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UV-VIS spectroscopy and GC-MS analysis of *Elaeocarpus Ganitrus* (Rudraksha) seeds

Subhashish Tripathy[1*], Amit Mishra[2], Arun Kumar Mishra[3]
[1] Ph.D. Research Scholar IFTM University, Moradabad, Uttar Pradesh, India
[2] Director, Maharana Pratap College of Pharmaceutical Sciences, Kanpur, Uttar Pradesh, India
[3] Professor, Faculty of pharmacy IFTM University, Moradabad, Uttar Pradesh, India

Abstract
Objective: Phytochemical screening of *Elaeocarpus ganitrus* seeds by UV-VIS Spectroscopy and GC-MS Analysis to know its bioactive compound.
Method: Instrumental analysis of Rudraksha seed extract in suitable UV-VIS and GC-MS instruments.
Result: The UV-VIS profile showed different peaks ranging from 350-550nm with different absorption respectively. GC/MS analysis of Rudraksha seed extract provides different peaks determining the presence of 19 phytochemical compounds.
Conclusion: The results show that important bioactive compounds are present in Rudraksha seed extract and these constituents may be responsible for its pharmacological and medicinal property.

Keywords: *Elaeocarpus ganitrus*, rudraksha, UV-VIS spectroscopy, GC-MS analysis

Introduction

Rudraksha is the Rudraksha tree's fruit stone (*Elaeocarpus ganitrus*). The Rudraksha bead is contained inside the fruit pulp when it is extracted [1]. The surface of the bead is rough, with ridges running from top to bottom, separating it into parts [2, 3]. It is believed that Rudraksha improves fitness, protects against misfortune and planetary afflictions, and brings purity and mental tranquility; it also helps to alleviate pain and is particularly successful in high blood pressure, heart attacks, epilepsy, cough, mental, and gynecological issues [4]. The Rudraksha's strength can't be matched by ghosts or evil spirits. Stress, anxiety, insomnia, nervousness, loss of focus, and depression can all be cured by wearing Rudraksha seeds. Hypertension, rheumatism, sterility, and immune modulator properties are all heart diseases [5]. UV-Vis Spectroscopy is a quantitative technique for determining how much light is absorbed by a chemical material. This is achieved by comparing the strength of light passing through a sample to that passing through a reference sample or blank. This method can be applied to a variety of samples, including liquids, solids, thin films, and glass [6]. It can be used to determine the phytoconstituents of plants. (GC-MS) is an analytical method for identifying various substances inside a test sample that incorporates the features of GC-MS spectrometry [7]. Drug detection, fire investigation, environmental monitoring, explosives investigation, and identification of unknown samples are all examples of GC-MS applications. In human body fluid and tissue extracts, GC-MS is a proven analytic technique with many applications in the detection and measurement of human body endogenous body metabolites and environmental exposure-related metabolites. In the end, the technique is well suited for the isolation of chemical species which are highly volatile and the function of chemical Derivatization actions to increase chemical instability [8].

Material and Method

Collection of authenticating *Elaeocarpus ganitrus* seeds (Rudraksha) was done by purchasing online from Rudra Center (https://www.rudraksha-ratna.com/) and further confirmed its originality by *CSIR-NISCAIR's*Research & Academics *in* Science & Technology Communication *new Delhi. Authentication No.-NISCAIR/ RHMD/ Consult/ 2019/3436-37.*

Material and Method for UV-VIS Spectroscopy [9, 10]

Elaeocarpus *ganitrus* Seeds were used to make the alcoholic extract. 500g Rudraksha seed powder extracted with 10 liters of methanol at reflux temperature for 15 hours and cool to room temperature, filtered concentrated under vacuum. UV-visible spectrophotometric analysis was conducted on the liquid *Elaeocarpus ganitrus* seed extract using a UV-visible spectrophotometer. The instrument chosen for UV-VIS Analysis was Double Beam UV-VIS Spectrophotometer, Model: PC Based Spectro-2202, Company: SYSTRONICS, India Cuvette: Quartz, 1cm Path length, Mode of Operation: Scan Mode, Scan range: 200nm-700nm, Sample code: S1, Max Absorbance: 2.389, Wavelength @ Max absorbance: 464nm, Sample volume: 0.5ml.

Material and Method for GC-MS spectroscopy [11, 12]

Sample Extraction

1 gram of sample was used for extraction with 20 ml Hexane and Acetone (1:1) for 8 hours. The solvent extracted complex was filtered and evaporated to dryness with a stream of nitrogen and further dissolved in hexane. The extract Stored at 4°C till further analysis.

Derivatization

100µg of the concentrated extracted sample was taken in a separating funnel and shaken by adding 10 ml of water and ethyl acetate in the ratio of 1:4 (adding 2.5 ml water to 7.5 ml Ethyl Acetate). The upper layer was collect and concentrated to 1 ml by the help of rotary evaporator. 50 µl N, O-Bis(trimethylsilyl) trifluoroacetamide and trimethylchlorosilane (BSTFA+TMCS) was further added, and then lastly 10µl of Pyridine was also added. Samples were additionally heated at 60ºC for 30 half an hour. For BSTFA+TMCS, we marked 100µl solution of 99µl of BSTFA and 1µl of TMCS. Samples were transferred in GC vial and dried using nitrogen gas. Samples were finally dissolved in methanol before GC-MS analysis.

Analytical Conditions

The model chosen for the analysis GC-2010 – Model GC–2010 – SHIMADZU. Column Oven Temp. was at 60.0 °C, Injection Temp at 260.00 °C, Injection Mode Split, Flow Control Mode was Linear Velocity, Pressure 73.3 kPa, Total Flow 16.3 mL/min, Column Flow was 1.21 mL/min, Linear Velocity 40.1 cm/sec, Purge Flow, 3.0 mL/min, Split Ratio 10.0, High-Pressure Injection off, Splitter Hold off.

Results

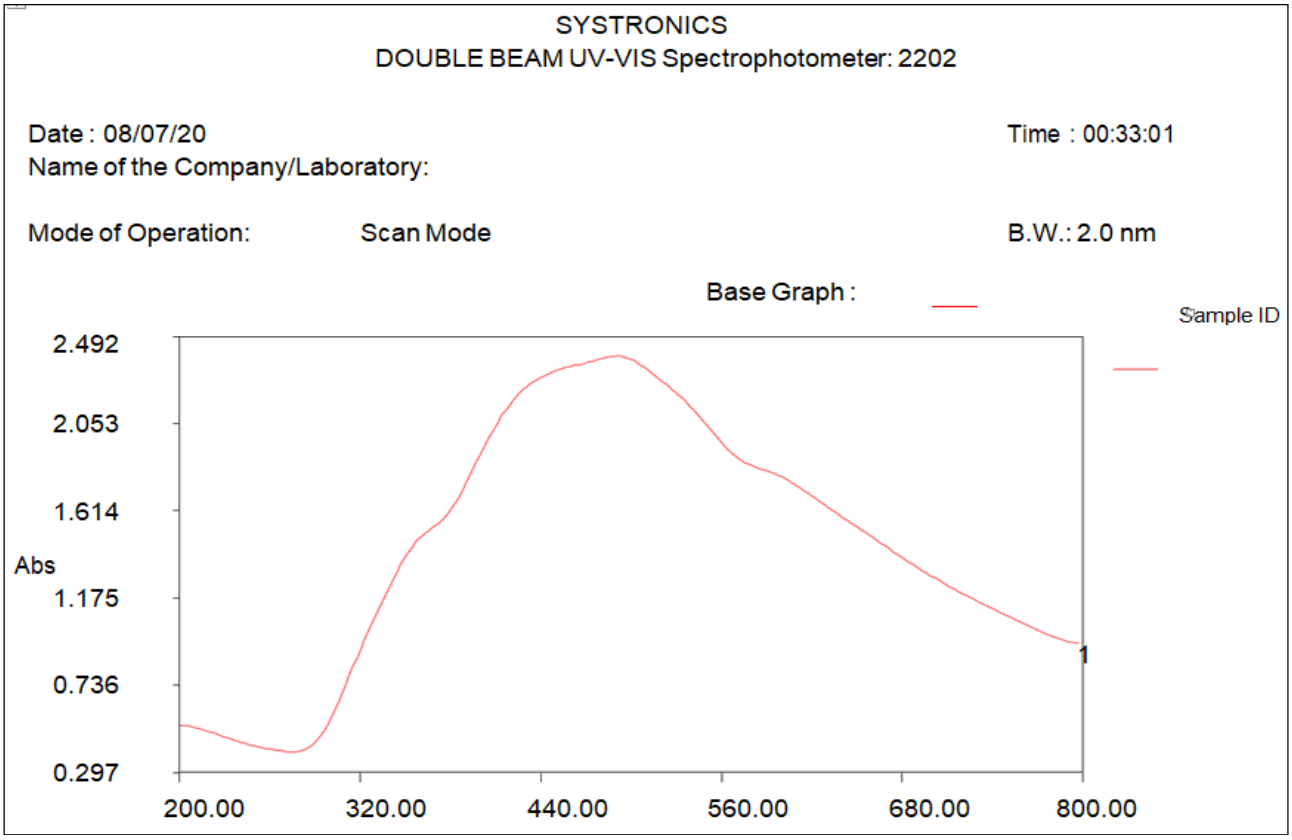

Fig 1: UV-VIS Spectrum

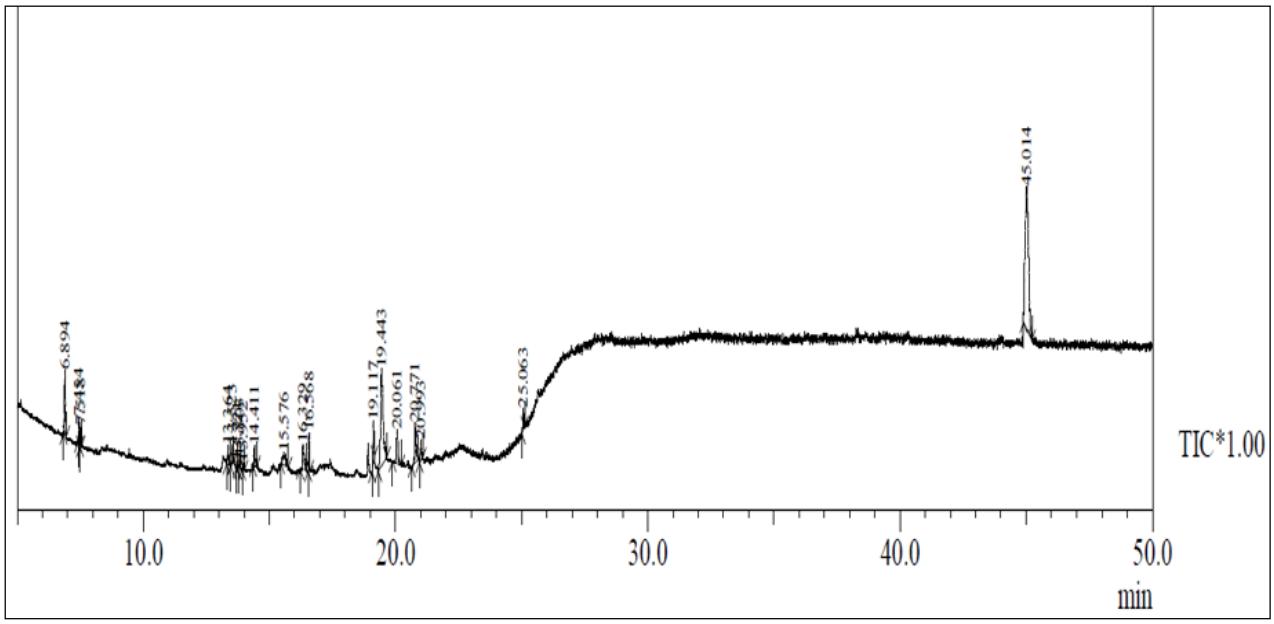

Fig 2: GC/MS chromatogram of *Elaeocarpus ganitrus* seed extract

Table 1: Chemical constituent present in the extract *Elaeocarpus ganitrus* Seeds as Per Peak Report TIC in GC-MS Analysis

Peak#	R. Time	Area	Area%	Name
1	6.894	161755	5.56	Undecane
2	7.454	39592	1.36	Cyclohexene, 1-methyl-4-(1-methylethenyl)-, (S)-
3	7.518	22340	0.77	1, 3, 3-TRIMETHYL-2-OXABICYCLO[2.2.2]OCTANE
4	13.364	36535	1.26	(Z)-CIS-.ALPHA.-BERGAMOTENE
5	13.523	28849	0.99	CYCLOHEXANE, 1-ETHENYL-1-METHYL-2,4-BIS(1-M
6	13.721	6944	0.24	2-CYCLOBUTEN-1-ONE, 4-[[(1,1-DIMETHYLETHYL)D
7	13.803	13777	0.47	BENZENEMETHANOL, 4-METHYL-
8	13.952	11297	0.39	AR-TURMERONE
9	14.411	47668	1.64	2-NAPHTHALENEETHANOL, 1,2,3,4,4A,5,6,8A-OCTAH
10	15.576	85484	2.94	1,2-BENZENEDICARBOXYLIC ACID, DIETHYL ESTER
11	16.329	110864	3.81	(7A-ISOPROPENYL-4,5-DIMETHYL-OCTAHYDRO-IND
12	16.568	66173	2.28	Patchouli alcohol
13	19.117	102382	3.52	Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydrox
14	19.443	611672	21.04	Dibutyl phthalate
15	20.061	119410	4.11	Ethylene brassylate
16	20.771	136586	4.70	17-Octadecynoic acid, methyl ester
17	20.993	42734	1.47	PENTADECANOIC ACID, METHYL ESTER
18	25.063	45156	1.55	1,2-BENZENEDICARBOXYLIC ACID, DIISOOCTYL ES
19	45.014	1217538	41.89	5,11,17,23-TETRATERT-BUTYLPENTACYCLO[19.3.1.1~
		2906756	100.00	

Discussion

The experiment's sole purpose was to identify the bioactive compound present in Rudraksha seed which gives its medicinal and pharmacological activity. *Elaeocarpus ganitrus is* known for its major alkaloid chemical constituents like Elaeocarpidine, (+)-Elaeocarpine, (+)-Isoelaeocarpin, (+)-Epiisoelaeocarpiline, (+) – Epiialloelaeocarpiline, (-) – Alloelaeocarpiline, (+) – Pseudoepiisoelaeocarpiline, Rudrakine and gallic and ellagic acids [13, 14]. UV-VIS spectrum graph is shown in Fig.1 which shows maximum absorbance at the range 464nm. The peak area lies between 350nm to 550 nm which indicates the presence of Benzene, Naphthalene, Anthracene Naphthacene, and Lots of ethylene and butadiene complex. The peak shows that *Elaeocarpus ganitrus* have an unsaturated group and heteroatom like S, N, O. Fig.2 express the GC/MS chromatogram of *Elaeocarpus ganitrus* seed extract. The GC-MS analysis of *Elaeocarpus ganitrus* Seeds extract revealed the presence of 19 compounds identified in the methanol extract [12, 15]. The recognition of the compounds was achieved by comparing obtained mass spectra. The small peaks may be accredited to the compounds there in small quantities as well as disintegrated main compounds. The peaks connected to low retention times are mostly low polar plant compounds**.** Table 1 shows the 19 identified bioactive compounds in GC-MS analysis. These bio active compounds may be responsible for Rudraksha seed medicinal property.

Conclusion

This investigation has given preface information to establish the chemical composition of *Elaeocarpus ganitrus* of using UV-VIS and GC/MS techniques. In the Phytochemical investigation, hexane and acetone extract shows the 19 bioactive compounds. UV-VIS spectroscopy shows the presence of utmost absorbance at the range 464nm. The peak area lies between 350nm to 550 nm which indicates the attendance of Benzene, Naphthalene, Anthracene Naphthacene, and Lots of ethylene and butadiene complex compound. It could be concluded that *Elaeocarpus ganitrus* contains various bioactive compounds. So it is recommended as a plant of pharmaceutical and medicinal importance. Nevertheless, extra study will require to be undertaken to ascertain fully its bioactivity, toxicity profile, the effect on the Medicinal and therapeutic property determination.

Consent for Publication

Not applicable.

Conflict of Interest

The authors affirm no conflict of interest, financial or otherwise

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