



**GC-MS ANALYSIS OF SOME BIOACTIVE COMPONENTS
IN THE ROOT EXTRACT OF *IXORA COCCINEA* LINN**

**NORLIANA GHAZALI*, NURUL ASMA ABDULLAH,
ASIAH ABU BAKAR AND NOOR KHAIRIENA MOHAMAD**

*School of Dental Sciences, Universiti Sains Malaysia, Health Campus 16150 Kubang Kerian,
Kelantan, Malaysia*

ABSTRACT

Ixora coccinea Linn is commonly known as jungle of geranium and red ixora found throughout India. In addition, the flowers, leaves, root and stems of *Ixora coccinea* Linn are used to treat various ailments in the Indian traditional system of medicine, the Ayurveda and also in various folk medicines. In the current study, the methanolic extract of *Ixora coccinea* Linn root has been subjected to GC-MS analysis. Seventeen chemical constituents have been identified, the major chemical constituents are n-Hexadecanoic acid (7.38 %), 9-Octadecenoic acid, Methyl-ester (1.97), Phenol, 2,6-dimethoxy (1.35 %), 13-Docosenamide (1.31%), Phenol, 3,4,5-trimethoxy (1.24 %), 4, 8, 12, 16-Tetramethylheptadecan-4-olide (1.13 %).

KEYWORDS: *Ixora coccinea* Linn, phytochemicals, GC-MS analysis, n-Hexadecanoic



NORLIANA GHAZALI

School of Dental Sciences, Universiti Sains Malaysia, Health Campus
16150 Kubang Kerian, Kelantan, Malaysia

Email: noorliana@usm.my

Phone No: +6014-5358699

*Corresponding author

INTRODUCTION

In recent years, there has been increasing interest in exploring medicinal plant as alternative medicine for health care and treatment for many kinds of disease. Herbal medicines have been proved that they are safer than synthetic medicine because the phytochemical in the plant extract target the biochemical pathway. Screening of phytochemicals compound from plant has led to the development of new medicinal drug which have efficient protection and treatment roles against various disease [1]. The phytochemical screening of the root of *Ixora coccinea* Linn revealed the present of alkaloids, carbohydrates, flavanoids, triterpenoids, steroids, tannins, resins and saponin [2]. *Ixora coccinea* Linn (Rubiaceae), a small shrub cultivated throughout India, has been reported to possess a number of medicinal properties [3]. *Ixora coccinea* Linn, is a dense, multi - branched ever green shrub commonly 4-6 ft (1-2-2m) in height, but capable of reaching up to 12ft (3.6m) hight. In Malay, *Ixora coccinea* Linn is known as 'pokok Tudung Periuk'. Previous studies revealed that *Ixora coccinea* Linn was traditionally founds to be useful for many ailments like hepatoprotective, chemoprotective, antimicrobial, antioxidant, antinociceptive and anti-inflammatory activities [4]. In addition, *Ixora coccinea* Linn is claimed to be useful in treatment of toothache and oral diseases and is being used as a mounthwash in Myanmar [5]. The root of the *Ixora coccinea* Linn has been utilized for nausea, hiccups, anorexia, stomachic, sores, diarrhea, fever and chronic ulcer [2, 6]. Previous studies have reported that *Ixora coccinea* Linn contains 9, 12-Octadecadienoic acid, Di-n-octyl phthalate, β -Amyrin, Kaempferol-7-o glucoside, Kaempferitrin, Quercitrin, Squalene and 3,7,11,15- Tetramethyl 2 hexadecen-1-ol [7, 8]. To authors' knowledge, limited studies have been done about the bioactive compound and their biology activity of the root of *Ixora coccinea* Linn. Hence the present study was aimed to evaluate the chemical constituents in the methanol extract of the root of *Ixora coccinea* Linn.

MATERIALS AND METHODS

Preparation of extract

The test material in this study was the root of *Ixora coccinea* Linn. This root was collected and dried in oven at 42°C. The dried root was grinded and 3g of grinded root was mixed with 30 ml of 50% Methanolic. Then the mixture was incubated at 37°C on horizontal shaker overnight. After that the mixture was filtered using filter paper and filter funnel. The filtrate was concentrated using rotary evaporator at 60°C. The methanolic extract of the plant was used for GC-MS analysis.

GC-MS analysis

GC-MS analysis of the ethanol extract of *Ixora coccinea* Linn was performed using a Hewlett Packard 5890 series Gas Chromatograph with 5973N Mass Selective Detector equipped with a Elite-5MS (5% Diphenyl / 95% Dimethyl Poly Silixane) Fused capillary column (30 x 0.25 μ m ID x 0.25 μ m Df). 70 Ev electron was used for ionization in GC-MS analysis . Helium was used as the carrier gas at a flow rate of 1.0 ml/min. The samples were analyzed with initial oven temperature at 50°C for 2 min, rising at 20°C/min to 280°C and later then, held for 10 minutes. The injection was performed the in split less mode and the injection port temperature was 250°C. Data acquisition was carried out in the MS scan mode (range 40-650m/z).

Identification of the components

Interpretation of mass spectrum of GC-MS was done using the database of National Institute Standard and Technology and, Wiley Registry of Mass Spectral Data's, New York (Wiley). The chemical compounds were identified by comparing the mass spectrum which stored in the NIST and WILEY. In addition, the information of the component of the test materials such as retention time, name, molecular weight and structure were obtained in this analysis.

RESULTS AND DISCUSSION

The the current study, GC-MS analysis revealed seventeen compounds in Methanolic extract of *Ixora coccinea* Linn root. The chromatogram in figure 1 indicated that the presence of bioactive constituents of *Ixora coccinea* Linn root extract. The seventeen phytoconstituents were characterized and identified based on the mass spectra of the constituents with the NIST and WILEY library. The active compounds in the root extract of *Ixora coccinea* Linn were presented with their retention time [9], molecular Formula, Molecular Weight (MW), and concentration (Peak area %) in Table 1. Various

phytochemicals which contributes to the medical activity were presented in Table 2. Six major phytochemical constituents' mass spectra were presented in Figure 2 to Figure 7. They were identified as n-Hexadecanoic acid (7.38 %), 9-Octadecenoic acid, Methyl-ester (1.97), Phenol, 2,6-dimethoxy (1.35 %), 13-Docosenamide (1.31%), Phenol, 3,4,5-trimethoxy (1.24 %), 4, 8, 12, 16-Tetramethylheptadecan-4-olide (1.13 %). The most interesting finding in this GC-MS analysis was the present of four types of chemical compound in the Sterol group. Previous animal studies were demonstrated that the plant which contain sterol group have anti-inflammatory activities [10, 11]

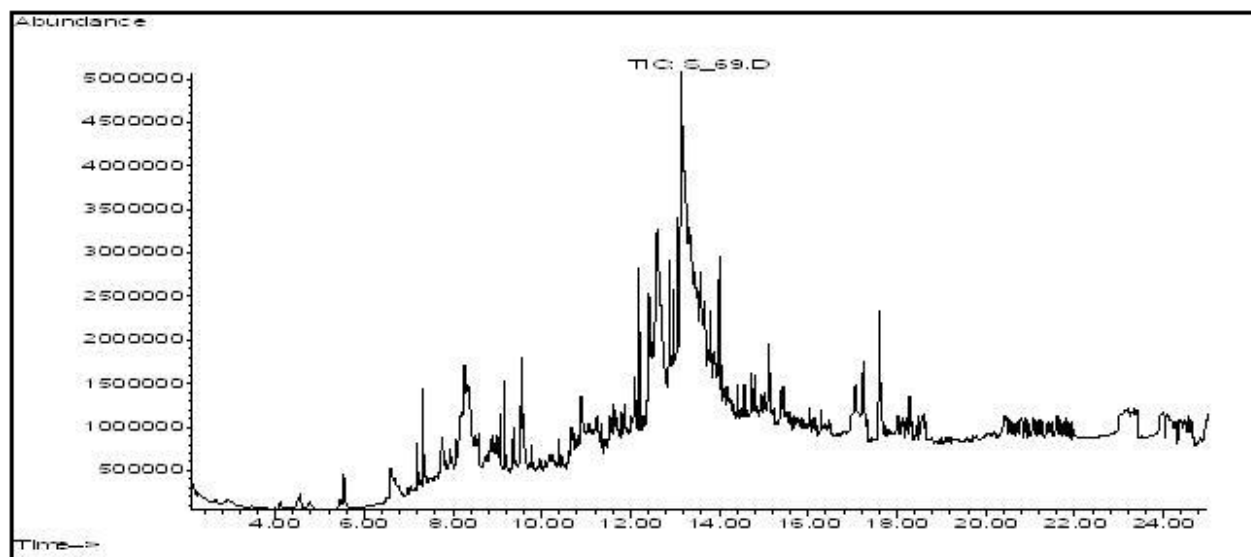


Figure 1
GC-MS chromatogram of methanolic extract of the *Ixora coccinea* Linn root

Table 1
Phyto-components identified in the methanolic extract of the root of *Ixora coccinea*

No	RT	Name of the compound	Molecular Formula	MW	Peak Area (%)
1.	4.117	2-heptanone	C ₇ H ₁₄ O	114	0.23
2.	6.596	2-pentylfuran	C ₉ H ₁₀ O	138	0.24
3.	9.551	2,6-dimethoxyphenol	C ₈ H ₁₀ O ₃	154	1.35
4.	10.895	3,4,5-trimethoxyphenyl	C ₉ H ₁₂ O ₄	184	1.24
5.	11.785	Methyl-9-Methyltetradecanoate	C ₁₆ H ₃₂ O ₂	256	0.29
6.	12.604	n-Hexadecanoic acid	C ₁₆ H ₃₂ O ₂	256	7.38
7.	12.877	9-Octadecenoic acid, Methyl-ester	C ₁₉ H ₃₄ O ₂	296	1.97
8.	12.968	n-Octadecanoic acid, methyl ester	C ₁₉ H ₃₈ O ₂	294	0.96
9.	13.801	4, 8, 12, 16-Tetramethylheptadecan-4-olide	C ₂₁ H ₄₀ O ₂	324	1.13
10.	14.627	Tricosanoic acid, Methyl Ester	C ₂₄ H ₄₈ O ₂	368	0.41
11.	14.929	Tetracosanoic acid, Methyl Ester	C ₂₅ H ₅₀ O ₂	382	0.49
12.	15.118	13-Docosenamide	C ₂₂ H ₄₃ NO	337	1.31
13.	15.327	Squalene	C ₃₀ H ₅₀	410	0.46
14.	17.61	7,8-Dimethyltolcol	C ₂₈ H ₄₈ O ₂	416	0.30
15.	17.064	24 α -Methylcholesterol	C ₂₈ H ₄₈ O	400	0.70
16.	17.246	5,22-Cholestadien-24-ethyl-3 β -ol	C ₂₉ H ₄₈ O	412	0.73
17.	17.61	22,23-Dihydroporiferasterol	C ₂₉ H ₅₀ O	414	0.99

Table 2
Activity of Phyto-components identified in the methanolic extract of the root of *Ixora coccinea* Linn

No	Name of the compound	Compound Nature	Activity
1.	2-heptanone	Aldehyde compound	No activity report
2.	2-pentylfuran	Phenolic compound	No activity report
3.	2,6-dimethoxyphenol	Phenolic compound	No activity report
4.	3,4,5-trimethoxyphenyl	Phenolic compound	No activity report
5.	Methyl-9-Methyltetradecanoate	Myristic acid	No activity report
6.	n-Hexadecanoic acid	Palmitic acid	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Lubricant, Antiandrogenic, Flavor, Hemolytic 5-Alpha reductase inhibitor
7.	9-Octadecenoic acid, Methyl-ester	Oleic acid	Anti-inflammatory Hypocholesterolemic Cancer preventive, Hepatoprotective Nematicide, Insectifuge Antihistaminic, Antieczemic, Antiacne, 5-Alpha reductase inhibitor, Antiandrogenic Antiarthritic Anticoronary, Insectifuge
8.	n-Octadecanoic acid, methyl ester	Stearic acid	Cosmetic, Flavor, Hypocholesterolemic, Lubricant, Perfumery, Propepic, Suppository
9.	4, 8, 12, 16-Tetramethylheptadecan-4-olide	Isoprenoid	No report activity
10.	Tricosanoic acid, Methyl Ester	Ester compound	No activity report
11.	Tetracosanoic acid, Methyl Ester	Ester compound	No activity report
12.	13-Docosenamide	Amide compound	Antimicrobial
13.	Squalene	Triterpene	Antibacterial, Antioxidant, Antitumor, Cancer, preventive, Immunostimulant, Chemo preventive, Lipoxygenase-inhibitor, Pesticide, Diuretic
14.	7,8-Dimethyltolcol	Sterols	Antiasthma, Antiinflammatory Diuretic Anticancer, Antiarthritic
15.	24 α -Methylcholesterol	Sterols	Antiasthma, Antiinflammatory Diuretic Anticancer, Antiarthritic
16.	5,22-Cholestadien-24-ethyl-3 β -ol	Sterols	Antiasthma, Antiinflammatory Diuretic Anticancer, Antiarthritic
17.	22,23-Dihydroporiferasterol	Sterols	Antiasthma, Antiinflammatory Diuretic Anticancer, Antiarthritic

***Source: Dr Duke's phytochemical and ethnobotanical database (Online database)

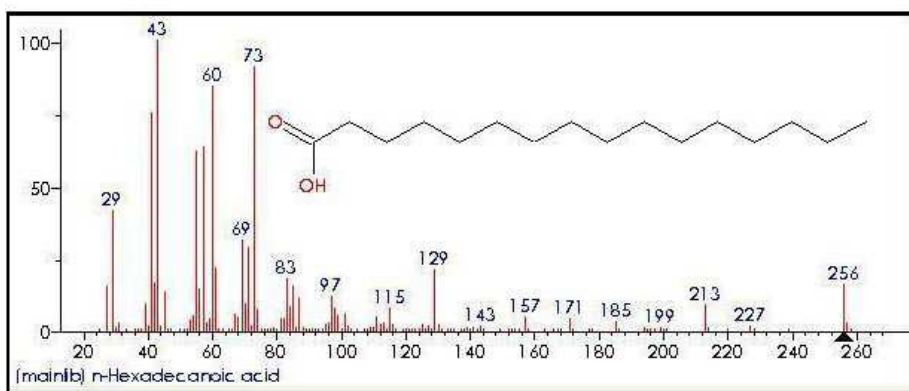


Figure 2
Mass spectrum of n-hexadecanoic (RT: 12.604)

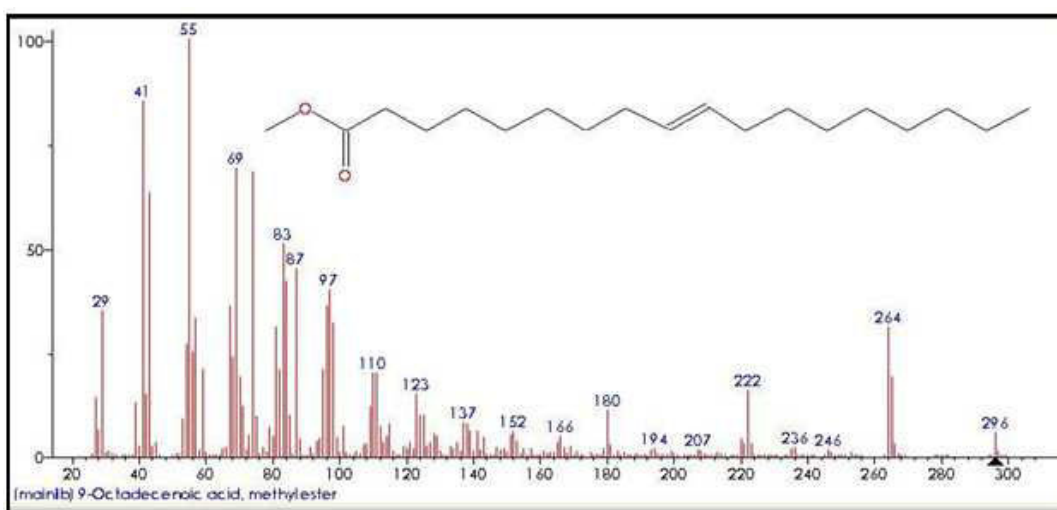


Figure 3
Mass spectrum of 9-Octadecenoic acid, Methyl-ester (RT: 12.877)

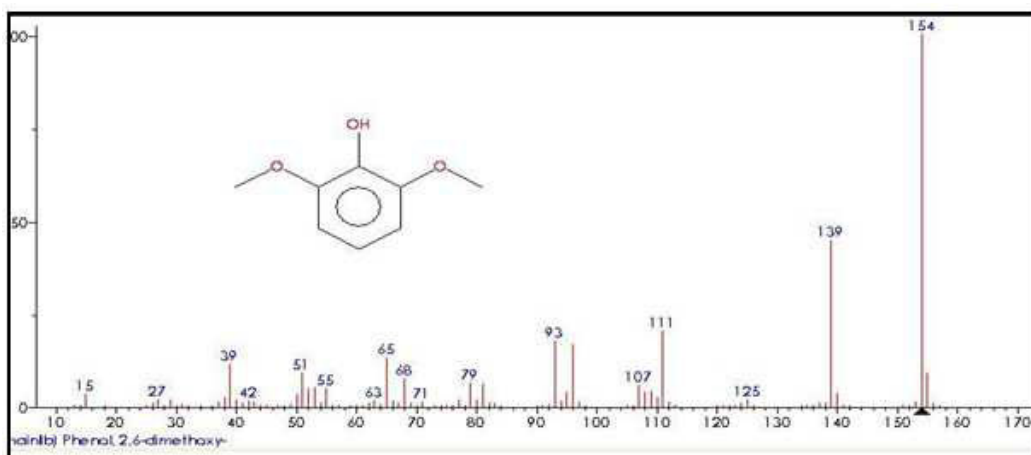


Figure 4
Mass spectrum of Phenol, 2,6-dimethoxy (RT: 9.551)

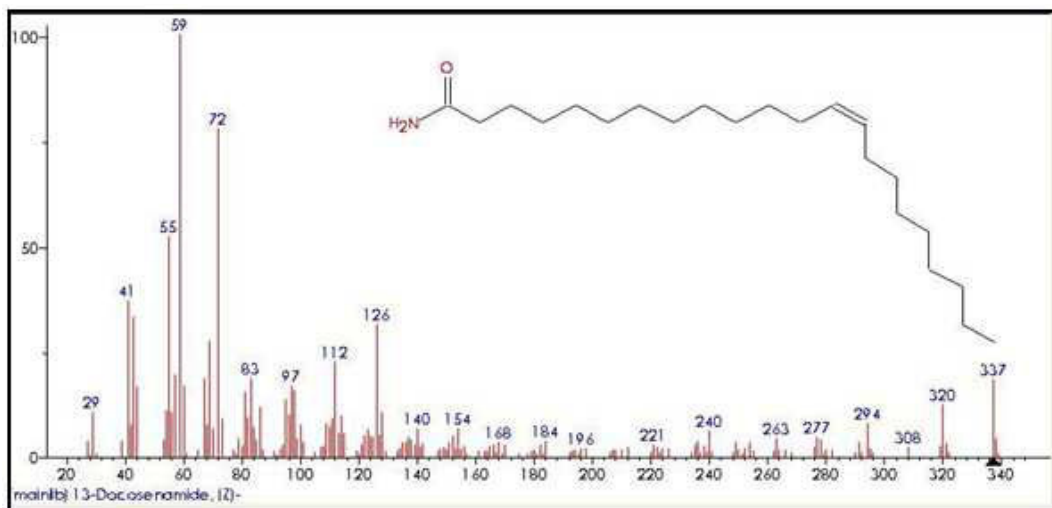


Figure 5
Mass spectrum of 13-Docosenamide (RT: 15.118)

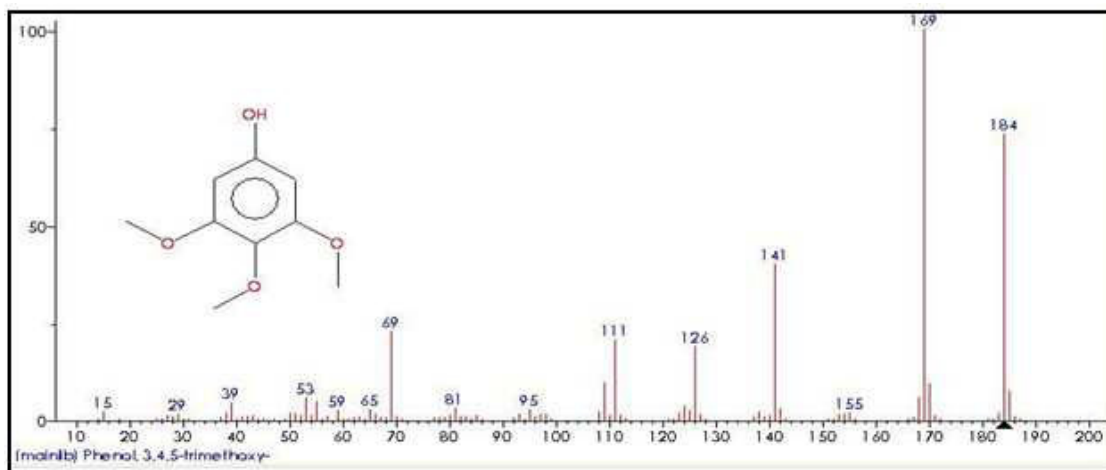


Figure 6
Mass spectrum of Phenol, 3,4,5-trimethoxy (RT: 10.895)

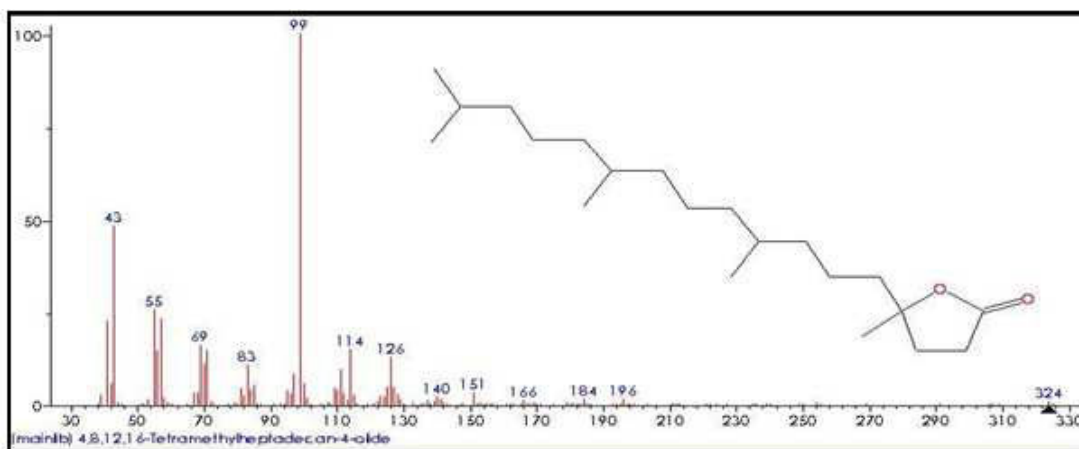


Figure 7
Mass spectrum of 4, 8, 12, 16-Tetramethylheptadecan-4-olide (RT: 13.801)

CONCLUSION

In this study, seventeen chemical constituents have been identified from the methanolic extract of the root of *Ixora coccinea* Linn by Gas chromatogram Mass spectrometry (GC-MS) analysis. The presence of various bioactive confirms the application of the root of *Ixora coccinea* Linn for various ailments by traditional practitioners. Further research is needed to determine the antibacterial, anti-toxicity and anti-inflammatory effect of this root extract.

REFERENCES

1. Sheeja K, Kuttan G: Activation of cytotoxic T lymphocyte responses and attenuation of tumor growth in vivo by *Andrographis paniculata* extract and andrographolide. *Immunopharmacology and immunotoxicology* 2007, 29(1):81-93.
2. Joshi AB, Surlikar PM, Bhohe M: Physicochemical and phytochemical investigation of the roots of *Ixora Coccinea* linn.
3. Maniyar Y, Bhixavatimath P, Agashikar N: Antidiarrheal activity of flowers of *Ixora Coccinea* Linn. in rats. *Journal of Ayurveda and integrative medicine*, 1(4):287.
4. Vadivu R, Jayshree N, Kasthuri C, Rubhini K, Rukmankathan G: Pharmacognostical standardization of leaves of *Ixora coccinea* Linn. *J Pharm Sci Res*, 2:164-170.
5. Than MA, Oo MW, Hla TH, Than A, Tut T, Lwin MT: Anti-inflammatory and anti-plaque activity of Ponna yeik (*Ixora coccinea* Linn.) leaves extract used as a mouthwash on chronic gingivitis patients. *Myanmar Health Sciences Research Journal* 2009, 21(1):26-31.
6. Elumalai A, Eswaraiah C, Venkatesh Y, Narendar C: Phytochemical and pharmacological profile Of *Ixora coccinea* Linn. *International Journal of Pharmacy & Life Sciences*, 3(3).
7. Joshi A, Surlikar P, Bhohe M: *ixora coccinea* linn: phytochemical investigation.
8. P.K.SURESH* PSA: Comparative Analysis Of Three Leaf Extracts Of *Ixora coccinea* Linn. for Their Protective and Anti- Oxidant Potentials and Correlation with Analytical Data *International Journal of Pharma and Bio Sciences* 2013, 4(4):937 - 949
9. Morandini ACdF, Sipert CR, Ramos-Junior ES, Brozoski DT, Santos CF: Periodontal ligament and gingival fibroblasts participate in the production of TGF- β^2 , interleukin (IL)-8 and IL-10. *Brazilian oral research*, 25(2):157-162.
10. Choi JH, Hwang YP, Lee HS, Jeong HG: Inhibitory effect of *Platycodi Radix* on ovalbumin-induced airway inflammation in a murine model of asthma. *Food and chemical toxicology* 2009, 47(6):1272-1279.
11. Othman RA, Moghadasian MH: Beyond cholesterol—lowering effects of plant sterols: clinical and experimental evidence of anti-inflammatory properties. *Nutrition reviews*, 69(7):371-382.

Gas chromatography and mass spectrometry (GC-MS) are highly compatible technique in separation of volatile compound and identifying characteristic of the compound.

ACKNOWLEDGEMENT

The authors are grateful for USM Short Term grant (304/PPSG/61312067) for funding of this research and also to the School of Dental Sciences, USM for providing the facilities and instruments.