Extraction and Characterization of Mirabilis Jalapa Seed Oil

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Abstract -- This paper deals with the extraction and characterization of seed oil of Mirabilis Jalapa, commonly called as the marvel of Peru or four o'clock flower using petroleum ether as solvent. The seeds were found to contain 4.5% oil .Refractive index, specific gravity, saponification number, and Iodine value, acid number was determined as main physicochemical characteristics. The density of extracted oil was found as 0.70 g/ml .The iodine value was found as 83 and saponification value 174. This saponification value indicates moderate cleansing ability whereas the high iodine value suggests reactivity towards atmospheric oxidation on exposure to air.

Indexed Terms- Mirabilis Jalapa, seed oil, solvent extraction, physicochemical properties, and saponification number.

I. INTRODUCTION

Mirabilis Jalapa seed oil is a light weight liquid derived from the seeds of the plant, four o'clock flower or the marvel of Peru, belongs to the Nyctaginaceae family. It is an evergreen garden flowering shrub. Mirabilis in Latin signifies "wonderful" and Jalapa is a usual place-name in North America and Central. It was exported from the Peruvian Andes in 1540 and became naturalized in many parts of the Southern U.S. It was introduced into Europe by the Spaniards in 1596.This plant was cultivated by the Aztecs for medicinal and ornamental purposes. Since the Flowers open in late afternoon and close by morning so called four-o'clock. The plants are erect and spreading, 2-3 fit tall and wide, producing yellow-white to shades of red and pink, sometimes streaked and mottled. They have many branches and opposite, pointed leaves 2-4 in long.

Chemical analysis indicates that it is rich in active compounds like flavonoids, triterpenes, proteins, steroids, and alkaloids. A group of amino acid-based proteins, called mirabilis antiviral proteins (MAPs) are mostly investigated. Stigma sterol, β-sistosterol, ursolic acid, oleanolic acid, brassica sterol, rotenoids have also been isolated from the aerial parts and roots, of this species. [1-3]

The parts of this plant have been reported purgative, diuretic and with wound healing properties. The leaves are diuretic, while a decoction is used to treat abscesses. They are used to reduce inflammation. The flowers are used for making pigments. In China, flowers are also used for cosmetic purposes and pounded seeds are used in Japan, China and Malaya for making cosmetic powder. The root is diuretic, aphrodisiac and purgative and used in the treatment of dropsy, and as a poultice to treat muscular swellings and scabies. The root juice is used in the treatment of diarrhoea, fever, and indigestion. The mixture of root powder and corn flour is baked and used in the treatment of menstrual disorders. The plant has a potential for the bioremediation of soils polluted with moderate concentrations of heavy metals such as Cadmium. [4-8]

II. MATERIAL AND METHODS

The seeds were collected from some of the gardens of Jodhpur. These were washed with water to remove dust and dirt particles and dried in an oven at 60^{o}C for 7 hours. After drying the seeds were stored. The seeds were crushed by Mortar and pestle into coarse powder.

Percentage of moisture was determined by following method:

40 g of seeds were weighed in a silica crucible and dried in an oven at 80^0 C for 7 hours. The weight of crucible and seeds sample was taken after every 2 hours using desiccators. This procedure was repeated till a constant weight is obtained.

The percentage of oil extracted was determined by taking 150 ml. of normal hexane a round bottom flask, with 30 g of crushed seeds in a thimble. The contents were heated at 60^0C and allowed for three continuous extractions. The extraction was repeated with different amounts of samples and the weights of extracted oil were taken. From these values the percentage of the oil was calculated.

300 ml of petroleum ether was taken in round bottom flask and 10 gram of crushed seeds was taken in a thimble and placed in the apparatus. The soxhlet was heated at 60^0c 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 seeds were taken and same procedure was repeated. After complete extraction the resulting mixture was taken for solvent recovery. This oil was cooled and filled in a sample viol. [9-10]

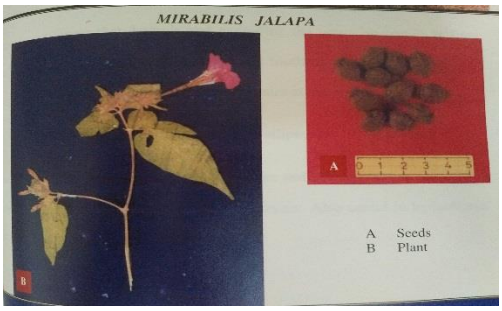
A. Characterization of the oil

The Refractive Index was determined by the Adobe Refractometer, at 30° C. Density bottle were used for specific gravity. ISO 3657 (1988) indicator method was applied to determine Saponification value. In this method 2g (M) of oil was weighed in a conical flask and 25 ml. of N/10 ethanolic KOH is added to it and allowed to heat for 1 hour with reflux. 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 V_1 .Blank volume was also run simultaneously and volume was taken (V_0). S.V. was calculated by S.V. = 56.1 N (V_0-V_1)/M

Acid Value was determined by mixing 25 ml of diethyl ether and 25 ml of ethanol in a beaker of 250 ml. Capacity and added to 10 g (W_0) of oil filled in a 250 ml conical flask. A few drops of phenolphthalein indicator were mixed to it. This mixture was titrated against M/10 NaOH with continue shaking to get dark pink colour at volume of NaOH V_0 .The free fatty acids were calculated as , FFA=2.82x100xV_0/W_0.

The acid value was calculated as FFA/2.ISO 3961 (1989) method was used to determine the Iodine value. [11-13]

Redwood viscometer no.1 was used for the determination of the viscosity of the extracted oil and was recorded as redwood second at room temperature. pH meter was used to determine the pH of the oil. 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 are shown in the following tables.

Table 1.PHYSICO CHEMICAL PROPERTIES OF SEEDS

Sr. no.	Property of seeds	Details
1	Seed morphology	Looks like black pepper, wrinkled, shiny , round and wrinkled
2	Moisture content	4.0%
3	Oil content	3.5 %
4	Protein content	24.87% (NX6.25%)

TABLE 2 PHYSICAL PROPERTIES OF THE OIL

Sr. no.	PROPERTY	OBSERVATION
1	Appearance	Clear
2	Refractive Index at room temperature	1.466

3	Specific gravity	0.70
4	Acid value (mg NaOH/g of oil)	1.345
5	Saponification value (mg KOH/g of oil)	174
6	Iodine value (g I_2/100 g of oil)	83
8	pH	6.6

IV. RESULTS AND DISCUSSION

The moisture in the matured seeds was found as 4 % which might be different for various seeds. The oil content was found as 3.5 % in the selected sample. This percentage may vary due to environmental and climatic conditions, and also by the mode of extraction. In earlier reports it has been found in the range of 3-5%.The protein content on the selected sample was found as 24.87 (NX6.25%).

Table 2 represents physicochemical properties of seeds. The oil is colourless and light weight. The refractive index of crude oil was found as 1.466 at room temperature. The specific gravity of oils was recorded as 0.72 .The acid value was found as 1.345 (mg NaOH/g of oil). Saponification values (mg KOH/g of oil) were calculated as 172. The Iodine value (g I_2/100 g of oil) was found as 83. 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 6.6.

V. CONCLUSION AND SCOPE

Although the percentage of oil was not in good agreement, yet the physico chemical properties of the seeds and seed oil provide applications in some processes. It is non-drying oil so it can be used in manufacturing of medicated cosmetics. In addition to its medicinal values the oil can also be used as drug binder. The environmental conditions, variety and age of plant, collection timings, storage etc. affect the yield of the oil. On the basis of present results and previous research findings, more applications could be suggested. [14-16]

In a nut shell one can conclude that Mirabilis seed oil should be studied further and the products should be standardized for better applications.

REFERENCES

[1] D. Miller, K. Bazore and M. Bartow, "Fruits of Ha-waii," 2nd Edition, University of Hawaii Press, Hawaii, 1955.

[2] O. W. Barrett, "The Tropical Crops," The Macmillan Co., New York, 1928.

[3] W. Kennard and H. Winters, "Some Fruits and Nuts for the Tropics," Misc. Pub. 801, Agricultural Research Service, US Dept. Agric, Washington, 1960.

[4] I. H. Burkill, "A Dictionary of the Economic Products of the Malay Peninsula," Vol. 1, Crown Agents for the Colonies, London, 1935.

[5] E. Quisumbing, "Medicinal Plants of the Philip Pines," Tech. Bui. 16, Department of Agriculture and Natural Resource, Manila, 1951.

[6] Dr. R. G. Patel, Prof. Dr. V. S. Patel, Studies on Mirabilis jalapa (Four O'clock Plant) Seed Oil, 1985 https://doi.org/10.1002/lipi.19850870104).

[7] T. K. Lim, Edible Medicinal and Non Medicinal plants: Volume 8, Springer Science & Business, 23-Apr-2014 - Science - 1024 pages.

[8] Asima Ghosh, Anupam Nayak & Julie Banerji, Chemical Characterization of Seed Proteins of Mirabilis Jalapa L. (Nyctaginaceae).

[9] M. A. Deora, P.Jaiswal, A.Mathur And M.R.K. Sherwani, Fatty acid composition of some minor seed oils from arid zone of Rajasthan, JICS, vol.80, Feb 2003, pp.141-142.

[10] P. Jaiswal, A.Mathur and Sherwani, Phytochemical Studies of some seed oils from arid zone of Rajasthan, Oriental Journal of Chemistry,vol.19(2),487-488.

[11] Chopra, R.N., Nayar, S.L. and Chopra, I.C. Glossary of Indian Medicinal Plants, 168 New Delhi, India: Publication & Information Directorate Hillside Road CSIR.

[12] Cammue, B.P., DeBolle, M.F., Terras, F.R., Proost, P., Van Damme, J., Rees, S.B.,

Vanderleyden , J.and Broekaert, W.F. 1992. Isolation and characterization of a novel class of plant antimicrobial peptides form Mirabilis jalapa L. seeds. The Journal of Biological Chemistry, 267: 2228–2233.