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# Phytochemical Screening and GC-MS, FT-IR Analysis of Methanolic Extract Leaves of *Solanum torvum* Sw.

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**Abstract:** *The bioactive compounds of Solanum torvum leaves have been evaluated using GC-MS and FT-IR. The chemical compositions of methanol extract leaves of Solanum torvum were investigated using Perkin-Elmer Gas Chromatography- Mass Spectrometry. While the mass spectra of the compounds found in the extract was matched by the National Institute of Standards and Technology (NIST) library. GC-MS analysis of extract of leaves Solanum torvum revealed the exsistance of 3-n-hexylthiolane, S,S-dioxide (49.407%) was found as the one major component is the methanol extract and the seven minor components such as Oleyl alcohol, trifluroacetate (12.23%), n- hexadecanoicacid(9.42), 3-methyl-2-(2-oxoprpyl)furan (4.97%) Hentriacontane (4.56%) 1, 2-benzendicarboxylic acid, mono (2-ethylhexyl)ester (3.92%) Choloroacetic acid, tetradecyl ester (3.45%), Benzoic acid 1-methoxy-1h-tetrazol-5-ylmethylester (2.60%). The result of FTIR analysis confirmed the presence of alcohol, alkanes, aromatic carboxylic acid, halogen compound, alkyl halide. The result of this study offer a platform of using Solanum torvum leaves as herbal alternative for various diseases.*

**Keywords:** *Phytochemical; Methanol extract; Solanum torvum Sw. GC-MS and FT-IR.*

## 1. INTRODUCTION

Plant have been traditional medicinal for several thousand year (Abu- Rabia,A, 2005). The knowledge medicinal plant has been accumulated in the course of many centuries based on different medicinal systems such as Ayurveda, Unani and Siddha. In india, it is reported that traditional healers uses 2500 plants species 100 species plant serves as regular sources of medicine during the last decades there had been an increasing interest in the study of medicinal plants and their traditional use in different parts of the world. According to the reports of the world health organization (WHO), as many as 80%of the world's people depend on traditional medicinal for their primary health care needs, due to the considerable economic benefit in their development and use for the treatment of various disease (Igoli *et al*., 2003).

The Solanaceae family comprises about 90 genera and 3000 species which are widely distributed in the world. They are a rich source of active secondary metabolites (Coletto da Silva et al., 2004). Within this family, the genus *Solanum i*s the largest and most complex with more than 1500 species (Chowdhury et al., 2007) which yield a great variety of steroidal saponins and glycoalkaloids of interest from ecological and human health viewpoints (Roddick et al., 2001). Numerous species of *Solanum* are known to possess a variety of biological activities including anti-mycotic (Gonzales et al., 2004; Singh et al., 2007), antiviral (Arthan et al., 2002), molluscicidal (Silva et al., 2006), teratogenic (Keeler et al., 1990), and cytotoxic properties (Nakamura et al., 1996; Lu et al., 2009).

*Solanum torvum* belong to the family Solanaceae and generally recognized as Turkey Berry is one such plant. It is a much prickle perennial under shrub growing up to 12' in height with leaves ovate or oblong, hairy on both sides, armed with prickles; along the nerves, flowers purple colored, in extra axillary cymes. Fruits globose, drooping berries yellow on ripe, with numerous small seeds are surrounded by persistent calyx at the base. Solanum torvum Sw. a folk herbal medicinal plant. The plant is sedative and diuretic and the leaves are used as a haemostatic. The ripened fruits are used in the preparation of tonic and haemopoitic agent and also for the treatment for pain (Kala, 2005). It has antioxidant properties (Sivapriya and Srinivas., 2007). It is intensively used worldwide in the traditional medicine as poison anti-dote and for the treatment of fever, wounds, tooth decay, reproductive problem and arterial hypertension (Ndebia *et al*., 2007). The valuable medicinal

properties of different plants are due to presence of several constitutes i.e, saponins, tannins, alkaloids, alkyl phenol, glycoalkaloids, flavonoids, sesquiterpens lactones, erpenoids and phenol ether (Cox, 1994).

Within a decade, there were a number of dramatic advances in analytical techniques, including FT-IR and GC-MS that were powerful tools for identification and determination of phytochemicals (Roberts and Xia, 1995). The present study was carried out the bioactive compounds present in the *Solanum torvum* leaves in methanol extract with the aid of GC-MS and FT-IR techniques, which may provide an insight in its use of traditional medicine.

## 2. MATERIAL AND METHODS

### 2.1. Plant Material

The fresh and healthy *Solanum torvum* leaves were collected in May 2014 from Vallam, Cuddalore District, Tamil Nadu, and India. The plant was taxonomically identified by using Flora of Presidency Madras. In the laboratory, the leaves were washed 2-3 times with running fresh water, than air dried under shade drying was grinded with mechanical grinder, the powder was kept in small labeled plastic bags. 100 g of leaves of *Solanum torvum* were subjected to successive extraction with different solvents in increasing polarity viz. Petroleum ether, Chloroform, Ethyl acetate and Methanol using Soxhlet apparatus. The solvent were evaporated under reduced pressure and stored in desiccators at $4^oC$. The methanol extracts was used for GC-MS analysis.

#### *2.1.1. Phytochemical Screening*

Phytochemical analysis was carried out for identification of tannins, terpenoids, flavonoid, alkaloid, phenol, phytosterol and saponins according to standard methods (Trease and Evans, 2008; Horborne, 1993).

#### *2.1.2. GC-MS Analysis*

Methanol extract of *Solanum torvum* leaves was analyzed with the help of GC-MS analyzer (Perkin Elmer Gas Chromatography-Mass Spectrum). On Elite-1 column the date was generated. The carrier gas helium (99.999%) was used at flow rate of 1 ml per min in split mode (10:1). 8µof methanol sample was injected to column at $250^oC$ injector temperature. Temperature of oven starts at $60^oC$ and hold for 6min and than it was raised at rate of $10^oC$ per min to $300^oC$ without holding. Holding was allowed for 6 min at program rate of $5^oC$ per min. temperature of ion sources was maintained at $240^oC$. The injector temperature was set at $250^oC$ and detector temperature was set at $260^oC$. The mass Spectrum of compounds present in samples was obtained by electron ionization at 70eV and detector operates in scan mode 50 to 600Da atomic units. A 0.5 seconds of scan interval and fragments from 50 to 600Da was maintained. Total running was 40 minutes.

#### *2.1.3. Identification of Components*

Identification was based on the molecular structure, molecular mass and calculated fragments. Interpretation on mass spectrum GC MS was conducted using the database of National Institute Standard and Technology (NIST) having more than 62,000 patterns. The name, molecular weight and structure of the components of the test materials were ascertained. The relative percentage amount of each component was calculated by comparing its average peak area to the total area. The spectrum of unknown components was compared with the version, 2005, software, Turbo mass 5.2. This is done in order to determine whether this plant species contains any individual compound or group of compounds, which may substantiate its current commercial and traditional use as an herbal medicine. Further it helps to determine the most appropriate methods of extraction these compounds.

#### *2.1.4. FTIR Spectroscopic Analysis*

Fourier transform infrared spectrophotometer (FTIR) is perhaps the most powerful tools for identifying the types of chemical bonds (functional groups) present in compounds. Dried powders of different solvent extracts of each plant material were used for FTIR analysis. 10mg of the dried extract powder was encapsulated in 100 mg of KBr pellet, in order to 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 $4cm^{-1}$.

## 3. RESULT AND DISCUSSION

In the present study, the investigation of phytochemical screening was different solvent extracts like; Petroleum ether, Chloroform, Ethyl acetate and Methanol extract of leaves in *Solanum torvum.* The result revealed that the methanolic extract of *Solanum torvum* recorded the presence of alkaloid, flavonoid, phenol, tannins, saponins, phytosterol and glycosides followed by other extract (Table.1).

**Table1.** *preliminary phytochemical screening of Solanum torvum Sw. Leaves*

| Phytochemical | Petroleum ether | Chloroform | Ethyl acetate | Methanol |
|---|---|---|---|---|
| Alkaloid | + | + | + | + |
| Flavonoid | - | + | - | + |
| Terpenoid | + | - | - | - |
| Tannins | - | - | + | - |
| Phenol | + | + | - | + |
| Saponin | - | - | + | + |
| Phytosterrol | - | - | + | + |
| Glycoside | - | + | + | + |

*(+) = positive (present); (-) = Negative (absent)*

Phytochemical constitutes such as tannins, flavonoids and several aromatic compounds or secondary metabolites of plants serves as defense mechanism against predation by many microorganisms. The curative properties of medicinal plants are perhaps due to the presence of various secondary metabolites such as alkaloid, flavonoid, tannins, phenolic compounds, saponins and phytosterols (Britto and Sebastian, 2012). The presence of alkaloisds, saponin, flavonoids, phenolic compounds, tannins, phytosterol and terpenoids are used in analgesic, and antiplasmodic and bacteriocidal activities (Stary, 1998). Thus the preliminary screening test may be useful in the detection of the bioactive principles and subsequently may lead to the drug discovery and development.

The studies on the active principles in the *Solanum torvum* leaves of Methanolic extract by GC MS analysis clearly showed the presence of towel compounds. The active principles with their Retention Time (RT), Molecular Formula (MF), Molecular Weight (MW), and Concentration (peaks areas %) are presented in (Table.2).

**Table2.** *GC-MS analysis of phytocompounds identified in the methanolic leaves extract of Solanum torvum Sw.*

| PEAK | R.T | AREA % | MOLECULAR FORMULA | COMPOUND NAME |
|---|---|---|---|---|
| 1 | 12.981 | 2.315 | $C_{10}H_{14}O$ | O- isopropylanisole |
| 2 | 14.163 | 2.609 | $C_{38}H_{36}O_6N_2$ | Benzoic acid 1-methoxy-1h-tetrazol-5-ylmethylester |
| 3 | 18.420 | 9.429 | $C_{16}H_{32}O_2$ | N-hexadecanoic acid |
| 4 | 19.080 | 2.478 | $C_8H_{10}O_2$ | 3-methyl-2-(2-oxopropyl)feran |
| 5 | 20.255 | 49.407 | $C_{10}H_{20}O_2S$ | 3-n-hexylthiolane,S,S-dioxide |
| 6 | 21.266 | 12.237 | $C_{20}H_{35}O_2F_3$ | Oleyl alcohol, trifluroacetate |
| 7 | 22.021 | 4.970 | $C_8H_{10}O_2$ | 3-methyl-2-(2-oxoprpyl)furan |
| 8 | 22.156 | 3.458 | $C_{16}H_{31}O_2Cl$ | Choloroacetic acid, tetradecyl ester |
| 9 | 22.521 | 3.928 | $C_{16}H_{22}O_4$ | 1,2-benzendicarboxylic acid, mono(2-ethylhexyl)ester |
| 10 | 22.906 | 2.240 | $C_{21}H_{42}O_2$ | Butyl 14-methylhexadeconate |
| 11 | 26.328 | 2.369 | $C_{31}H_{64}$ | Hentriacontane |
| 12 | 27.873 | 2.369 | $C_{31}H_{64}$ | Hentriacontane |

The GC-MS chromatogram of the eight peaks of the major compounds detected was shown in (Figure-1, Table 3).

The results revealed that 3-n-hexylthiolane, S,S-dioxide (49.407%) was found as the one major component is the methanol extract and the seven minor components such as Oleyl alcohol, trifluroacetate (12.23%), n- hexadecanoic acid (9.42), 3-methyl-2-(2-oxoprpyl)furan (4.97%) Hentriacontane (4.56%) 1,2-benzendicarboxylic acid, mono(2-ethylhexyl)ester (3.92%), Choloroacetic acid, tetradecyl ester (3.45%), Benzoic acid 1-methoxy-1h-tetrazol-5-ylmethylester (2.60%).

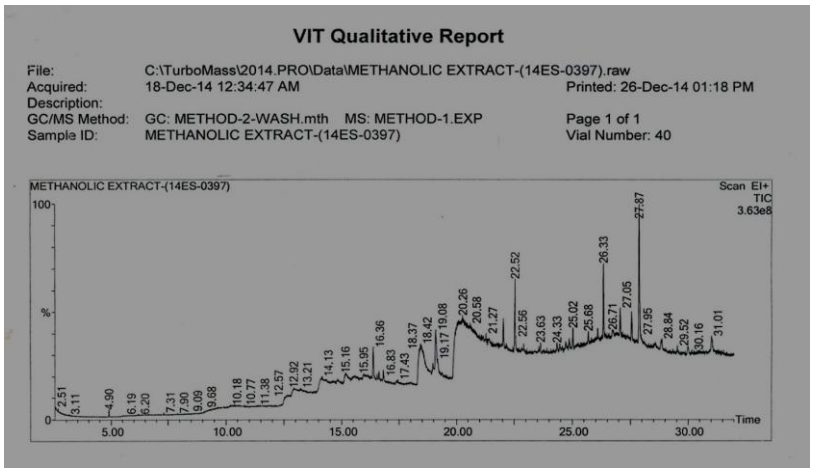
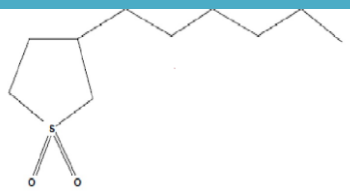
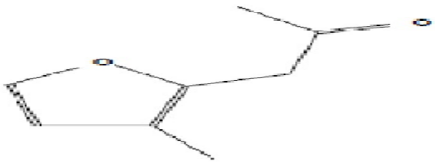
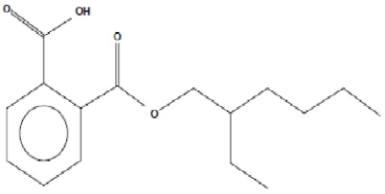
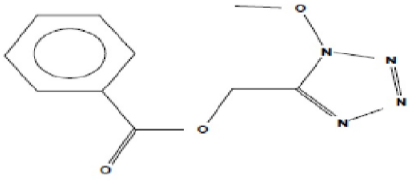



**Fig1.** *GC-MS analysis of Solanum torvum leaves of methanol extract.*

**Table3.** *GC-MS analysis of Eight major phytocomponents identified in the methanolic leaves extract of Solanum torvum Sw.*

| NAME OF THE COMPOUNDS | STRUCTURE | ACTIVITY |
|---|---|---|
| **3-n-hexylthiolane,S,S-dioxide** |  | Antitumor, anticancer, antidote, antimicrobial anti-viral activity. |
| **Oleyl alcohol, trifluroacetate** |  | |
| **N-hexadecanoic acid** |  | Antibacterial and antifungal activity |
| **3-methyl-2-(2-oxoprpyl)furan** |  | Antioxidant, antimicrobial and bacteriocide, Antipyretic, anti-inflammatory activity |
| **Hentriacontane** |  | Anti-inflammatory, diuretic, anti-tubercular agent. |
| **1,2-benzendicarboxylic acid, mono(2-ethylhexyl)** |  | Flavouring agent, perfumes, ice creame. |
| **Choloroacetic acid, tetradecyl ester** |  | Antioxidant, antimicrobialand bacteriocide, anti- inflammatory activity |
| **Benzoic acid 1-methoxy-1h-tetrazol-5-ylmethylester** |  | Anti-microbial activity. |

The GC-MS analysis of the identified compound from ethanol extract of the *Chaetomorpha antennia* leaves specific activities such as antimicrobial, anti-inflammatory, neuroprotective, and potent antioxidant activity have also been reported bioactive compound in seaweed *Chaetomorpha antennia* ethanol extract (Thanigaivel *et al.*, 2014). The structure and kinetics studies of n-Hexedeconic acid (palmitic acid) revealed that it is an inhibitor of phospholipase, hence and anti-inflammatory compound (Aparna *et al.*, 2012). The FT-IR spectrum was used to identify the functional groups of the active components present in extract based on the peaks values in the region of IR radiation. When the extract was passed into the FT-IR, the functional groups of the components were separated based on its peaks ratio. The results of FT-IR analysis confirmed the presence of alcohol, alkanes, aromatic carboxylic acid, and halogen compound, alkyl halide (Figure-2 and Table.4).

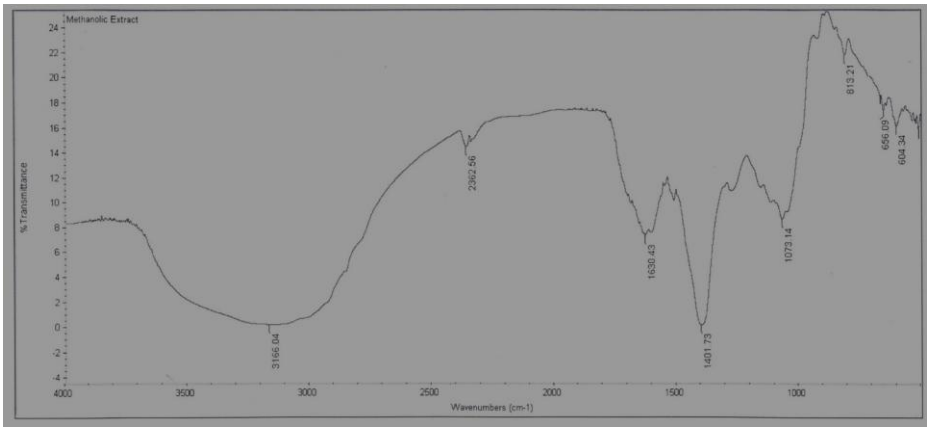



**Fig2.** *FTIR analysis of Solanum torvum leaves of Methanolic extract.*

**Table4.** *FTIR Peak Values of Methanolic Extract of Solanum torvum leaves.*

| S. NO | PEAK VALUES | FUCTIONAL GROUPS |
|---|---|---|
| 1. | 3166.04 | Alcohol |
| 2. | 2362.56 | Nit riles |
| 3. | 1630.43 | Alkanes |
| 4. | 1401.73 | Aromatic |
| 5. | 1073.14 | Carboxylic acid |
| 6. | 813.21 | Aromatic |
| 7. | 656.09 | Halogen compound |
| 8. | 604.34 | Alkyl halide |

## 4. CONCLUSION

The presence of various bioactive compounds justifies the use of the leaves for various ailments by traditional practitioners. However isolation of individual phytochemical constituents and subjecting it to biological activity will definitely give fruitful results. It could be concluded that *Solanum torvum* contains various bioactive compounds. So it is recommended as a plant of phytopharmaceutical importance. However, further studies will need to be undertaken to as certain fully its bioactivity, toxicity profile, effect on the ecosystem and agricultural products.

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