

Extraction, Characterization and Comparison of Fixed oil of *Moringa oleifera* L & *Moringa concanensis* Nimmo Fam.Moringaceae

Megha Gaikwad, Shantanu Kale*, Snehal Bhandare,
Vaibhav Urunkar, Amol Rajmane

Department of Pharmacognosy, M.G.Vs Pharmacy College,
Nashik-422003, Maharashtra, India.

*Corres. Author: shantanu_kale@yahoo.com
Phone: + 919422770747; Fax: + 91 2532511931

Abstract: The fixed oil of the seed of *M.oleifera* L & *M. concanensis* Nimmo Fam.Moringaceae was analyzed using GC-MS. Eleven compounds from fixed oil *M. oleifera* L and Nine compounds from *M. Concanensis* Nimmo were characterized.

Methyl ester 9-Hexadecanoic acid (55.23%), hexadecanoic acid (29.90%), Eicosanoic acid (9.64%) was found to be the major compounds of *M. oleifera* L while Pentadecanoic acid (55.60%), 11- octadecenoic acid (10.40%), docosanoic acid (7.24%) were found to be the major compounds of *M. Concanensis* Nimmo oil.

A comparison of the chemical composition of the *M.oleifera* L with *M. Concanensis* Nimmo revealed that the *M. Concanensis* Nimmo oil contains more relative amount of fatty acid derivatives. In both the samples, 9-octadecenoic acid, hexadecanoic acid, pentadecanoic acid, eicosanoic acid & docosanoic acid are identified as common fractions.

Keywords- GC-MS, *M.oleifera*, *M.concanensis* Nimmo.

INTRODUCTION

The Moringaceae is a single-genus family with 14 known species of these, *M. oleifera* Lam. (syn. *M. pterygosperma* Gaertn.) is the most widely known and utilized species. [1, 2] It is a small or medium-sized tree, about 10 m high, cultivated throughout India. A native of the sub-Himalayan regions of northwest India, *M. oleifera* is also indigenous to many countries in Africa, Arabia, Southeast Asia, the Pacific and Caribbean islands, and South America. [2, 3] In some parts of the world, *M. oleifera* is referred to as the “drumstick tree” or the “horseradish tree,” whereas in others it is known as the “kelor tree.” [4] In the Nile River valley, the tree is called “Shagara al Rauwaq,” which means “tree for purifying.” [5] In Pakistan, Moringa is represented by only two species: *M. concanensis* and *M. oleifera*. [6, 7]

M. concanensis Nimmo is widely used in India, since the Ayurveda and Unani medicinal systems use it for the treatment of several ailments. [8, 9] It is a small tree with thick bark, glabrous, except younger parts and inflorescence. The horseradish odour of *M. concanensis* Nimmo is more intense than *M. oleifera*. Fatty oil obtained from the seed kernels of Moringa is yellowish brown, semi-solid, with a faint odour of bitter almonds. [9]

Moringa concanensis has recently been characterized with regard to its seed oil potential. Its oil is high in oleic acid and resembles in context of fatty acid composition with seed oils of other *Moringa* species, which includes the *M. stenopetala*, *M. peregrina* and *M. oleifera*. High-oleic oils are gaining importance, especially for replacing polyunsaturated

vegetable oils and are reported to exhibit good oxidative stability during frying.^[10]

The objective of the present study is to determine the chemical composition of the fixed oil from the seeds of *M.oleifera* L & *M. Concanensis* Nimmo. This is the first report on the comparison of the chemical composition of the fixed oil of Indian species of Moringa.

EXPERIMENTAL

Plant material:

Plant materials of *M. concanensis*, Nimmo were collected from Tah. Mouda, Dist. Nagpur, India and *M.oleifera* were collected from Nasik. The plant material was identified, authenticated taxonomically and herbarium sheet deposited to Botanical Survey of India, Pune (Ref. BSI/ WRC/ TECH/ 2011). The herbarium of the plant was deposited in the BSI against voucher no. MEGA 03. The seed were cleaned, dried under direct sunlight and powdered by a mechanical grinder.

Extraction of Fixed oil:

Air-dried seeds of *M.oleifera* L & *M. Concanensis* Nimmo (Fam. Moringaceae) were separately powdered and extracted with 50 volumes of petroleum ether (60-80°C) using a Soxhlet apparatus. This process of extraction was repeated for 6h, the petroleum ether distilled out by distillation assembly, then concentrated by hot plate drying and air-drying at temperature of 40±2 °C.

Materials:

Boron fluoride-methanol (140 g BF₃ per liter of methanol) was obtained from Applied Science Laboratories, Inc., State College, Pa. Pentane and hexanes were purified by passing through silica gel (15).^[11]

BF₃- Methanol Reagent:

One liter of reagent grade methanol, in a 2-liter flask, is weighed and cooled in an ice Bath. With the flask still in the bath, BF₃ is bubbled through a glass tube into the methanol until 125 grams is taken up. This operation should be performed in a good fume hood, and the gas should not flow so fast that white fumes emerge from the flask (The BF₃ must be flowing through the glass tube before it is placed in and until it is removed from the methanol or the liquid may be drawn into the gas cylinder valve system.) This reagent has an excellent shelf life and has been used up to 4months after preparation.^[12]

Preparation of FAME (fatty acid methyl ester):

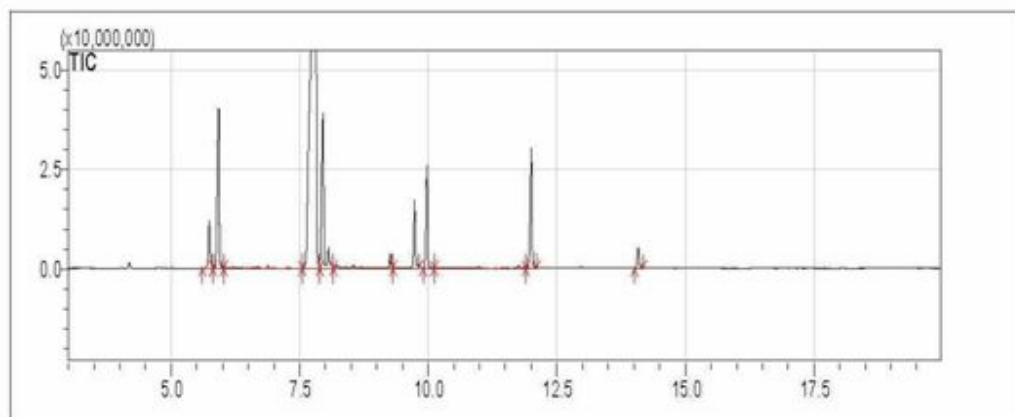
2 g of oil sample was saponified by means of 25 ml 0.5 M methanolic NaOH in 250 ml round bottom flask. Then, 300 mg of saponified oil sample was treated with 8ml of BF₃ – Methanol and boiled for 2-4 min. Thereafter, 2-3 ml of petroleum ether (40⁰-60⁰C) was added to resultant solution to dissolve the esters. Saturated NaCl solution was added enough to floats FAMES on the top of the flask. FAMES were collected by means of syringe and kept in closely tight glass vial in refrigerator.^[13, 14]

GC-MS analysis:

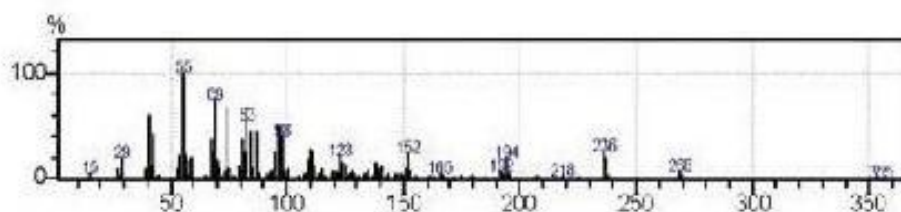
GC-MS was carried out on samples of oils using Instrument Hewlett Packard G 1800A, operating with following parameters- Column: Capillary column HP-5 {Length 30 Mtr, (Id 0.25 mm)}, carrier gas: Helium, Flow Rate: 1ml/min, Inlet Temp: 250⁰C, Detector temp: 280⁰C, with temperature programming 100⁰C-3min-10-250⁰-30-280⁰C with mass detector and Library search was carried out by HPCHEM Software.

Table 1: Comparison of Chemical Constituents of fixed oil

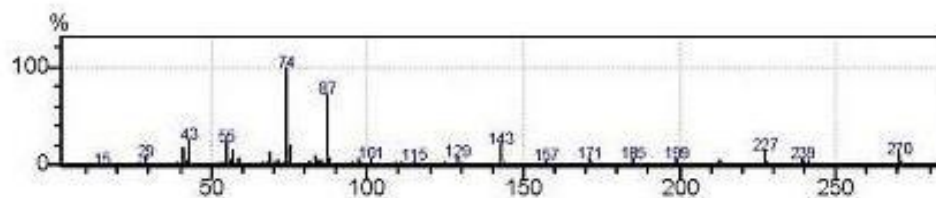
Sr No	<i>M.oleifera</i> <i>Lam</i>	Retention Time(min)	% Area	<i>M. Concanensis</i> <i>Nimmo</i>	Retention Time(min)	% Area
1	9-octadecenoic acid	18.22	9.64	9-octadecenoic acid	5.743	2.91
2	hexadecanoic acid	14.81	29.10	hexadecanoic acid	5.923	9.90
3	docosanoic acid	19.65	2.84	docosanoic acid	12.005	7.24
4	eicosanoic acid,	19.65	9.64	eicosanoic acid,	5.81	5.81
5	pentadeconic acid	14.81	29.10	pentadeconic acid	55.60	55.60
6	Tetracosanoic acid	21.77	1.52	cyclopropanoic acid	3.78	3.78
7	Hepatadecanoic acid	21.77	1.52	henicosanoic acid	14.085	1.34
8	1,3,5cycloheptatrine	6.27	1.30	11- octadecanoic acid	7.950	10.40
9	Pentacosane	22.70	22.70	oleic acid	9.262	1.80
10	Octacosane	22.70	22.70			
11	9- Hexadecanoic acid	15.76	55.23			

Figures:**Figure1 : GC-MS peak of *M. concanensis* nimmo**

PEAK 1

**Figure: 2 Mass Spectrum of fragment, 9-octadecenoic acid of Seed Oil**

PEAK 2

**Figure: 3 Mass Spectrum of fragment, hexadecanoic acid of Seed Oil**

PEAK 3

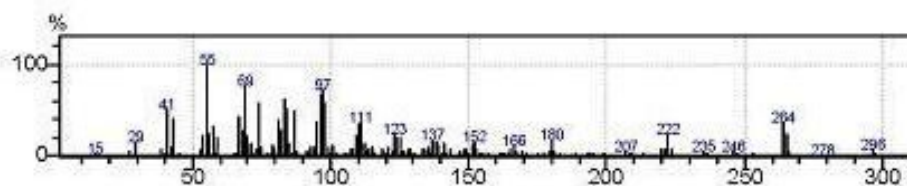


Figure: 4 Mass Spectrum of fragment, pentadecanoic acid of Seed Oil

PEAK 4

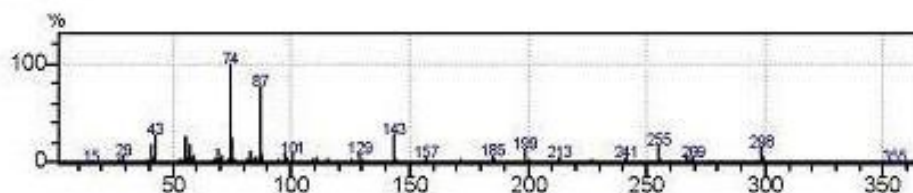


Figure: 5 Mass Spectrum of fragment, 11- octadecanoic acid of Seed Oil

PEAK 5

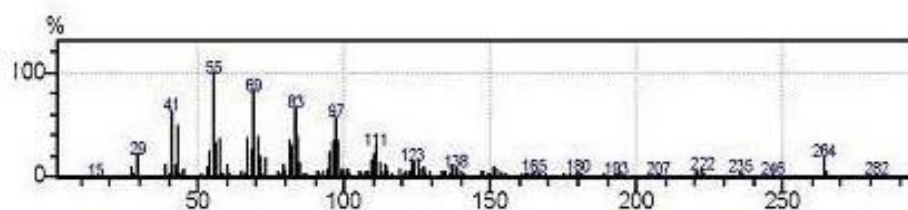


Figure: 6 Mass Spectrum of fragment, oleic acid of Seed Oil

PEAK 6

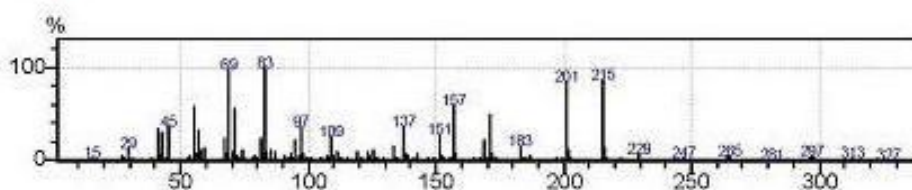


Figure: 7 Mass Spectrum of fragment, cyclopropanoic acid of Seed Oil

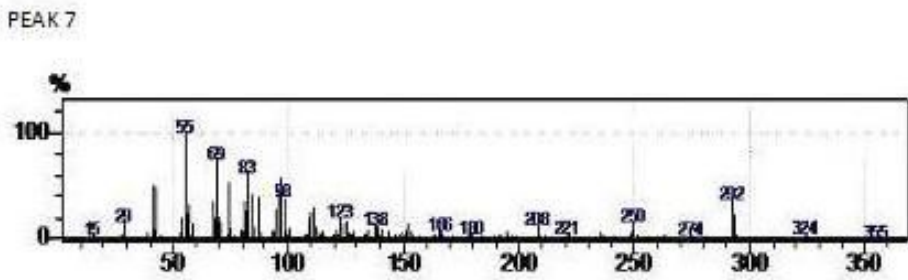


Figure: 8 Mass Spectrum of fragment, eicosanoic acid of Seed Oil

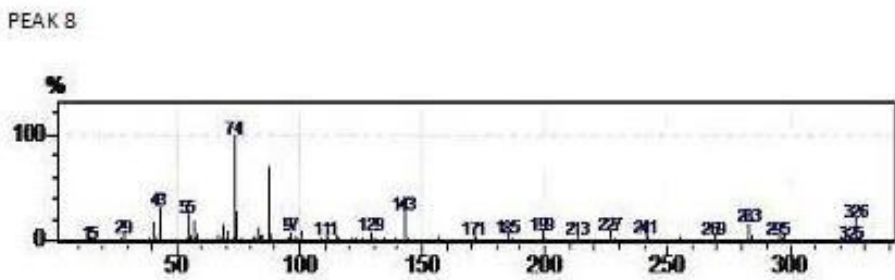


Figure: 9 Mass Spectrum of fragment, docosanoic acid of Seed Oil

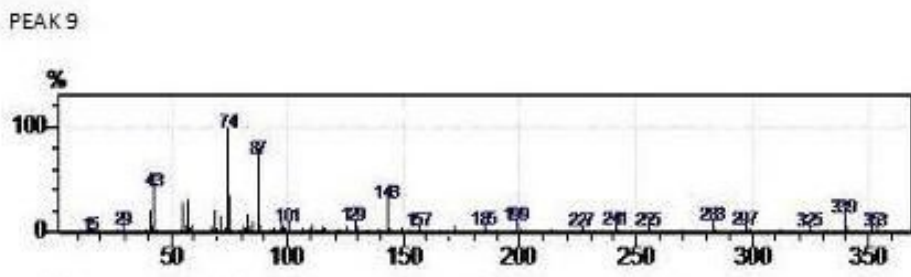


Figure: 10 Mass Spectrum of fragment, henicanoic acid of Seed Oil

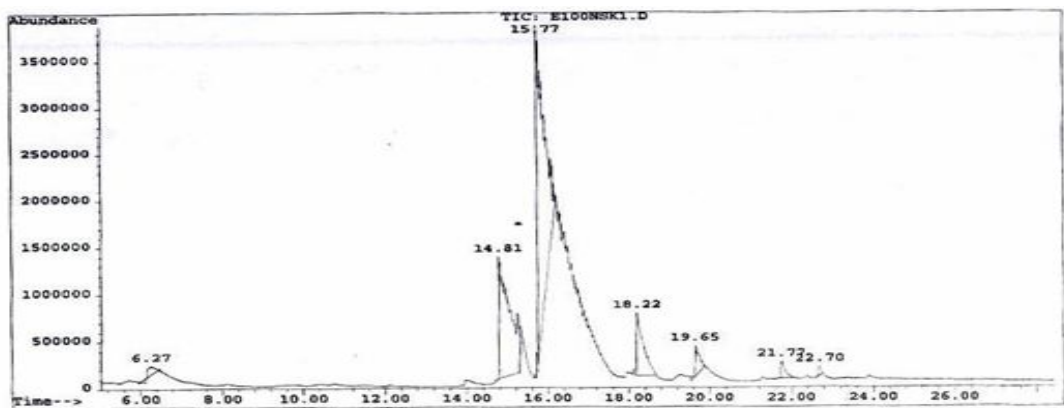


Figure 11 : GC-MS peak of M. Oleifera Lam

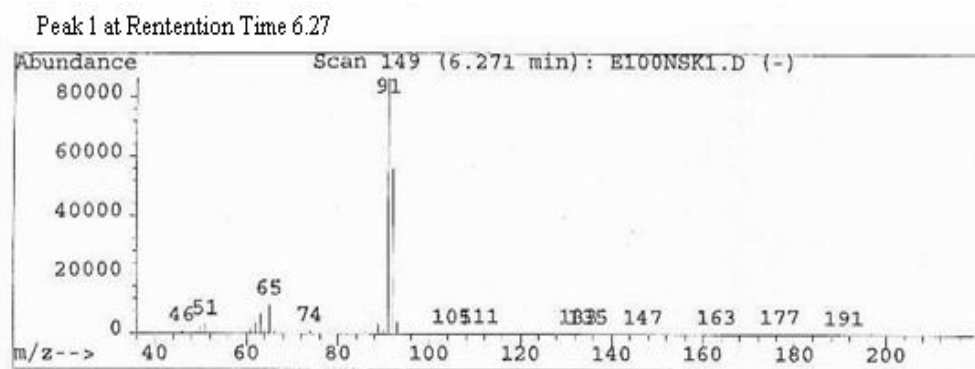


Figure 12 : Mass Spectrum of fragment, 1, 3, 5 cycloheptatriene of Seed Oil

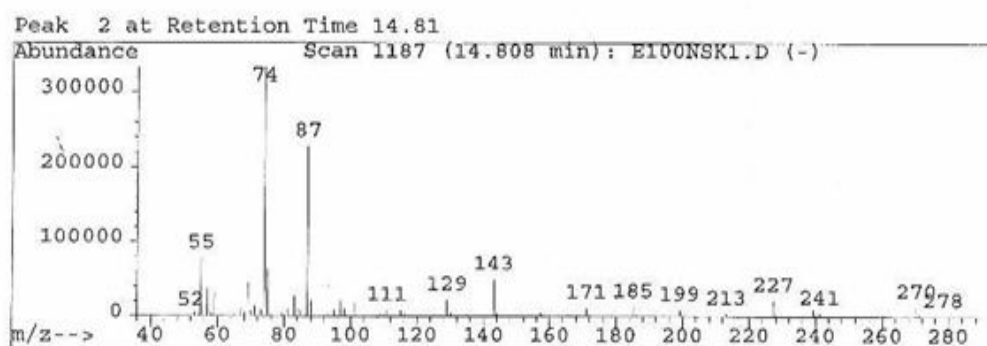


Figure 13 : Mass Spectrum of fragment, hexadecanoic acid and pentadecanoic acid of Seed Oil

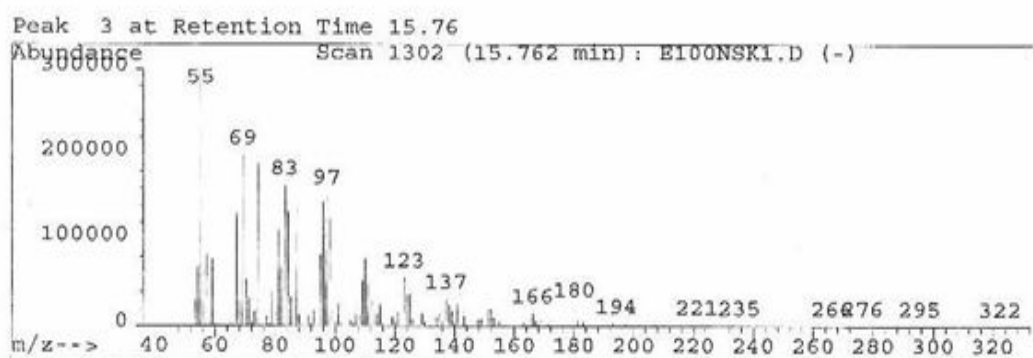


Figure 14 : Mass Spectrum of fragment, 9-hexadecanoic acid of Seed Oil

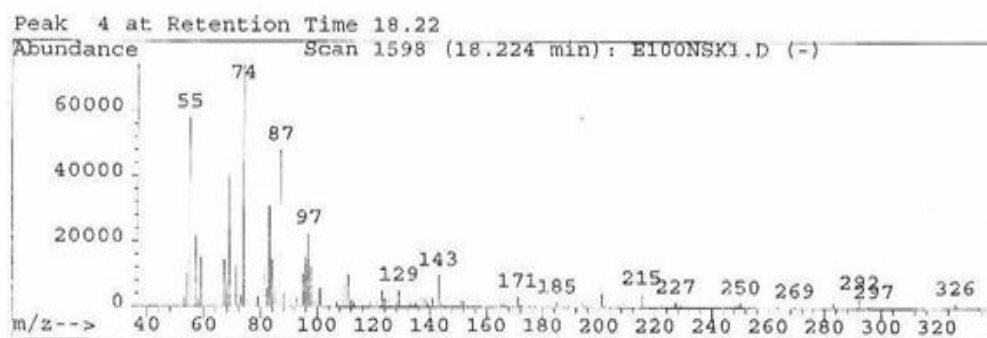


Figure 15 : Mass Spectrum of fragment, 9-octadecenoic acid of Seed Oil

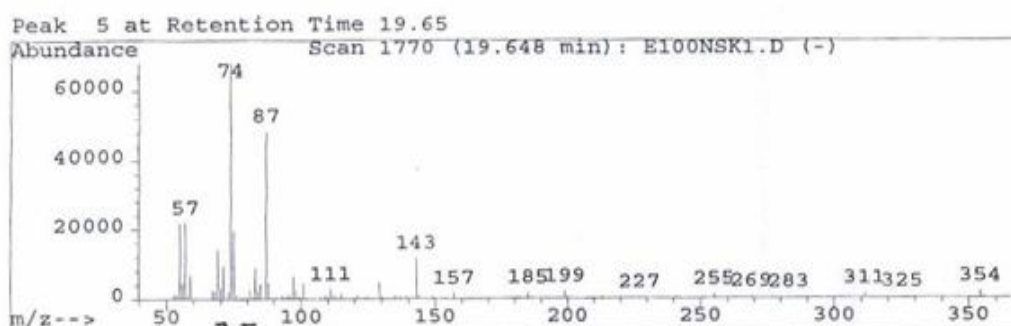


Figure 16 : Mass Spectrum of fragment, docosanoic acid and eicosanoic acid of Seed Oil

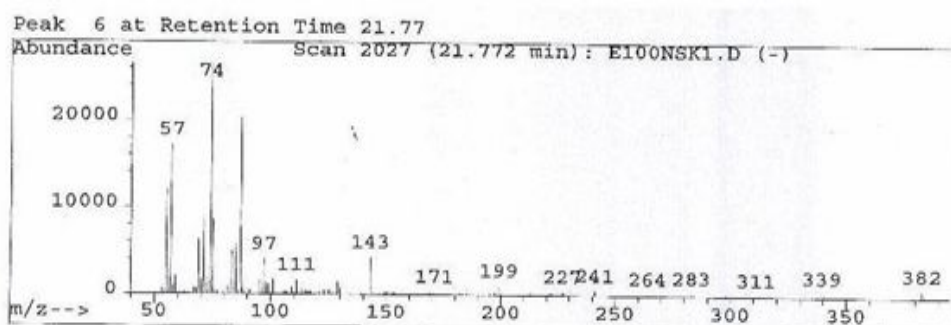


Figure 17: Mass Spectrum of fragment, Tetracosanoic acid and Heptadecanoic acid of Seed Oil

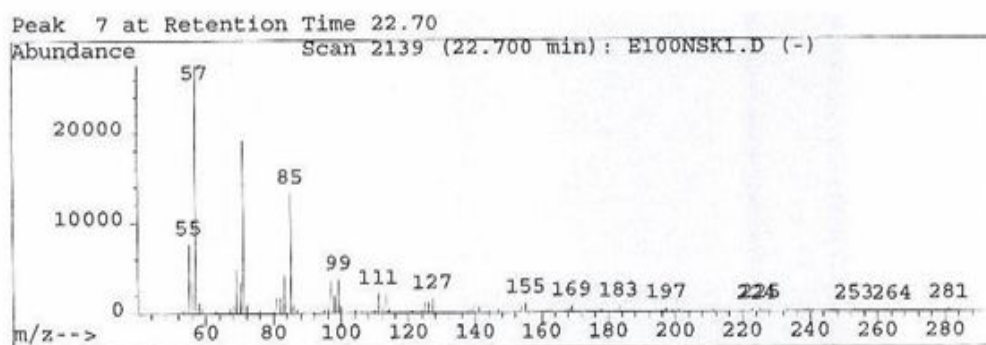


Figure 18: Mass Spectrum of fragment, Octacosane and Pentacosane of Seed Oil

RESULTS

The fixed oil of the seeds of *M. Concanensis Nimmo* & *M.oleifera L* (Fam. Moringaceae) was analyzed by GC-MS (Figure 1 and Figure 17). The compounds were identified by matching their fragmentation patterns in mass spectra with those stored in NIST library with the help of HPCHEM software and published mass spectra. The details are summarized in Table 1.

DISCUSSION

The eleven compounds from fixed oil *M.oleifera L* and nine compounds from *M. Concanensis Nimmo* were characterised (Table 1).

Comparison of composition of fixed oil from seeds revealed that the *M.oleifera L* contains more 9-Hexadecanoic acid or Palmitoleic and Eicosanoic acid (9.64%) or Arachidic acid derivatives.

The fixed oil of *M.oleifera L* contains 9-Hexadecanoic acid (55.23%), hexadecanoic acid (29.90%), and Eicosanoic acid (9.64%) as the major compounds. This is different from oils seeds of *M. Concanensis Nimmo* as it shows pentadecanoic acid as a major compound.

Five compounds present in the *M.oleifera L* seed oil are found in the *M. Concanensis Nimmo* seed

fixed oil. These are 9-octadecenoic acid, hexadecanoic acid, pentadecanoic acid, eicosanoic acid & docosanoic acid.

Tetracosanoic acid was found to be present only in *M.oleifera L* while 11-octadecenoic acid cyclopropanoic acid, henicosanoic acid.

As possible uses of Moringa in Cosmetic product (for body care) and in medicaments (treatment of, Anthelmintic, Warts, anti-tumor, Ulcer, rheumatism, arthritis, antispasmodic, mineral/vitamin deficiency) are proposed.

CONCLUSION

Both the species of Moringa contains 16 compounds out of them 3 were found to be same. The qualitative and quantitative determinations of the major and minor constituents of vegetable oils are done by GC-MS chromatography which are the techniques widely applied for the analysis of edible oils and fats.

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