicated by the absence of any oily matter up to the appearance of clear solution. Clarity was achieved in about one hour of boiling. The access of KOH was titrated with 0.5N HCl using phenolphthalein indicator[17].

$$\text{Saponification Value} = \frac{56.1\ (B - S)\ N}{W}$$

B = Vol. of standard HCl required for blank titration in ml

S = Vol. of standard HCl required for sample in ml

N = Normality of HCl

W = Weight of oil sample in gm

(viii) Determination of Unsaponifiable Matter:

5 gm oil sample was taken in a 250 ml conical flask along with 50 ml of alcoholic KOH and this was refluxed with air condenser for one hour. 5 ml C_2H_5OH was added during the saponification and the condenser was washed with 10 ml C_2H_5OH. Now warm mixture was transferred to a separating funnel and the flask was cooled to 20-25^oC. To this was added 50 ml of petroleum ether and was shaken vigorously and then allowed the layers to separate.

The lower soap layer was transferred to another separating funnel and ether extraction was repeated for further three times using 50 ml portions of petroleum ether. Ether extract was combined three times with 25 ml of aqueous alcohol and followed the process with 25 ml of distilled water to ensure that ether extract is free from alkali. Ether solution is now transferred to 250 ml beaker and separator was rinsed with ether. Evaporation of 5 ml portions of ether was done in Erlenmeyer flask which was previously dried and weighed. For removing all the ether, 2-3 ml of acetone was added and boiled on water bath and was weighed. To

remove last traces of ether, drying was done at 100°C for about 30 min. till constant weight was obtained. Residue was now dissolved in 50 ml of warm ethanol which was now titrated with 0.02N NaOH in the presence of phenolphthalein indicator[18].

$$\text{Unsaponifiable Matter} = \frac{100\,(A - B)}{W}$$

A = Weight of residue in gm

B = Weight of free fatty acid in the extract in gm

W = Weight of sample in gm

(ix) TLC Test:

Silica gel G is mixed with chloroform and CH_3OH (80 + 20 ml ratio) . Mixture was spreaded on the glass plate and dried in air and then activated at 110°C for 15 min., and was now cooled in the desiccator. Now 10 ml of 10% solution of oil in $CHCl_3$ was taken on a dry glass plate and slide was placed in a developing tank containing petroleum ether. Now tank was covered and solvent was allowed to travel for 6 cm from the origin (about 4 min.), now plate was removed from the tank and dried in the air, to this was sprayed fluorescence. Appearance of a yellow florescent spot on the solvent front indicates the presence of mineral oil. Oil forms a yellow and green streak about 5-6 cm long from the point of spotting.

Free fatty acid, Peroxide value, Iodine value, P/S ratio, Color, Ash, Density and Solubility were also observed and recorded by the standard methods[14-18].

RESULTS

Oil obtained by extraction through hexane is a dark yellow viscous liquid and is soluble in petroleum ether, benzene and diethyl ether. Results of various physicochemical parameters evaluated in the present study are as given as follows:

Physicochemical properties of Silk Mimosa seed oil

No.	Physicochemical Properties	Observed Values
1	Moisture content	In oil 10.03%, moisture 2.01%
2	Viscosity	9.423 Centipoise
3	Density	0.757 Kg/m^3
4	Color	Yellow
5	pH Value	5.2
6	Specific Gravity	0.910
7	Acid Value	6.28
8	Saponification Value	190.63
9	Unsaponifiable matter	0.9
10	Iodine Value	113.32
11	Rf Value	0.70 cm
12	Ash	3.2 Wt %
13	Solubility	Insoluble in water, soluble in petroleum ether, benzene and diethyl

		ether
14	P/S Ratio (Polyunsaturated/Saturated Ratio)	2.963
15	Free Fatty Acid	2.54%
16	Peroxide Value	6.621 meq 02/kg oil

DISCUSSION

Seeds of A. Julibrissin contained 10.03% of oil (dry weight basis) and 2.01% of moisture, the moisture of this oil is compared with those of other seed oils such as Phoenix Canariensis (10.36%)[19], Spanish broom (10.50%)[20] and Rasberry (10.70%)[21].

The saponification value of A. Julibrissin seed oil (190.63) is similar to that of other oils such as Linseed oil (190.86), Sunflower oil (188.98) and Olive oil (191.93)[22]. The high saponification value indicates that oils are normal triglycerides and are very useful in production of liquid soap and shampoo industries. Therefore the value obtained for A. Julibrissin seed oil in this study shows that it has high potency for use in the production of liquid soap and shampoo.

Acid value is an indicator for edibility of oil and suitability for industrial use. Silk mimosa has the highest acid value of 6.28, which suggests that the oil is suitable for edible purposes and also in the manufacturing of paints and varnishes. Insolubility in water and its yellow color also makes it very useful for paint industry.

A. Julibrissin specific gravity is 0.910. Most popular plant oils have specific gravity of 0.92 and is considered good for any cooking oil. Some authors have stated that the specific gravity suitable for edible oil ranges from 0.8800 to 0.944[23].

The peroxide value is 6.621 meq 02/kg oil is higher than that of Soybean oil (1.52 meq 02/kg oil) and this can be attributed to the presence of higher amounts of polyunsaturated fatty acids which makes it useful in terms of nutrition.

Iodine value is an indicator of the degree of saturation of fatty acids and no significant difference was observed among the oil samples. The obtained oils had iodine value 113.32. The results indicate that oil has more unsaturated fatty acids, therefore oil can be used in soap and paint industry and makes it desirable in terms of nutrition. Silk mimosa seed oil was characterized by a polyunsaturated/saturated (P/S) ratio of 2.96. The value of this ratio is in correlation with those of refractive index, a higher ratio of P/S is regarded favorable for the reduction of serum cholesterol and prevention of heart diseases.

Rf Value, Viscosity, Density, pH Value and Free fatty acid percentage was 0.70 cm, 9.423 centipoise, 0.757 kg/m^3, 5.2 and 2.54% indicates that A. Julibrissin seed oil with cover can be used for making hair shampoo, soap, protective layer, paints and some nutrition products.

CONCLUSION

This preliminary physicochemical study shows that silk mimosa seed oil could be successfully used for high quality industrial paint formulation, in making of hair shampoo, soaps, protective layer, soap printing ink and as a raw material in the manufacturing of various chemicals. Due to its Iodine value (113.32), Peroxide value (6.621 meq 02/kg oil), P/S ratio (2.96), Acid value (6.28) and Specific Gravity (0.910) suggest that it is useful for edible oil range and a substitute for few nutrition products.

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