**Phytochemical, GC-MS and FT-IR Analysis of *Papaver somniferum* L**

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**Abstract**

The present study was aimed to analysis of bioactive constituents of *Papaver somniferum* (Poppy seed). The ethanol extract of the seeds were subjected to Phytochemical Screening, Gas chromatography- mass spectroscopic (GC-MS) and Fourier transform infrared spectroscopy (FTIR) analysis. GC-MS analysis of the seeds was performed using a Scion 436- GC Bruker model nd Interpretation on mass spectrometry MS was conducted using the database of National Institute Standard and Technology (NIST) and IR spectrum was recorded in spectrophotometer (Shimadzu, IR Affinity1, Japan). Phytochemical screening for seeds extracts indicated the presence of various secondary metabolites like Alkaloid, Cardiac Glycosides, Flavonoid, Phytosterols and Terpenoids. GC-MS analysis of compounds with totally, Thirty Nine volatile compounds major chemical compounds were identified, such as 9-Octadeconoic acid(30.72%), 9-Tetradec-1-ol, acetate, (E)- (24.02%), 9,12-Octadecadienoic acid, methylester, (E,E)- (7.82%), cis,9,10-Epoxoctadecan-1-ol (7.43%) and Undec-10-ynoic acid(4.36%). FT-IR analysis of peak values with various functional compounds such as alcohols, phenols, carboxylic acids, aldehydes, amides, amino acids, anhydrides, esters, ketones, Unsatuated aliphatics, aromatics, Unsatuated heterocycles, amines, Nitro compound, Alkanes, alkenes, sugars, Sulphur, phosphorus, and fluorine compounds. The present results concluded that the phytochemicals was observed in ethanol extract which revealed that the *Papaver somniferum* (Poppy seed) is potential use in different fields namely medical and pharmaceuticals and greatly valuable in medicinal practice for the treatment of several human ailments.

**Keywords:** GC-MS, FT-IR, *Papaver somniferum* L and NIST.

**Introduction**

Spices have been defined as plant substances from indigenous or exotic origin, aromatic or with strong taste, used to enhance the taste of foods (Pundir et al., 2010). Herbs and spices have been used for flavoring, food preservation, and/or medicinal commitments. Currently many ethnic cuisines are familiar for their reliance on “signature” herbs and spices. Several readings have endorsed the antimicrobial, antioxidant and pharmaceutical properties of spices and herbs to their phenolic compounds (Shan et al., 2005). Several studies have shown that spices are able to counteract oxidative stress in in vitro and in vivo systems (Ahmed et al., 2000). They extend the storage life of foods by preventing rancidity and oxidation of lipids (kelen and Tepe, 2008) or through bacteriostatic or bactericidal activity (Nazef et al., 2008) and they execute the antifungal activity (Kotzekidou et al., 2008). Spices and their extracts were had various therapeutic properties (Ayodele et al., 2009), they are affect digestion processes differently. Most of them stimulate the secretion of saliva.

*Papaver somniferum* L. belongs to the *Papaveraceae* family, and is commonly known as “Opium poppy.” The plant is found wild in various parts of Europe, northern Africa, and western Asia (GRIN database 2009). It is traditionally used as an herbal medicine against coughing, bronchitis, sore throat, minor sleep problems, and possesses a sedative effect (Soulimani et al., 2001). Previous investigations on this plant have revealed its nutritional composition (Trichopoulou et al., 2000), content of alkaloids, (Kalav,and Sarryar, 2007) and ethnobotanical studies (Scherrer et al., 2005, Kultu, 2007) and (Cornara et al., 2009). Poppy seeds are used in traditional cuisine of several nations, mostly in confectionary and bakery food products such as fillings in cakes and desserts, or sprinkled on bread or rolls. (Erinç et al., 2009). Moreover, they are a source of highly valuable oil, which is used not only for culinary purposes but also as an adjuvant for pharmaceutical and medical diagnostics, or as a component of cosmetic products and high-class oil-paints or varnishes (Krist et al., 2005).

GC-MS and FT-IR has played an important role in pharmaceutical analysis in recent years (Movasaghi et al., 2008), recently, spectroscopy has emerged as one of the major tools for biomedical claims and has made noteworthy progress in the field of clinical evaluation. Exploration has been accepted on a number of natural tissues using spectroscopic techniques, including FT-IR spectroscopy. GC-MS analysis is a breakthrough in analysis of phytoconstituents and structure elucidation of these compounds as they have a sensitivity of detecting compounds as low as 1 ng (Liebler et al., 1996). The present study was carried out the bioactive compounds present in the *Papaver somniferum* L Spice in ethanol extract with the aid of GC-MS and FT-IR techniques, which may offer a perception in its use of out-dated medicine.

**Material and Methods**

**Extraction and Phytochemical Screening**

*Papaver somniferum* L were dried and powdered using a mixer blender to make fine powder. Then 2 grams of the powdered sample was added to 250 mL of solvent was eluted sequentially based on the polarity index of the solvents. Then the extracts were subjected for rotary evaporator and saved at fridge for future uses.

Preliminary qualitative analysis of phytochemical screening was performed with shade dried and powdered of...
the spice. The presence and absence of derivative compounds like alkaloids, carbohydrates, Phytosterols, flavonoids, phenolic, tannins, saponins, and terpenoids were confirmed by phytochemical screening using standard protocols (Harborne, 1973).

Preparation of Extracts for GC–MS
20 g of the powdered seeds of Papaversomniferum L. were soaked in 100ml of 95% methanol for 12 h and filtered through Whatmann filter paper No. 41 along with 2 g sodium sulfate to remove the deposits and traces of water in the remainder. The filtrate was then concentrated and the extract contained both polar and nonpolar phytocomponents of the plant material used. 2 μl of this solution was used for GC/MS analysis (Muthukumaran et al., 2017).

GC Condition and Identification of Compounds
The sample was examined through Gas Chromatography Mass Spectrometry/Mass Spectrometry Electron Ionization (GC-MS/MS) mode. The GC-MS/MS was a Scion 436-GC Bruker model coupled with a Triple quadrupole mass spectrophotometer with fused silica capillary column BR-5MS (5% Diphenyl/95% Dimethyl polysiloxane) and Length: 30m; Internal diameter: 0.25 mm; Thickness: 0.25 μm. Helium gas (99.999%) was used as the carrier gas at a constant flow rate of 1 ml/min and an injection volume of 2 μl was working (split ratio of 10:1). The injector temperature 250°C; ion-source temperature 280°C.

The oven temperature was automated from 110°C (isothermal for 2 min), with an increase of 10°C/min, to 200°C, then 5°C/min to 280°C, wind up with a 9 min isothermal at 280°C and total GC running time was 41 min. This last escalation was to clean the column from any residues. The mass spectrometer was activated in the positive electron ionization (EI) mode with ionization energy of 70eV. The solvent delay was 0-3.0 min. A scan intermission of 0.5 seconds and fragments from m/z 50 to 500 Da was programmed. The inlet hotness was set at 280°C, source temperature 250°C. The relative fraction amount of each component was calculated by comparing its average peak area to the total areas. Software approved to handle mass spectra and chromatograms was MS Work station 8.

The NIST Version 2.0 library database of National Institute Standard and Technology (NIST) having more than 62,000 patterns was used for identifying the chemical components. The GC-MS/MS was performed by Food Safety and Quality Testing Laboratory, Indian Institute of Food Processing Technology, Thanjavur

FTIR Spectroscopic Analysis
Fourier transform infrared spectrophotometer (FTIR) is perhaps the most potent tools for identifying the types of chemical bonds (functional groups) present in compounds. Dry powders of altered solvent extracts of each plant material were used for FTIR analysis. 10mg of the dry extract powder was encapsulated in 100 mg of KBr pellet, in orderto prepare translucent sample disc. The powdered sample of each plant specimen was loaded in FTIR Spectroscope (Shimadzu, IR Affinity1, Japan), with a scan range from 400 to 4000 cm−1 with a resolution of 4cm−1.

Result and Discussion
Phytochemical Analysis
Spices have been supplementary to foods since ancient times as flavoring agent, also as food preservers and folk medicines. Spice is a natural compound that is extracted from the seeds, fruits, flowers or trunks (skin, roots, leaves) of several plants and add to food to provide taste, smell or flavor. Spices are staple dietary additives consumed all over the world (Farrell, 1990). Each spice has a unique aroma and flavor that derive from compounds known as phytochemicals or secondary metabolites. In the present study, the investigation of phytochemical screening was done by ethanol extract of Papaver somniferum L. The result revealed that the ethanolic extract of Papaver somniferum L recorded the presence of Alkaloid, Cardiac Glycosides, Flavonoid, Phytosterols and Terpenoids whereas the Carbohydrates-Saponins, Tannins were absent in the extract.

Table 1: Phytochemical screening of Papaver somniferum L

| Phytochemical       | Poppy seed |
|---------------------|------------|
| Alkaloids           | +          |
| Carbohydrate        | -          |
| Cardiac Glycosides  | +          |
| Flavonoids          | +          |
| Phytosterols        | +          |
| Saponins            | -          |
| Tannins             | -          |
| Terpenoids          | +          |

+ Present - Absent

GC MS Analysis
The compounds present in the ethanolic extract of Papaver somniferum L, were identified by GC-MS analysis (Fig. 1). Thirty Nine volatile compounds from ethanolic extract of Papaver somniferum L were separated and identified by GCMS. The components identified, molecular formulae, molecular weight and the time of elution with peak area were delivered in Table 2.

The GC-MS analyses of Papaver somnif(=merum L established the identification of 39 volatile compounds in the ethanolic extract. The composition are as follows: 9-Octadecenoic acid (30.72%), 9-Tetradecen-1-ol, acetate, (E)- (24.02%), 9,12-Octadecadienoic acid, methyl ester,
(E,E) (7.82%), cis-9,10-Epoxyoctadecan-1-ol (7.43%) and Undec-10-ynoic acid (4.36%). The chemical group classifications are as follows: Monoterpenes (1.33%), Aromatic (0.47%), Amino acid (1.42), Fatty acid (51.03%), Acetate (24.31%), Nitrogen compounds (0.14%), Alcohol (0.73%), Aldehyde (0.33%), Alkanes (1.22%), Alkenes (1.07), Esters (0.94%), Epoxy compounds (2.23%), naphthalene (0.71%) and ketones (0.75%).

Table 2: GC-MS analysis revealed the presence of bioactive compounds in the Papaversomniferum L (Poppy seeds).

| S. No | Identified Compound Details | Activity |
|-------|-----------------------------|----------|
| 1     | α-Pinene (RT-2.06), Molecular Formula- C_{10}H_{16}, MW 136, Peak Area% 0.12, Compound Nature- Monoterpene | Anti-inflammatory, Sedative, Anticancer, Antitumor, Antibacterial, Antiflu, Nematicide, Insecticide, Pesticide, Herbicide, Flavor, Immunomodulator, Fungistat, Antiobesity, Detoxicant, Chemo preventive, Expectorant, Photo sensitizer |
| 2     | Benzene, 1-methyl-3-(1-methylethyl) (RT-2.33), Molecular Formula- C_{10}H_{14}, MW 134, Peak Area% 0.47, Compound Nature- Aromatic compound | No activity reported |
| 3     | 1,4-Cyclohexadiene, 1-methyl-4-(1-methylethyl)-(RT-2.53), Molecular Formula- C_{10}H_{16}, MW 136, Peak Area% 1.21, Compound Nature- Monoterpene | Anti-inflammatory, Sedative, Anticancer, Antitumor, Antibacterial, Antiflu, Nematicide, Insecticide, Pesticide Herbicide, Flavor, Immunomodulator, Fungistat, Antiobesity, Detoxicant, Chemo preventive, Expectorant, Photo sensitizer |
| 4     | Butanoic acid, 4-(dimethylamino)-3-hydroxy, (RT-3.64), Molecular Formula- C_{6}H_{13}NO_{3}, MW 147, Peak Area% 1.42, Compound Nature- Amino compound | Antimicrobial |
| 5     | 3-Ethylheptanoic acid, (RT-6.01), Molecular Formula- C_{9}H_{16}O_{2}, MW 158, Peak Area% 0.04, Compound Nature- Fatty acid compound | No activity reported |
| 6     | 1,3-Propanediol, 2-(hydroxymethyl)-2-nitro- (RT-8.40), Molecular Formula- C_{4}H_{9}NO_{5}, MW 151, Peak | Antimicrobial |
| Compound | Nature | Molecular Formula | MW | Peak Area% | Compound | Nature |
|----------|--------|------------------|----|------------|----------|--------|
| 1,3-Propanediol, 2-(hydroxymethyl)-2-nitro- | Antimicrobial | C₄H₉NO₅ | 151 | 0.07 | | |
| Cyclopentaneundecanoic acid, methyl ester- | No activity reported | C₁₇H₃₂O₂ | 268 | 0.05 | | |
| Tetradecanoic acid, ethyl ester- | Nematicide, Antioxidant, Cosmetic Cancer preventive, Hypercholesterolemic Lubricant | C₁₇H₃₂O₂ | 268 | 0.05 | | |
| Undec-10-ynoic acid- | No activity reported | C₁₁H₁₈O₂ | 182 | 0.22 | | |
| n-Hexadecanoic acid- | Antioxidant Hypcholesterolemic Nematicide Pesticide, Anti androgenic Flavor Hemolytic 5-Alpha reductase inhibitor | C₁₆H₃₂O₂ | 256 | 0.22 | | |
| Undecanoic acid- | No activity reported | C₁₁H₂₂O₂ | 186 | 0.38 | | |
| 9,12-Octadecadienoic acid, methyl ester, (E,E)- | Anti androgenic, 5-Alpha reductase inhibitor Antihistaminic, Anticoronary, Insectifuge Antieczemic, Antiacne | C₁₉H₃₄O₂ | 294 | 7.82 | | |
| 9,12-Octadecadienoic acid (Z,Z) | Anti androgenic 5-Alpha reductase inhibitor Antihistaminic Anticoronary Insectifuge Antieczemic Antiacne | C₁₉H₃₄O₂ | 294 | 0.78 | | |
| 11,14-Eicosadienoic acid, methyl ester | Cardio protective | C₂₁H₃₈O₂ | 322 | 5.81 | | |
| 9-Octadecynoic acid | No activity reported | C₁₈H₃₂O₂ | 280 | 0.30 | | |
| 9-Tetradecon-1-ol, acetate, (E)- | No activity reported | C₁₆H₃₀O₂ | 254 | 24.02 | | |
| No. | Name | Molecular Formula | MW | Peak Area % | Compound Nature | Activity |
|-----|------|-------------------|-----|-------------|----------------|----------|
| 18  | cis-9,10-Epoxyoctadecan-1-ol | C_{18}H_{36}O_{2} | 284 | 7.43 | Alcoholic compound | Antimicrobial |
| 19  | 1,2,15,16-Diepoxyhexadecane | C_{16}H_{30}O_{2} | 254 | 2.23 | Epoxy compound | No activity reported |
| 20  | Dodecane, 2,6,10-trimethyl | C_{15}H_{32} | 212 | 1.01 | Alkane compound | No activity reported |
| 21  | 9,12-Octadecadienal | C_{15}H_{32} | 264 | 0.33 | Aldehyde compound | No activity reported |
| 22  | Methoxyacetic acid, 4-tetradecyl ester | C_{17}H_{34}O_{3} | 286 | 0.51 | Ester compound | No activity reported |
| 23  | E,E-1,9,17-Docasatriene | C_{22}H_{40} | 304 | 0.70 | Alkene compound | No activity reported |
| 24  | cisZ-11,12-Epoxytetradecan-1-ol | C_{14}H_{28}O | 228 | 0.68 | Alcoholic compound | Antimicrobial |
| 25  | (Z)6,(Z)9-Pentadecadien-1-ol | C_{15}H_{28}O | 224 | 2.36 | Alcoholic compound | Antimicrobial |
| 26  | Methoxyacetic acid, 3-tetradecyl ester | C_{17}H_{34}O_{3} | 286 | 0.43 | Alcoholic compound | No activity reported |
| 27  | 1,E-11,Z-13-Octadecatriene | C_{18}H_{32} | 248 | 0.13 | Alkene compound | No activity reported |
| 28  | trans-2-Undecen-1-ol | C_{11}H_{22}O | 170 | 0.51 | Alcoholic compound | Antimicrobial |
| 29  | E-2-Tetradecen-1-ol | C_{14}H_{28}O | 212 | 0.21 | Alcoholic compound | Antimicrobial |
The functional therapeutic activity of the poppy seed compounds were identified through Dr. Duke’s Phytochemical Database. The fatty acids which constitute 51.03% possess antioxidant activity and also the anti-inflammatory activity. Compounds namely, α-Pinene, 1,4-Cyclohexadiene, 1-methyl-4-(1-methylbutyl)-, n-Hexadecanoic acid are having insecticide activity and proven for pesticide activity. Flavors compounds like ketones, aldehydes and alcohols were enriched in poppy seed. The present study indicates that poppy seed is a good natural source of sterols. In addition, the findings in this study are

| Compound | Nature | Alcoholic compound | Area % | Molecular Formula | MW | Peak Area % | Area |
|----------|--------|-------------------|-------|-------------------|-----|-------------|------|
| Naphthalene, decahydro-2,2-dimethyl- (RT-26.86) Molecular Formula- C₁₂H₂₂, MW 166, Peak Area% - 0.71, Compound Nature- Naphthalene compound | No activity reported | | | | |
| 2-Hydroxy-(Z)-9-pentadecenyl propanoate, (RT-27.56) Molecular Formula- C₁₈H₃₄O₃, MW 298, Peak Area% - 0.29, Compound Nature- Hydroxy compound | No activity reported | | | | |
| 13-Oxabicyclo[10.1.0]tridecane, (RT-27.84) Molecular Formula- C₁₂H₂₂O, MW 182, Peak Area% - 0.13, Compound Nature- Alcoholic compound | No activity reported | | | | |
| E,E-1,9,17-Docasatriene, (RT-28.83) Molecular Formula- C₂₂H₄₀, MW 304, Peak Area% - 0.07, Compound Nature- Alkane compound | No activity reported | | | | |
| Dodeca-1,6-dien-12-ol, 6,10-dimethyl- (RT-29.24) Molecular Formula- C₁₄H₂₆O, MW 210, Peak Area% - 0.73, Compound Nature- Unsaturated alcoholic compound | No activity reported | | | | |
| Z,Z,Z-4,6,9-Nonadecatriene, (RT-29.69) Molecular Formula- C₁₉H₃₄, MW 262, Peak Area% - 0.17, Compound Nature- Alkene compound | No activity reported | | | | |
| 5α-Androstan-16-one, cyclic ethylene mercaptol (RT-30.78) Molecular Formula- C₂₁H₃₄S₂, MW 350, Peak Area% - 2.13, Compound Nature- Steroid | Antimicrobial Anti-inflammatory Anticancer Diuretic Antiarthritic Antiasthma | | | | |
| Oxacycloheptadec-8-en-2-one, (RT-31.11) Molecular Formula- C₁₆H₂₈O₂, MW 252, Peak Area% - 0.75, Compound Nature- Ketone compound | No activity reported | | | | |
| cis-7,cis-11-Hexadecadien-1-yl acetate, (RT-32.37) Molecular Formula- C₁₈H₃₂O₂, MW 280, Peak Area% - 0.29, Compound Nature- Acetate compound | No activity reported | | | | |
| 12-Methyl-E,E-2,13-octadecadien-1-ol, (RT-33.51) Molecular Formula- C₁₉H₃₆O, MW 280, Peak Area% - 0.08, Compound Nature- Unsaturated alcoholic compound | No activity reported | | | | |
important for the nutrition sciences, because fatty acids and phytosterols, in particular, seem to have considerable effects on health.

**FTIR Analysis of Papaver somniferum**

The FT-IR spectrum was used to find the functional groups of the active components present in extract based on the peaks values in the region of IR radiation. Once the extract was passed into the FT-IR, the functional groups of the components were separated based on its peaks ratio.

The ethanolic extract of *Papaver somniferum* L showed characteristic absorption bands at 3285.85 cm\(^{-1}\) for O–H stretching vibration presence of alcohols, phenols, 2925.05 cm\(^{-1}\) (O–H stretching vibration presence of carboxylic acids), 2855.04 cm\(^{-1}\) (CHO Aldehydes (Fermi doublet), 1744.18 cm\(^{-1}\) (C=O Acid halides, aldehydes, amides, amino acids, anhydrides, carboxylic acids, esters, ketones, lactams, lactones, quinines), 1637.03 cm\(^{-1}\) (C=C, C=N, NH Unsatuated aliphatics, aromatics, unsaturated heterocycles, amides, amines, amino acids), 1545.82 cm\(^{-1}\) (NO2 Nitro compound CH3 and CH2 Alkanes, alkenes), 1454.4 cm\(^{-1}\) (C–H bend stretching vibration presence of alkenes), 1313.89 cm\(^{-1}\) (N–O stretching vibration presence of nitro compounds), 1235.3 cm\(^{-1}\) (C-O-C and C-OH Ethers, alcohols, sugars S=O, P=O, C-F Sulphur, phosphorus, and fluorine compounds) and 1049.35 cm\(^{-1}\) for Si-O and P-O Organosilicon and phosphorus compounds (Fig. 2 & Table 3).

![Fig. 2: FTIR- Spectrum wave numbers of Papaver somniferum L](image)

**Table 3: FTIR Analysis of Papaver somniferum L**

| S. No | Peak values | Frequency ranges(cm\(^{-1}\)) | Functional groups and Possible compounds |
|-------|-------------|-------------------------------|----------------------------------------|
| 1     | 3285.85     | 3500–3200                     | O–H stretching vibration presence of alcohols, phenols |
| 2     | 2925.05     | 3300–2500                     | O–H stretching vibration presence of carboxylic acids |
| 3     | 2855.04     | 2800–2600                     | CHO Aldehydes (Fermi doublet) |
| 4     | 1744.18     | 1870–1650                     | C=O Acid halides, aldehydes, amides, amino acids, anhydrides, carboxylic acids, esters, ketones, lactams, lactones, quinines |
| 5     | 1637.03     | 1650–1550                     | C=C, C=N, NH Unsatuated aliphatics, aromatics, unsaturated heterocycles, amides, amines, amino acids |
| 6     | 1545.82     | 1550–1300                     | NO2 Nitro compound CH3 and CH2 Alkanes, alkenes, etc |
| 7     | 1454.4      | 1470–1450                     | C–H bend stretching vibration presence of alkenes |
| 8     | 1313.89     | 1400–1290                     | N–O stretching vibration presence of nitro compounds |
| 9     | 1235.3      | 1300–1000                     | C-O-C and C-OH Ethers, alcohols, sugars S=O, P=O, C-F Sulphur, phosphorus, and fluorine compounds |
| 10    | 1049.35     | 1100–800                      | Si-O and P-O Organosilicon and phosphorus compounds |

**Conclusion**

The presence of naturally active compounds also contributes to its healthy value and thus proved to be potential sources of useful foods. Additionally, isolation, purification and characterization of the phytochemicals will make remarkable studies. The result of this study would lead to discovery of some compounds which are very useful for the manufacturing of new drugs. This primary information will simplify in leading further studies on discovery of bioactive
ingredients, resolve of their efficacy by in vivo studies and demonstration of their safety and efficacy in clinical trials.

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Conflict of Interest: None.

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