Solvent Extraction and Characterization of Essential Oil from Allamanda voilacea

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Abstract. The objective of this study is extraction and characterization to identify the chemical composition present in the leaves extract of Allamanda voilacea (Apocynaceae family) collected from Pollachi, Tamil Nadu. The extraction process is achieved by solvent extraction method using soxhlet apparatus, followed by characterization using gas-chromatography – (GC-MS) Gas-Mass spectrometry. Iso-propyl alcohol ((CH₃)₂-CH-OH) was used as a solvent in the extraction process. A total of 21 compounds were extracted from the leaves extract. The major compounds in the extract include Eticyclidine (23.96%), Alpha.Terpineol(17%), 1,4-Methano-1H-indene,octahydro-4-methyl-8-methylene-7-(1-methylethyl)-,[1S(1.alpha.,3a.beta.,4.alpha.,7.alpha.,7a.beta.)] (10.96%), Endo-borneol (8.74%), .alpha.-ylangene (7.77%), Benzene,1-chloro-3,5-difluoro-(7.37%), 2,5-di-tert-Butylnitrobenzene (5.46%). Considering the properties of the above compounds, they can be used in perfume and drug industries.

Keywords: Allamanda voilacea, solvent extraction, chemical compounds

1 Introduction

The use of aromatic plants has increased over the years due to its intrinsic properties. Chemical compounds extracted from these plants have known to posses antibacterial, antifungal, diuretic, expectorant and antioxidant properties. Apart from their medicinal properties, they are being used in food, pharmaceutical, cosmetics, perfumes and chemical industries. This aim of this work is to examine the chemical composition of the leaves of species Allamanda violacea or Allamanda blanchetii. Allamanda is an angiosperm commonly found in all parts of world. These plants are evergreen shrubs, commonly found in all parts for their beautiful infl orescence. This plant consists of approximately 15 species, namely A. augustifolia, A. blanchetii, A. caccicola, A. cathartica, A. doniana, A. laevis, A. martii,
A. nobilis, A. oenotherifolia, A. polyantha, A. puberula, A. schottii, A. setulosa, A. thevetifolia, and A. weberbaueri [1]. The specimen Allamanda violacea belongs to the kingdom Plantae, Family Apocynaceae, Sub-family Rauvolfioideae, Genus Allamanda and Species Violaceae. The leaves of this plant are arranged opposite in whorls. The inflorescence is compound cyme, which contains five lobed sepals. The fruit is schizocarp which contain two and occasionally four.

Manogaran and Sulochana [2] analysed the flowers of Allamanda cathartica phytochemically and the compounds were extracted from ethyl acetate extract employing chromatographic techniques. They reported that majority of the compounds were flavoids. Fartyal [3] evaluated the antifungal activities of the extracts from the leaves and flowers of Allamanda cathartica Linn. They concluded that the leaves had good antifungal potency against microorganisms and potential source for production of antifungal drugs. Okwubie and Senior [4] evaluated the antimicrobial activity of the crude root extracts of Allamanda cathartica species. They concluded that the ethyl acetate and methanol extracts of Allamanda cathartica showed good antibacterial activities and could serve as a lead for the development of new antibacterial agents. Ghosh and Banerjee [5] performed a comparative analysis of the level of secondary metabolites present in the leaves, flowers and stem of the two species of Allamanda, namely, Allamanda blanchetii and Allamanda cathartica. They used methanol and double distilled water for the extraction process and concluded that the flowers of both species have higher amount of flavonoids, polyphenols, polysaccharide and floral extracts has high anti-oxidant properties. Petricevich and Abarca-Vargas [1] conducted a review on the phytochemistry of Allamanda carthatica. Oliveira et al. [6] analysed the effect of the extract from a native plant from Caatinga, Allamanda blanchetii for its induction of resistance mechanism in sugarcanes. They concluded that the extract from A. blanchetii induced an increase in the glucanase and was more effective that the acilbenzolar-S-metil (ASM). It is evident from the literature that the chemical composition of the leaves of Allamanda violacea is yet to be analysed. The main aim of this study is to analyse the chemical compounds present in the leaves of Allamanda violacea.

2 Materials and methods

All the chemicals were of reagent grade. Isopropyl alcohol was purchased from Merck, Mumbai, India. The raw material Allamanda violacea were purchased from Dr.Mahalingam college campus, Pollachi, Coimbtore, Tamil Nadu, India. After collecting the samples, they were washed with fresh water followed by distilled water to get rid of any coupled epiphytes and debris. Then they were dried under shade for one week. The dried leaves were ground to powder with electric grinder mixer. The specimen of the sample used in this study is shown in Figure 1.
2.1 Soxhlet Extraction of Allamanda voilacea

Soxhlet apparatus is a specialized glass refluxing unit mainly used for organic solvent extractions. The 25 g of the grind leaves powder is placed in a thimble made up of filter paper and is placed inside the soxhlet apparatus. The kit is fitted to a round bottomed (RB) flask containing the solvent and to a reflex condenser. The solvent in the RB flask is boiled gently, the vapour passes up through the side tube, reduced by the condenser and falls into the thimble containing the material and slowly fills the soxhlet. When the solvent reaches the top of the attached tube it siphons over into the flask, thus removes the portion of the substance, which it has extracted. The resulted solution was cooled and it is standard process of steam distillation employed for the isolation of volatile oil from crude resulted solution and it is stored in dark for further examination of GC-MS analysis. Similar studies have been conducted by Manikandan et al.[7-9].

3 Results and discussion

Resulted solution was extracted from the leaves extract of Allamanda voilacea and characterized in this study using the GC-MS analysis. The chemical composition of the resulted solution has been illustrated in Table 1 below.

Table 1. Chemical composition of the essential oil from Allamanda voilacea
| S.NO | Component Name                          | Chemical Structure | RT  | Mass  | Area (%) |
|------|----------------------------------------|--------------------|-----|-------|----------|
| 1    | 1-(1-Adamantyl)-1-Phenylethanol         | ![Image](image1.png) | 4.47| 256.2 | 2.20     |
| 2    | Bicyclo[2.2.1]heptan-2-ol,1,3,3-trimethyl | ![Image](image2.png) | 5.26| 154.1 | 1.59     |
| 3    | 7-octon-2-ol,2,6-dimethyl               | ![Image](image3.png) | 5.79| 156.2 | 1.61     |
| 4    | Endo-borneol                            | ![Image](image4.png) | 5.93| 154.1 | 8.74     |
| 5    | 2,7-Octadiene-1,6-diol,2,6-dimethyl     | ![Image](image5.png) | 6.35| 170.1 | 1.67     |
| 6    | Alpha.Terpineol                        | ![Image](image6.png) | 6.55| 154.1 | 17       |
| No. | Chemical Name | Formula | Molecular Mass | MW | MS | IR |
|-----|--------------|---------|----------------|----|----|----|
| 7   | Tricycle[3.3.1.1(3,7)]decane, 1-[(hydrazinocarbonyl)amino] | tricyclo[3.3.1.1(3,7)]decane, 1-[(hydrazinocarbonyl)amino]- | 8.11 | 209.2 | 1.25 |
| 8   | 10,12-Tricosadiynoic acid, methyl ester | 10,12-Tricosadiynoic acid, methyl ester | 9.11 | 360.3 | 1.36 |
| 9   | d-ylangene (d-alpha-ylangene) | d-ylangene | 9.41 | 204.2 | 7.77 |
| 10  | 1H-Cyduprop[e]azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-1-[1aR-(1a.alpha.,7a.beta.,7b.alpha.,7b.beta.)]- | 1H-Cyduprop[e]azulene, 1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-1-[1aR-(1a.alpha.,7a.beta.,7b.alpha.,7b.beta.)]- | 9.49 | 204.2 | 0.53 |
| 11  | Eticyclidine | Eticyclidine | 9.67 | 203.2 | 23.96 |
| 12  | Caryophyllene | Caryophyllene | 9.80 | 204.2 | 0.58 |
| 13  | 1,4-Methano-1H-indene, octahydro-4-methyl-8-methylene-7-(1-methylethyl)-, 1S-(1.alpha.,3a.beta.,4.alpha.,7.alpha.,7a.beta.) | 1,4-Methano-1H-indene, octahydro-4-methyl-8-methylene-7-(1-methylethyl)-, 1S-(1.alpha.,3a.beta.,4.alpha.,7.alpha.,7a.beta.) | 9.93 | 204.2 | 10.96 |
14 Cis-5,8,11,14,17-Eicosapentaenoic acid

15 2,5-di-tert-Butylnitrobenzene

16 Benzene,1,1′-(1,1,2,2-tetramethyl-1,2-ethenediy1)bis-

17 Benzenemethanamine,α-methyl-N-(3-phenyl-2-propenylidene)-

18 3-Octadecyne

19 9,12-Octadecadiynoic acid(Z,Z)-

20 Benzene,1-chloro-3,5-difluoro-

21 Caebonicacid,methyl ester,[(E,E)-3,7,11-trimethyl-2,6,10-dodecatrien-1-yl] ester
The constituents based on the retention time are 1-(1-Adamantyl)-1-Phenylethanol with RT of 4.47, Bicyclo[2.2.1]heptan-2-ol,1,3,3-trimethyl with RT of 5.26, 7-octan-2-ol,2,6-dimethyl with RT of 5.79, Endo-borneol with RT of 5.93, 2,7-Octadiene-1,6-diol,2,6-dimethyl- with RT of 6.35, Alpha.Terpineol with RT of 6.55, Tricycle[3.3.1.1(3,7)]decane,1-[(hydrazinocarbonyl)amino]- with RT of 8.11, 10,12-Tricosadiynoic acid, methyl ester with RT of 9.11, alpha.-ylangene with RT of 9.41, 1H-Cydoprop[e]azulene,1a,2,3,5,6,7,7a,7b-octahydro-1,1,4,7-tetramethyl-, [1Ar (1a.alpha.,7a.beta.,7b.alpha.,7a.beta.)]- with RT of 9.49, Eticyclidine (RT=9.67), Caryophyllene (RT=9.80), 1,4-Methano-1H-indene, octahydro-4-methyl-8-methylene-7-(1-methylethyl)-, [1S-(1.alpha.,3a.beta.,4.alpha.,7.alpha.,7a.beta.)]- with RT of 9.93, Cis-5,8,11,14,17-Eicosapentaenoic acid with RT=10.91, 2,5-di-tert-Butyl Nitrobenzene with RT=14.38, Benzene,1,1’-(1,1,2,2-tetramethyl-1,2-ethnediyl)bis- with RT=15.29, Benzenemethanamine, alpha.-methyl-N-(3-phenyl-2-propenylidene)- with RT=15.92, 3-Octadecyne with RT=16.19, 9,12-Octadecadienoic acid(Z,Z)- with RT=16.72, Benzene,1-chloro-3,5-difluoro- with RT=23.72, Caebonic acid, methyl ester,[(E,E)-3,7,11-trimethyl-2,6,10-dodecatrien-1-yl] ester with RT=26.28. The major compounds in the extract of Allamanda voilacea leaves include Eticyclidine (23.96%), Alpha.Terpineol (17%), 1,4-Methano-1H-indene, octahydro-4-methyl-8-methylene-7-(1-methylethyl)-, [1S-(1.alpha.,3a.beta.,4.alpha.,7.alpha.,7a.beta.)] (10.96%), Endo-borneol (8.74%), alpha.-ylangene (7.77%), Benzene,1-chloro-3,5-difluoro-(7.37%), 2,5-di-tert-ButylNitrobenzene (5.46%).

The useful applications of some of these compounds have been narrated as follows. Endo-borneol is a bicyclic organic compound and a terpene derivative is found in nature. It is enantiomer commercially product used in manufacturing of Chinese traditional medicines, and essential oils. It has natural habit of insect repellent [10,11].

Terpineol is commonly used as ingredients in making of perfumes, cosmetics and flavour making industry[12]. Eticyclidine is adissociative type of anesthetic drug which creates hallucination. Caryophyllene is normally used to reduce inflammation in brain, reduces the chemicals which causes stresses[13].

Phenylethanol is a colourless liquid contains the mild fragrance of gardenia-hyacinth from the hyacinthus family. It can be used as acid catalyser and one of the key precursors for synthesis[14].

Future research is planned using other solvents as acetone, n- hexane, methanol, ethanol and the same procedure will be repeated to isolate the compounds. Then the individual constituents isolated would be studied to develop drug constituents which can be used for agro-chemical industrial product applications.
4 Conclusion

Chemical compounds were characterised from the extract of the leaves of Allamanda voilacea. The extraction process was carried out using the solvent extraction method using iso-propyl alcohol. The major compounds characterised include Eticyclidine (23.96%), Alpha.Terpineol (17%), 1,4-Methano-1H-indene,octahydro-4-methyl-8-methylene-7-(1-methylethyl)-,[1S(1.alpha.,3a.beta.,4.alpha.,7.alpha.,7a.beta.)] (10.96%), Endo-borneol (8.74%), .alpha.-ylangene (7.77%), Benzene,1-chloro-3,5-difluoro-(7.37%), 2,5-di-tert-ButylNitrobenzene (5.46%). Some of these compounds present can be used in drug and perfume industry.

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