powdered leaf samples were subjected to successive extraction with acetone using Soxhlet Extractor. Fresh leaf material was ground using distilled water and filtered and used as an aqueous extract. The extracts obtained using solvents were concentrated using rotary vacuum evaporator, the extract thus obtained was preserved for the usage of various analysis[12].

Antibacterial Screening

Nutrient broth had been used for *Staphylococcus aureus* and *Psuedomonas aeruginosa*, Lactose broth medium for *Klebsiella pneumonia.* These microbes were sub-cultured and used for the antibacterial activity. Acetone and aqueous extract was investigated with agar well-diffusion method**.** An in-vitro antimicrobial screening was carried out using Muller Hinton Agar (MHA) by Agar well -diffusion method according to Perez et al., 1990[13]. The petriplates were allowed to stand for one hour for pre-diffusion of the extract into the medium[14].

Antifungal screening

The agar diffusion method[15] was employed to test the organism. *Candida albicans was* inoculated into test tubes containing Rose Bengal broth and *Aspergillus niger* was in potato dextrose broth incubated at room temperature for 72 hours. The organisms were sub-cultured into Rose Bengal agar and potato dextrose agar by the pour plate method. A sterile cork borer (6mm) was used to bore holes in the culture media and the bases of the wells were sealed with a drop of molten agar to prevent unwanted spreading of the extracts. In a drop-wise manner, 1ml of the extract was added into each of the well and the cultures were allowed to stand for 30 minutes before incubation at room temperature for 48 hours. Thereafter active growth zone of inhibition were measured with the aid of a Kirby Bauer Meter rule considering the diameter of the cork borer, control plate was also prepared for each test organism.

FT-IR analysis

Fourier Transform Infrared Spectrometer (Make Perkin Elmer, Mode Spectrum RXI 2012) study was carried out in Archbishop Casmir Instrumentation Centre (ACIC), St.Joseph's College, Trichy, Tamilnadu, India to identify the functional groups present in *Cymbopogon citratus* with the adsorbents of 4000-400 cm^{-1} range. The adsorption capacity of adsorbent depends upon the porosity as well as chemical reactivity of functional groups at the adsorbent surface[16].

High Performance Liquid Chromatography

Chromatographic separation was performed by set up of High Performance Liquid Chromatography (HPLC) system, equipped with Pump-Lc-8A, Column - C 18, variable wavelength detector- SPD 20A at a flow rate of 2.0 ml/min & detector wavelength of 254 nm. The injection volumn was 1.0 µL and the run time was 14 min for each injection[17].

3. Results

Results of the antimicrobial activity of *Cymbopogon citratus* portrayed the growth inhibition effect of acetone and aqueous extract of Lemon grass leaves tested on gram positive bacteria - *Staphylococcus aureus* gram negative bacteria- *Psuedomonas aeruginosa*, *Klebsiella pneumonia and Escherichia coli* were detected. *Staphylococcus aureus* has 14mm,11mm, *Klebsiella pneumonia* has 12mm, 11mm, *Escherichia coli* has 13mm,10mm and *Psuedomonas aeruginosa* did not show any inhibitory effect, among this *Staphylococcus aureus* has high inhibitory to compare with other organisms.While experimenting with fungal species such as *Candida albicans* has 8mm, 7mm,*Aspergillus niger* has very low inhibitory effect described in Table 2. Identified the phytochemicals such as alkaloids, flavonoid, tannin, carbohydrate, saponin, glycoside, protein, amino acid and phenol respectively, among this tannin and phenol is richly present. Functional groups were illustrated as -C-H Alkanes (stretch), -O-H Alcohol and Phenols (stretch), -O-H Carboxylic acid (stretch), -C=C- Aromatic (stretch), -C≡C-H, Alkynes (stretch), C-N Amines (stretch), -C-H Alkanes (stretch), C-H Aromatic (Out of plane bending), C-O Ether group (stretch) shown in Table.1 and Figure.1.

HPLC analyzed the quantity of compounds present in *Cymbopogon citratus* and reviewed the peak area percentage of Resorcinol (75%) and Ellagic acid (25%) in the retention time of 3.117 and 4.569 depicted in Table 3 and Figure2.

Table 1: Systematic Organic analysis for Functional Group Identification –FT-IR

S.No	*Frequency*	*Wave Length*	*Functional Groups*	*Bonds*
1	2800-3000	2820.77 2922.63	Alkane (Stretch)	-C-H
2	3200-3500	3259.85 3403.56 3468.87	Alcohol Phenol (Stretch)	-O-H
3	2500-3300	2737.39 2820.77 2922.63 3959.85	Carboxylic Acid (Stretch)	-O-H
4	1500-2600	1595.12	Aromatic (Stretch)	-C=C-
5	2100-2270	2154.49	Alkynes (Stretch)	-C≡C-H
6	1385-1370	1383.23	Alkanes (Stretch)	-C-H
7	1260-1000	1107.32	Ether (Strech)	C-O
8	500-900	668.78 768.03	Aromatic (Out of Plane Bending)	C-H

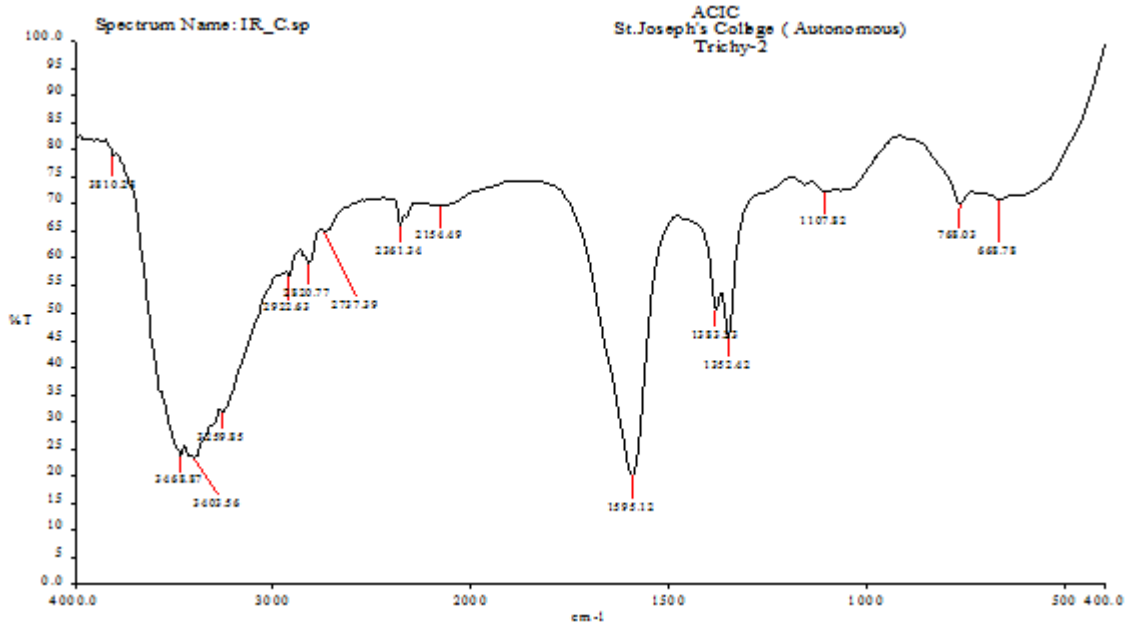

Figure 1: FT-IR Spectrum *Cymbopogon citrates*

Table 2: Antibacterial and Antifungal Screening of *Cymbopogon citratus* extracts against Micro Organisms --U @C:\HPLC\DATAS\--U.lcd

Test organisms	Antibacterial activity		Antifungal activity	
	Acetone extract (mm)	Aqueous extract (mm)	Acetone extract (mm)	Aqueous extract (mm)
Staphylococcus aureus	14	11	-	-
Psuedomonas aeruginosa	Nil	Nil	-	-
Klebsiella pneumonia	12	11	-	-
Escherichia coli	13	10	-	-
Candida albicans	-	-	8	7
Aspergillus niger	-	-	6	Nil

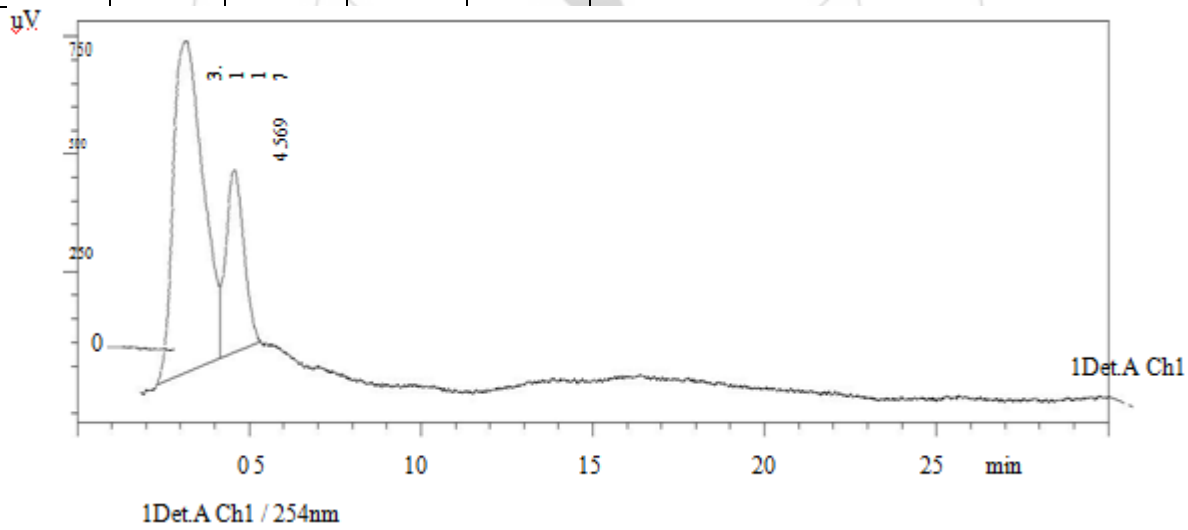

Figure 2: HPLC Chromatogram of *Cymbopogon citrates*

Table 3: Compounds of *Cymbopogon citratus* – HPLC

Peak	Compound name	Ret. Time	Area	Height	Area%	Height %
1	Resorcinol	3.117	42634	705	75.089	64.530
2	Ellagic acid	4.569	14144	388	24.911	35.470
			56778	1093	100.000	100.000

4. Discussion

Medicinal plants are very important to human beings in preserving our health. There is a growing interest in the pharmacological evaluation of various plants used in Indian traditional system of medicine. All the extracts were acidic in nature (pH values ranging between 3-5). The acidity combined with bioactive components might enhance the antimicrobial activity of the extracts especially against the bacteria. Qualitative phytochemical investigation revealed that the extracts contained some phytoconstituents such as saponins, tannins, alkaloids and flavonoids are present in the acetone extracts; alkaloids and flavonoids in aqueous extracts. These bioactive components, beside other water soluble components which are naturally occurring in most plant materials, are known to be bactericidal or bacteriostatic, fungicidal or funfistatic in nature thus conferring the anti-microbial property to plants[18, 19, 20]. Lemongrass has great interest due to its commercially

valuable essential oils and widely used in food technology as well as in traditional medicine. Owing to the new attraction for natural products obtained from lemon grass a proper photochemical and pharmacological study is required, which shall opens new pharmacological avenues for this magnificent plant which are helpful for clinical experimentation and also in the development of novel drugs.

5. Conclusion

Ultimately, this study states about various activity of *Cymbopogon citratus* such as determining the phytocompounds, identifying the functional groups, evaluating the antimicrobial activity and analyzing the compounds of *Cymbopogon citratus* depicted more medicinal, pharmaceutical, antibacterial and antifungal properties. Therefore it has hall mark and boulevard to the growing society.

References

[1] Akhila A (2010). Essential Oil-bearing Grasses: The genus *Cymbopogon*. Medical and aromatic plants-industrial profile. Taylor and Francis Group, L.L.C.
[2] Sugumaran M, Joseph S, Lee KLW, Wong KW (2005). Herbs of Malaysia. Shah Alam: Federal Publication.
[3] Jaganath IB, Ng LT (2000). Herbs: The garden pharmacy of Malaysia. Malaysia: MARDI.
[4] WHO (World Health organization), 1979.The selection of essential drugs.Second report of the WHO Expert Committee. WHO Technical Report Series, 641: 1-44.
[5] Linares S, Gonzalez N, Gómez E, Usubillaga A, Darghan E, (2005). Effect of the fertilization, plant density and time of cutting on yield and quality of the essential oil of *Cymbopogon citrates* Stapf. Revist de la Facultad de AgronĆa LUZ. 22: 247-260.
[6] Schaneberg BT, Khan IA (2002). Comparison of extraction methods for marker compounds in the essential oil of lemongrass by GC. J. Agric. Food Chem. 50: 1345-1349.
[7] Carlson LHC, Machado RAF, Spricigo CB, Pereira LK, Bolzan A (2001). Extraction of lemongrass essential oil with dense carbon dioxide. J. Supercritical Fluids. 21: 33-39.
[8] Mitscher, L.A., S. Drake, S.R. Goliapudi and S.K. Okwute, 1981. A modern look at folkloric use of anti-infective agents. *Journal of Natural Products*, 50: 1025-1040.
[9] Deans, S.G. and K.P. Suboda, 1990. Biotecnology and Bioactivity of culinary and medicinal plants. Ag Biotech News and Information, 2: 211-216.
[10] Mc Mahon J.B, Currens M.J, Gulakowski R.J, Buckheit R.W.J, Lackman-Smith C, Hallock Y.F, Boyd M.R., Michellamine B, 1995, a novel plant alkaloid, inhibits human immunodeficiency virus-induced all killing by at least two distinct mechanisms. *Antimicrobial Agents Chemotherapy*, 39,484-488.
[11] Noble R.I., 1990, The discovery of Vinca alkaloids chemotherapeutic agents against cancer. *Biochem. Cell. Biol.*, 68(12): 1544 – 1551
[12] Ojo OO, Kabutu FR, Bello M. Babayo, 2006 Inhibition of paracetamol-induced oxidative stress in rats by extracts oflemongrass (*Cymbropogoncitratus*) and green tea (*Camellia sinensis*) in rats. African Journal of Biotechnology 2006; 5(12):1227-1232.
[13] Uzama, D. (2009) Phytochemical screening and antibacterial activity of garlic (Allium sativum L.) extracts. *Env. Sci. J. Trop*; 6(4): 158 – 161.
[14] Hassan M.M., Oyewale A.O., Amupitan,J.O., Abdullahi M.S. and Okonkwo, E.M.(2005) Preliminary phytochemical and antibacterial investigation of crude extracts of the root bark of *Detarium microcarpum*, *J. Chem. Soc. Nig.;* 29(1):26 – 29.
[15] Boyanova, L., G. Gergova, R. Nikolov, S. DerejianE. Lazarova, N. Katsarov, I. Mitov and Z. Krastev, 2005. Activity of Bulgarian propolis against 94 Helicobacter pylori strains *in vitro* by agar-well diffusion. *Journal of Medical Biology*, 5: 481-483.
[16] Perez, C., Paul, M. and Bazerque, P. 1990 An antibiotic assay by the agar well diffusion method. *Acta. Bio. Med. Exp*.; 15(2); 113 -115.
[17] Esimone, C.O., Adiku, M.U. and Okonta, J.M. 1998. Preliminary antimicrobial screening of the Ethanolic extract from the the Lichen *Usnea Subfloridan*(L). J. Pharmaceutic Res. Dev.; 3(2): 99-102.
[18] Babayi, H, I. Kolo, J. I., Okogun & Ijah, U.J.J. (2004). The antimicrobial activities of methanolic extracts of *Eucalyptus camadulensis* and *Terminalia catapa* against some pathogenic microorganisms. *Journal of Biochemistry*, 16: 106-111.
[19] Kumar P.S, Ramalingam S, Senthamarai C, Niranjanaa M, Vijayalakshmi .P, Sivanesan .S (2010) Adsorption of dye from aqueous solution by Cashewnut shell: Studies on equilibrium isotherm, kinetics and thermodynamics of interactions. Desalination, 261:52-60.
[20] Rosalinda c. Torres, (1992) citral from (D C) Stapf (lemongrass) oil *Cymbopogon citratus*
[21] Eloff, J. N. (1998). Which extract should be used for the screening and isolation of antimicrobial compounds from plants. *J. Ethnopharm*. 60:1-3
[22] Majorie, M. C. (1999). Plant products as antimicrobial agents. *Clin. Microbiol. Rev. 12(4): 564-582.*
[23] Rios, J. L. and Recio, M.C. (2005). Medicinal plants and antimicrobial activity. *J. Ethnopharm*. 100: 80-84.