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Pharmacognostical, Preliminary Physicochemical and Nutraceutical Profile of Seed and Oil of 'Mrug 1 Variety' of *Sesamum indicum* L.

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ABSTRACT

Introduction: Oil of *Sesamum indicum* L. is one among the most important vegetable oil in medicinal, cosmetic and other industries. Gujarat is the leading state in India producing *Sesamum indicum* L. and 'Mrug1' variety of *Sesamum indicum* L. is produced in Gujarat. **Aim:** To evaluate chief pharmacognostical, physico-chemical and nutraceutical parameters of 'Mrug1' variety of *Sesamum indicum* L. **Materials and Methods:** Seeds of *Sesamum indicum* L. were collected from farmer of Sumara village in Gujarat state [India] and oil was extracted by expelling method. This study was conducted at government laboratories of pharmacognosy and pharmaceutical Chemistry in Jamnagar and private analytical laboratory, Mumbai. Authentication, standardization and purity tests were done as mentioned in Ayurvedic pharmacopoeia of India; nutritional analysis of oil was done by AOAC method 996.06 and 946.10. **Results:** Powder of sesame seeds had slightly aromatic odour; prismatic crystals of calcium oxalate was an important findings in powder microscopy. Transverse section of sesame seed showed presence of crystalline bodies on the epidermal region, presence of oil globules and aluerone grains. Chief findings of physico-chemical study are: Acid value= 1.64mg KOH/g) X10², Iodine value= 113.35g I₂/100g, Saponification value=186.6 mg KOH/g. Chief findings of nutritional analysis are Mono unsaturated fatty acid= 42.82g, Poly unsaturated fatty



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acid= 41.39g, Trans fat acid= Nil, Saturated Fatty Acid= 15.78g, Cholesterol <1.0mg.

Conclusion: *Mrug 1* variety of *Sesamum indicum L.* meets the minimum qualitative standards as reported in the API at a preliminary level. The results of this study may be used as the reference standard in related advance research and clinical research.

KEYWORDS

Tila, Gingili, Expelling, Saurashtra, Guajrat



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INTRODUCTION

Oil of *Sesamum indicum* L. is one of the most important vegetable oil in India and it has got commercial value not only because of its rancidity resistant property but also because of its cosmetic, medicinal and nutritional uses. *Sesamum indicum* L. is cultivated almost in every region of India since ancient times¹. In English it is known as sesame or gingili. It belongs to family 'Pedalianceae (of the *pedalium* tribe)². The genus *sesamum* is a self-pollinated annual herb having basic chromosome number $2n=26$ and it consists of 35 recognized species and out of which *Sesamum indicum* L. is an annual herb cultivated extensively³. India is the topmost country producing sesame seeds and Gujarat is the leading state in India producing *Sesamum indicum* L. that contributes 22.3% of total production⁴. At present there are number of varieties available of *Sesamum indicum* L.. The variety studied in this paper is 'Mrug 1'. It is a variety of *Sesamum indicum* L. cultivated in Saurashtra region of Gujarat state. Therefore, the primary objective of this study was "to study seeds and oil of 'Mrug 1' variety of *Sesamum indicum* L. pharmacognostically, physico-chemically and nutraceutically".

About Mrug1 variety: It takes 85 to 90 days for maturity. The crop yields 5 quintal

sesame seeds per hectares and the seeds contain about 53% oil. Seeds are white in colour⁵. In Gujarat state harvest season is October to January⁴. The collected sample was harvested in the month of January and then after proper pharmacognostical identification oil was extracted without any chemical processing in the month of April. The sample was then analyzed for its physico-chemical and nutraceutical properties in laboratories of I.P.G.T. R.A., Jamnagar and equinox laboratory, Mumbai respectively.

Pharmacological actions and uses: In *āyurveda*⁶⁻⁸, there is broad spectrum medicinal use of *Sesamum indicum* L.. Many modern studies have also proved medicinal properties of oil of *Sesamum indicum* L.. The sesame oil is mildly laxative, emollient and demulcent and rich in antioxidant components like lignans, which are responsible for greater shelf-life, flavour and taste. It is useful in industrial preparations of perfumery, cosmetics and in pharmaceuticals as a vehicle for drug delivery, insecticides, paints and varnishes⁹. It brings down blood pressure to normal when used for cooking food¹⁰. It possesses burn healing effect¹¹.

AIM

To evaluate its chief pharmacognostical, physico-chemical and nutraceutical



parameters of 'Mrug1' variety of *Sesamum indicum L.*

MATERIALS AND METHODS

Samples: Seeds and oil of 'Mrug1'⁵ variety of *Sesamum indicum L.* were taken for study. Newly harvested, air dried sesame seeds were purchased from a farmer of Sumarā village [Jamnagar district, Gujarat-India]. All physical impurities or foreign matter were manually removed. Seed oil was extracted by expelling method¹² after 4 months of harvesting.

Site of Study: Authentication of sesame seeds was done in government pharmacognosy laboratory in Jamnagar; physicochemical study of sesame oil was carried out in government laboratory of Pharmaceutical Chemistry in Jamnagar and nutritional analysis of sesame oil was carried out from a private analytical laboratory in Mumbai.

Pharmacognostical analysis:

Identification and authentication of sesame seeds was done based on morphological features, organoleptic characters, study of transverse section and powder microscopy of sesame seeds as mentioned in Ayurvedic Pharmacopoeia of India [A.P.I.¹³] and textbook of pharmacognosy¹⁴⁻¹⁶.

Macroscopic study: Macroscopic characters of sample was studied

systematically by observing specimen with necked eyes.

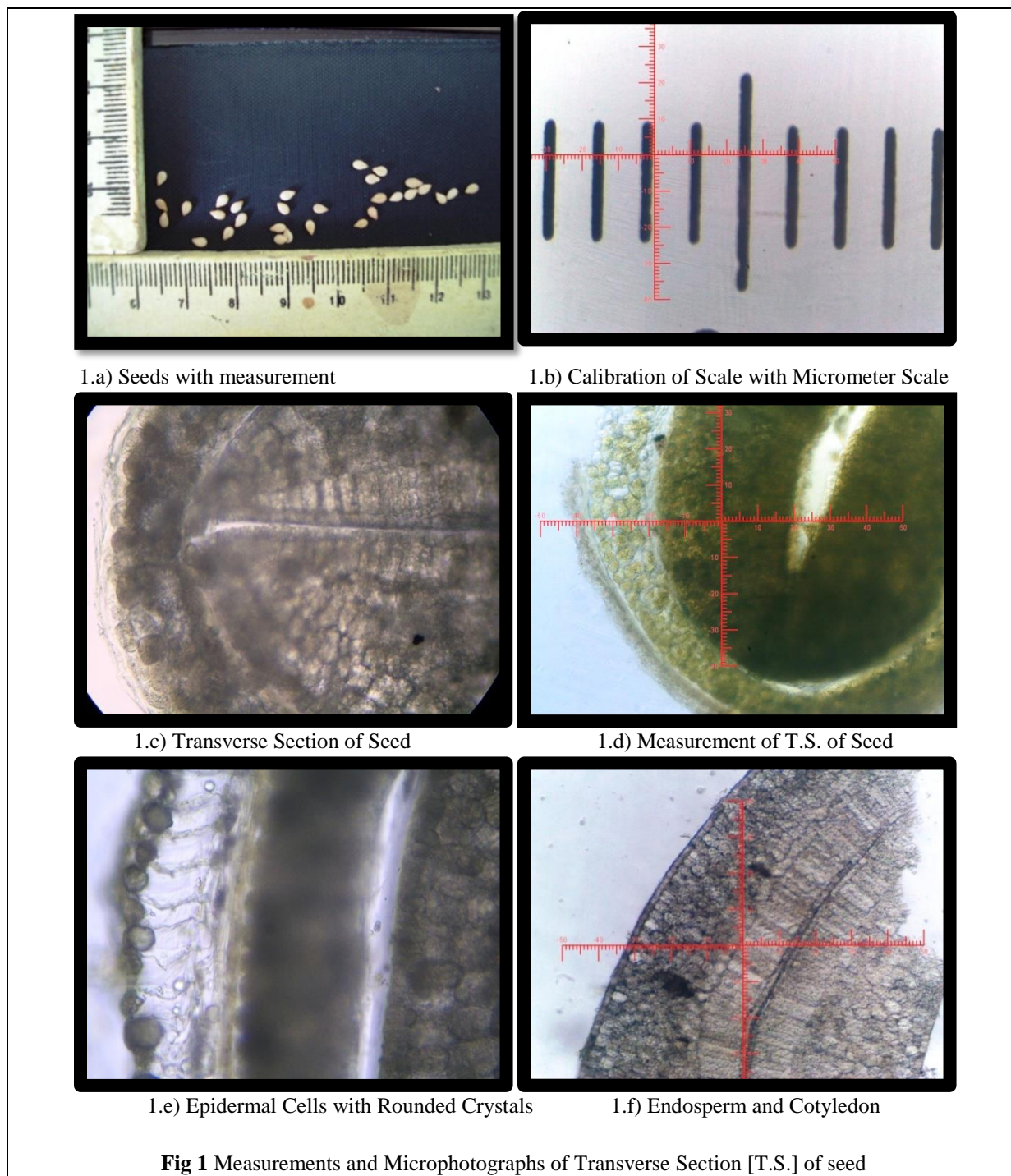
Organoleptic study¹⁴: Evaluation of sample was done by various organoleptic characters like, colour, texture, odour, taste and so forth of its powder. Observations were done directly by sensory organs.

Microscopic study¹⁶: Free hand transverse sections of the sesame seed were kept under distilled water and observed under the microscope for the presence of primary and secondary metabolites, like starch grains. Section was observed to study various ergastic cell contents like, crystals of calcium oxalate, calcium carbonate, and silica if present any. The natures of these crystals were also confirmed by performing some tests like, solubility of them in acids (HCl). The sections then stained with Phloroglucinol and HCl for detecting lignified elements like fibres, sclereids, xylem vessels, tracheids and so on. The section stained with alcoholic picric acid was also observed. All structures were observed under Corlzeiss Trinocular microscope attached with camera.

Powder microscopy: Small amount of powder was kept on the slide without stain and studied under Corlzeiss Trinocular microscope attached with camera.

Physico-chemical Analysis:

Identification Test¹⁷: Baudouin test was performed for identification of sesame oil.



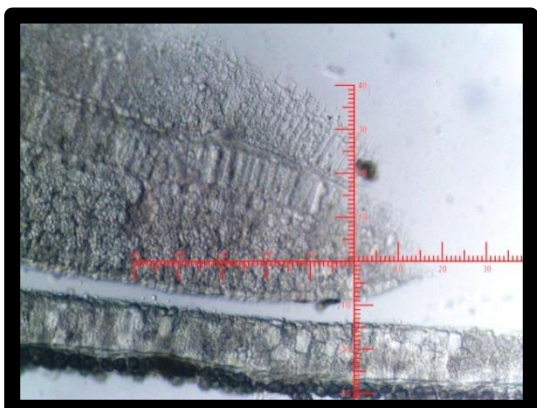
Purity and strength: Various Parameters which are mentioned in A.P.I. for *tiltaila* (sesame oil)¹⁷ like specific gravity, refractive index, weight per ml, acid value, iodine value, saponification value, adulteration test for cotton seed oil¹⁷ were

analysed by routine methods described A.P.I.¹⁸ **High Performance Thin Layer Chromatography study [HPTLC] of oil:** High-Performance Thin Layer Chromatography [HPTLC] of sample oil

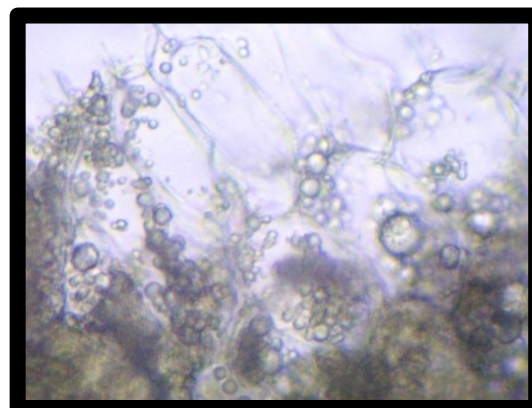


was carried as per standard protocol. Solvent system used was Hexane: Diethyl

ether (7:3 v/v).



1.g) Length of Epidermis

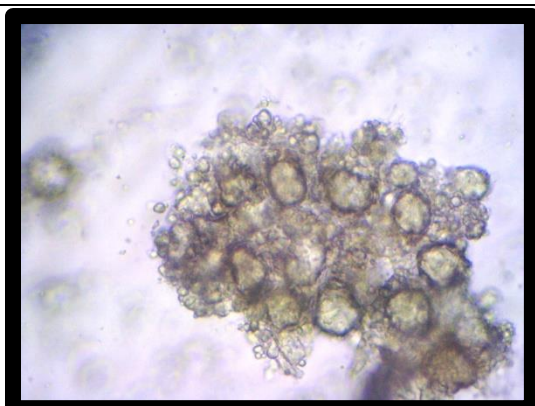


1.h) Parenchyma cells with Oil Globules

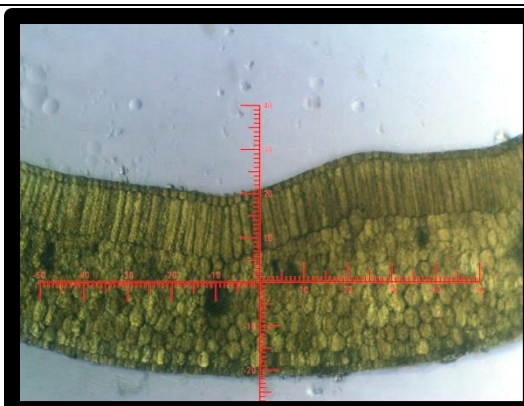
Sample preparation: 0.1ml oil was taken and diluted with 1 ml of Hexane and used for chromatography. Thereafter pre-chromatographic data derivatization was done with alcoholic KOH.

Nutritional analysis of sesame seed oil was done by adopting recommended methods of Association of Official Analytical Chemist [AOAC method 996.06 and AOAC method 946.10]. Total fat was estimated by FSSAI Manual method.

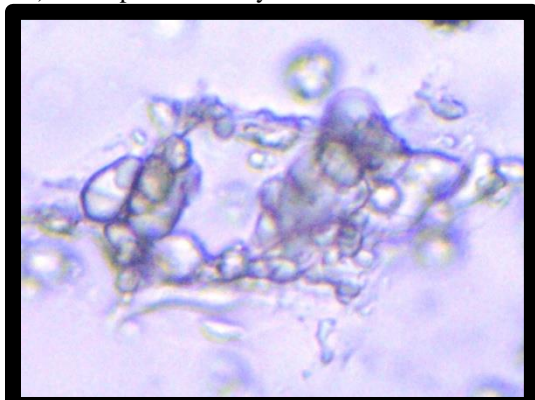
Nutraceutical Analysis:



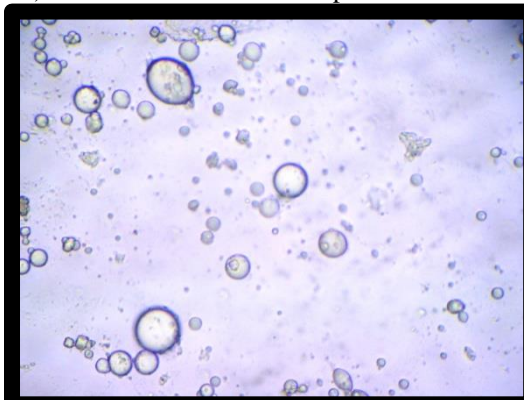
2.a) Endosperm with crystalline bodies



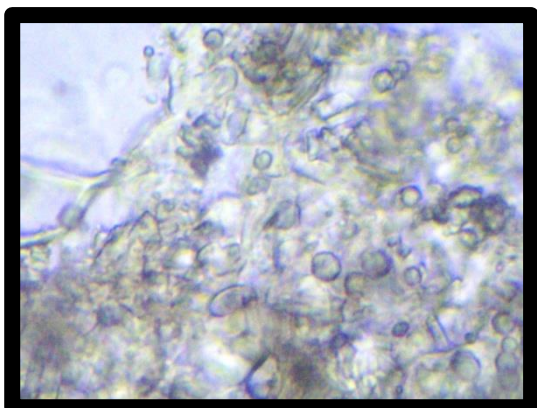
2.b) Palisade Cells With Endosperm Cells



2.c) Aluerone Grains



2.d) Oil Globules



2.e) Parenchyma Cells with Starch Grains



2.f) Simple fibre



2.g) Simple and Compound Starch Grains

Fig 2 Microphotographs of powder of seeds of *Sesamum indicum* L.

OBSERVATION AND RESULTS

Pharmacognostical Analysis:

Macroscopic Study: Seeds were white colored, flattened ovate shaped. They had smooth touch. Dimensions of seed were 2.5 mm length and 1.5 mm width [Table 2]

[Figure 1.a]. These findings matched with standard description given in A.P.I.¹³.

Organoleptic characters of seed powder: Organoleptic characters of powder of seed are shown in table 1.

Table 1 Organoleptic characters of powder

Sr. No.	Parameter	Result
1	Colour	Buff colour-Cream yellow
2	Odour	Oily smell, slightly aromatic
3	Taste	Slightly bitter, oily
4	Touch	Sticky

Microscopic Study:

Transverse Section [T.S.] of Sesame seed: [Figure 1.c]

Testa: Cuticle is seen. Epidermis is consisting single layer of thin walled palisade like cells with wavy anticlinal walls. Each cell containing rounded mass of angular crystals of calcium oxalate [Figure 1.e]. Below the epidermis 3-4 layered tangentially running thin walled parenchyma cells [Table 2] [Figure 1.g] are present. Testa present below the parenchyma layer and is collapsed.

Table 2 Measurements of Transverse Section of *Sesamum indicum* L- Mrug 1 variety

Sr. No.	Name of Structure	Dimension
1	Transverse section	1.5±0.1 X 0.7±0.1 millimetre [Figure 1.d]
2	Epidermis	0.09 ±0.01 mm [Figure 1.g]
3	Cuticle in testa	0.014 mm [Figure 1.g]
4	Parenchyma cells of testa	0.09 ±0.01 mm [Figure 1.g]
5	Endosperm	0.21±0.01 mm [Figure 2.b]



Endosperm: Endosperm 6-7 layered, consisting of cellulosic polygonal cells of parenchyma [Table 2] [Figure 1.f, 1.g, 2.b] containing fixed oils and small aleurone grains [Figure 1.h].

Embryo: Cotyledons of embryo are very wide and are two in number [Figure 1.c, 1.d]; externally covered with thin cuticle; single layered epidermal cell and then a row of palisade cells adjoining to lower single layered epidermis, remaining mesophyll tissue being isodiametric radially arranged polygonal parenchyma cells embedded with aluerone grains [Figure 2.e] and fixed oil.

Powder microscopy:

Powder microscopic characters found palisade cells along with crystals [Figure 2.a], prismatic crystals, aluerone grains

[Figure 2.c], oil globules [Figure 2.d]. These diagnostic findings matched with A.P.I.¹³. Parenchyma cells with starch grains [Figure 2.e], simple fibre [figure 2.f], simple and compound starch grains [figure 2.g] were also been seen.

Physico-Chemical Analysis:

Identification [Baudouin] test was positive. This confirmed its distinction from other fixed oils.

Results of tests for purity and strength of sesame oil are shown in table 3.

High Performance Thin Layer Chromatography study [HPTLC] of oil: The results are shown in table 4 and figure 3.a, 3.b.

Nutraceutical analysis:-

Results of nutritional analysis of oil [fatty acid profile] are shown in table 5.

Table 3 Identity, Purity and Strength of oil of *Sesamum indicum L- Mrug 1* variety

Sr. No.	Parameter	Result	Standard value as per API
1	Identification- Boudoins test	Positive	Positive
2	Cotton seed oil	Negative	Negative
3	Rancidity test-Kreis test	Negative	Negative
4	Specific gravity	0.912 g/mL	0.9160-0.9190
5	Refractive index [at 40 ⁰ C]	1.471	1.4650 to 1.4665
6	Wt. per ml [at 25 ⁰ C]	0.912	0.916 to 0.921 g
7	Acid value	1.64 mg KOH/g)X10 ⁻²	Not more than 2
8	Iodine value	113.35g I ₂ /100 g	Between 103 and 116
9	Saponification value	186.6 mg KOH/g	Between 188 and 195

Table 4 HPTLC study of oil at 254 nm and 366 nm

Wavelength	Number of spots	R _f value
254 nm	6	0.2, 0.9, 0.39, 0.51, 0.90, 0.96
366 nm	2	0.2, 0.96

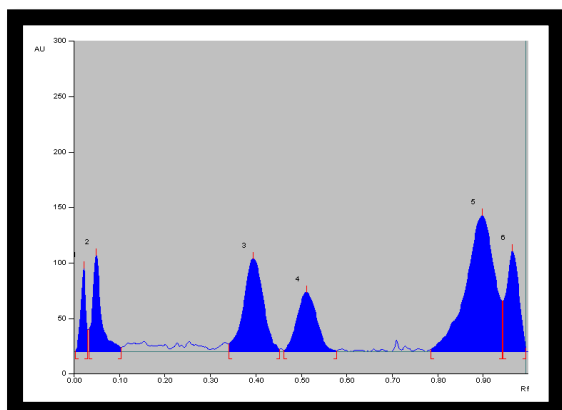
DISCUSSION

Aim of this study was to determine values of chief physico-chemical and nutraceutical

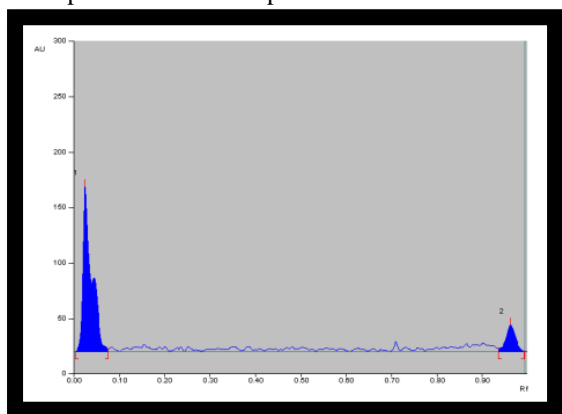
parameters of oil of *Mrug 1* variety of *Sesamum indicum L.* extracted by expelling method. Though the raw sesame seeds were purchased directly from farmer and oil was extracted in front of investigator,



identification test for sesame oil was done for revalidation.



3.a. Spectrum of oil sample at 254 nm



3.b. Spectrum of oil sample at 366 nm

Table 5 Nutritional analysis per 100 g

Sr. No.	Parameters	Methods	Results
1	MUFA	AOAC 996.06	42.82 g
2	PUFA	AOAC 996.06	41.39 g
3	Trans Fat	AOAC 996.06	Nil
4	Saturated Fatty Acid	AOAC 996.06	15.78 g
5	Cholesterol	AOAC 946.10	<1.0 mg
6	Total Fat	By FSSAI Manual	99.94 G

In pharmacognostical study of sesame seeds the transverse section of sesame seed showed presence of crystalline bodies on the epidermal region, presence of oil globules and aluerone grains. These are the important characters. Organoleptic study and powder microscopy of seed powder

showed slightly aromatic odour and prismatic crystals of calcium oxalate which are important findings. Pharmacognostical findings matched with standard findings described in A.P.I. except number of layers of cellulosic polygonal parenchyma cells in endosperm which found 6-7 in *Mrug* 1 variety while described as 2-3 in A.P.I.¹³. These observations indicated authenticity of sample seeds of *Mrug* 1 variety of *Sesamum indicum* L.

Organoleptic physico-chemical and nutritional properties of oil may vary according to method of extraction of oil and its further processing. In this study oil was extracted by simple mechanical pressure method [expelling] and not processed further. According to Shah NC¹, the oil extracted without any processing by such traditional method adopted in present study becomes mixed with a huge portion of colouring matter present in the epidermis [*testā*] of the seed. Because of this it doesn't feel so pleasant to see and also not tasty as that obtained by boiling seeds for short time till the seeds become perfectly white followed by drying before extraction of oil. This study revalidated above observations and also found that extracting oil even by this method full fill basic standard of identity, purity and strength of A.P.I.¹⁷. Physical properties of oil like specific gravity, refractive index and weight per ml



were within standard range as per A.P.I. Acid value, iodine value and saponification values were also within standard range as per A.P.I. The acid value is a measure of free fatty acid [FFA] present in lipid. Increased amount of FFA in a sample of oil is indicative of hydrolysis of triglycerides which occurs by the action of lipase enzyme. The source of lipase enzyme can be the tissue from which the oil was extracted. The sample studied in this study was extracted by simple expelling method and is not filtered by fine filter so may contained more amount of seed tissues from which the oil or fat was extracted. Therefore such oil may show increased acid value after shorter duration. The iodine value is a measure of average degree of unsaturation of a lipid; higher the iodine value, more susceptible is the lipid to oxidation and rancidification. Nutraceutical study revealed that the percentage of monounsaturated fatty acid [MUFA] and polyunsaturated fatty acid [PUFA] is more than that of saturated fatty acids. But still sesame oil is known for its long shelf life and rancidity resistant properties due to present of many antioxidants in it¹⁹. The saponification number is a measure of the average molecular weight of the triacylglycerols in a sample. HPTLC profile of oil shows 6 spots at 254 nm and 2 spots at 366 nm respectively. At

both, the wavelengths similarity is seen at 0.2 and 0.96 R_f respectively. This similarity signifies presence of same class of molecules.

Nutritional analysis revealed that monounsaturated fatty acids and polyunsaturated fatty acids are the chief constituents of oil of *Mrug 1* variety of sesame seeds while saturated fatty acids are present in minority. Trans fatty acids are nil. All these increase its nutritional value.

CONCLUSION

Findings of this study concluded that the *Mrug 1* variety of *Sesamum indicum L.* and its oil extracted by simple expelling method meet the minimum qualitative standards as reported in the API at a preliminary level. The results of this study may be used as the reference standard in related advance research as well as for the clinical research.

CONFLICT OF INTEREST:

There are no conflicts of interest.



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