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SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF SOME CHALCONES

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ABSTRACT

Two Chalcones were synthesized by condensing parachloroacetophenone with benzaldehyde derivatives in dilute ethanolic sodium hydroxide solution at room temperature according to Claisen- Schmidt condensation. All these compounds were characterized by means of elemental analysis, IR, ^1H NMR spectroscopic data. The antimicrobial activity of these compounds was evaluated by the Agar well diffusion method.

Key words: *Chalcones, Synthesis, Antimicrobial activity.*

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INTRODUCTION

Chalcones are a group of compounds with various substitution patterns on the two aromatic rings of 1, 3-diphenyl-2-propen-1-one. They constitute an important class of natural products belonging to the flavonoid family and are well known intermediates for synthesizing various heterocyclic compounds. These are used to synthesize several derivatives like cyanopyrididines, pyrazolines, isoxazoles and pyrimidines having different heterocyclic ring systems[1-3] .These derivatives show non-linear optical (NLO) properties with excellent blue light transmittance and good crystallizability[4].

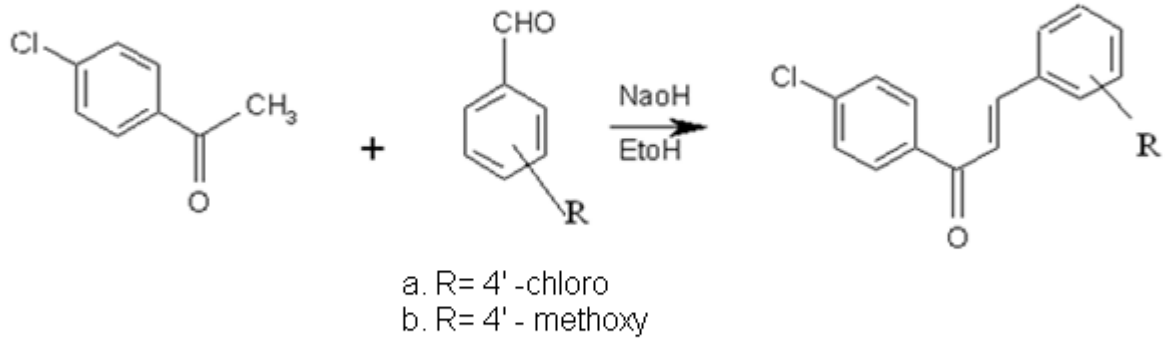
The compounds with the backbone of chalcones have been reported to possess various biological activities such as antimicrobial [5-7], anti-inflammatory[8], antimalarial [9,10], antileishmanial[11] , antioxidant [12], antitubercular [13,14]. The presence of a reactive α, β- unsatutated carbonyl system of chalcones makes it biologically active[15]. So the endeavour of the present work is prepare chalcones using the reactions of parachloroacetophenone with different aromatic aldehydes in the presence of dilute ethanolic sodium hydroxide (50%) solution at room temperature characterizing the resulting products using elemental analysis, IR and ^1H NMR spectral

studies and further screening the compounds for their antimicrobial activity.

MATERIALS AND METHODS

All the products were synthesized and characterized by their spectral analysis. The chemicals, 4-chloroacetophenone, 4'-chlorobenzaldehyde, 4'-methoxybenzaldehyde, sodiumhydroxide, hydrochloric acid, and ethanol were purchased from either E- Merk or Qualigens (AR quality) reagents, pure distilled solvents were used throughout the work. Ethanol (Bengal, B.P, 78^0 C) was refluxed with calcium oxide for 6 hours and allowed to stand overnight. Later, it was distilled and distillate was fractionated over sodium ethoxide. Melting points were determined in an open capillary tube and are uncorrected. IR spectra were recorded in KBr on a JASCO FT/IR-5300. ^{1}H NMR spectra were recorded on Brucker spectrometer at 300MHz in CdCl3, (900W).

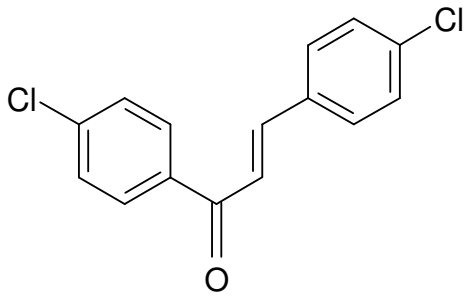
Elemental analysis was carried out on a Flash Ea 1112 Series Chn Report Thermo Finnigan. Chalcones were synthesized by Clasien- Schmidt condensation[16] using Ethanol as reaction solvent. The chemicals and solvents used were of laboratory grade and were purified. Completion of the reaction was monitored by thin layer chromatography (TLC) on pre-coated sheets of silica gel-G (Merck, Germany) using iodine vapour for detection. Column chromatography was performed on silica gel (Merck, 60-120 mesh). The synthetic pathway is presented in Scheme 1 and physicochemical data and spectroscopic data for the synthesized compounds are given Table 1 and Table 2.



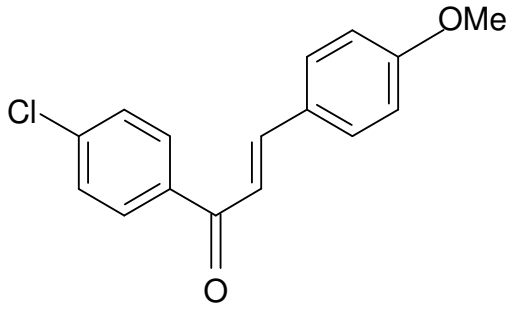
Scheme1: Synthetic diagram of 4-chloro substituted Chalcones

1. Synthesis of 4, 4'- dichloro chalcone

An equimolar mixture of 2.2gm (1.8ml, 0.0125 moles) p-chloroacetophenone and 1.9gm (0.0125 moles) p-chlorobenzaldehyde are dissolved in ethanol in 150 ml conical flask. The mixture was stirred with a magnetic stirrer and 16 ml of NaOH 50% was added dropwise into it. The mixture was stirred at room temperature until it solidified. After the completion of the reaction (monitered by TLC), the crude mixture was poured into ice water and then acidified the product with 10%HCl solution in cold condition. The bright yellow coloured compound was collected on a Buckner funnel under suction pump. The solid is washed with water thoroughly and dried and recrystallised from absolute ethanol to give 4, 4'-dichlorochalcone **(1)** as light yellow solids.



(1) Synthesis of 4- chloro,4'- methoxy chalcone
Reaction with parachloroacetophenone (2.5gm) and paramethoxy benzaldehyde (2 gm); 4-chloro, 4'-methoxy chalcone **(2)** was obtained by the above described procedure.



RESULTS AND DISCUSSIONS

The Claisen-Schmidt condensation is an important C-C bond formation for the synthesis of 1, 3-diaryl-2-propen-1-ones (chalcones). It is generally carried out of the use of strong bases such as NaOH or KOH in polar solvents (MeOH or DMF). Synthesis of chalcone is a single step method. The synthesized chalcone derivatives were undergone physicochemical characterization and the obtained results are given in Table.1. The yields of the synthesized compounds were found to be significant. The structure of the synthesized compounds was confirmed by IR, Mass and elemental analysis. Elemental analysis showed that the percentage of the carbon, hydrogen, Chlorine and oxyzen was found experimentally is equivalent to the calculated values in all compounds. All the compounds give the characteristic IR and peak that proved that the presence of particular functional group (Table 2), and ^{1}H NMR helps to find the different types of protons present in the structure.

4, 4'- dichloro chalcone have the molecular formula of $C_{15}H_{10}OCl_2$. The IR band at 1649 cm^{-1} suggesting the presence of (C=O) group. The IR band at 1581 cm^{-1} indicates that the presence of (C=C) (olifinic) group. IR band at 1556 cm^{-1} & 1397 cm^{-1} indicates presence of (C=C) (aromatic) group. The IR band at 2355 cm^{-1} suggesting the presence of (C-H) group. Melting point of the compound is 148°C which is uncorrected.

The molecular formula of **4-chloro, 4'-methoxy chalcone** is $C_{16}H_{13}O_2Cl$. The IR band at 1650.8 cm^{-1} suggesting the presence of (C=O) group. The IR band at 1584.57 cm^{-1} indicates that the presence of (C=C) (olifinic) group. IR band at 1503 cm^{-1} & 1445 cm^{-1} indicates presence of (C=C) (aromatic) group. The IR band at 2379.4 cm^{-1} suggesting the presence of (C-H) group. Melting point of the compound is 117°C which is uncorrected.

Table: 1 physicochemical data of Chalcones

Comd	M.F.	Yield %	M.W	M.P 0C	ElementalAnalysis							
					C		H		Cl		O	
					% Found	% calcd	% Found	% calcd	% Found	% calcd	% Found	% calcd
1	C15H10OCl2	88	277	148	63.9	64.9	3.3	3.6	25.3	25.6	5.7	5.9
2	C16H13O2Cl	91	272.5	117	69.9	70.4	4.6	4.7	12.7	13.0	11.9	11.9

Table: 2 Spectral data of the Chalcones

S.No	Compound	IR (cm^{-1}) υ (C=O), υ (C=C), υ(C=C), υ (C-H) (Olef) (aroma)	PMR(δ ppm)
1	4,4'-di chloro chalcone	1649 1581 1556 2355 1397	8.1(d,2H,6H,J= 8.5 Hz) 7.0 (d,3H,&4H,J= 8.6 Hz) 7.55(d,2'H,&6'H,J= 8.3 Hz) 6.90 (d,3'H,&5'H,J= 8.4 Hz) 7.25(S,1H,H-α); 7.85(S,1H, H-β)
2	4-chloro, 4'-methoxy chalcone	1650.8 1584.57 1503 2379.4 1445	7.57(d, J= 8.45 Hz , 2'H&6'H) 6.89 (d, J= 8.5Hz, 3'H&5'H) 3.85(S , 3H, - OCH_3) 8.15 (d,2H,&6H, J= 8.4 Hz) 7.3 (S,1H,H-α); 7.78 (S,1H, H-β)

Table: 3 Antimicrobial data of compounds

S.no	compounds	Mean zone of inhibition (in cm)	
		Xanthomonas campestris	*Agrobacterium tumifaciens*
1	4,4'-dichloro chalcone	0.6	1.0
2	4-chloro,4'-methoxy chalcone	0.5	1.2

ANTIMICROBIAL ACTIVITY

Compounds with electron releasing groups such as hydroxyl and methoxy showed better antibacterial activity than the others not having such groups. Compounds having pharmachophores such as chloro,dichloro and fluoro groups have exhibited more antifungal activity on all the three fungi than the others. Chalcone derivatives with these substituents showing greater antimicrobial activity[17] . The synthesized compounds were screened for their in vitro Antimicrobial activity against *Xanthomonas campestris, Agrobacterium tumifaciens* according to Agar well diffusion method.The agar medium was purchased from HI media Laboratories Ltd., Mumbai, India, and reporet in Table: 3. Nutrient agar medium medium was employed as culture medium and DMSO was used as solvent control for antimicrobial activity.

CONCLUSION

The synthesized substituted chalcones were characterized by TLC, melting point, IR, ^1H NMR spectral studies and Elemental analysis. From the antimicrobial screening it was observed that all the compounds exhibited activity against all the organisms employed. The results obtained from this study confirmed that the product has formed. Hence forth viewing these characteristic properties more compounds can be synthesized and subjected to pharmacological evaluation.

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REFERENCES

1. E I. Hashah MA, E I- Kady M, Saiyed MA, Elaswy AA, Egypy. j. Chem, 27, 1985, 715.
2. Crawley LS, Fanshawe WJ, J heterocyclic Chem, 14, 1977, 531.
3. Taylor EC, Morrison RW, J.Org. Chem, *32*, 1967, 2379.
4. Utale PS, Rathuvanshi PB, Doshi AG, Asin J.chem, 10, 1988, 597.
5. Shettigar S, Chandrasekaran K, Umesh, Sarojini BK, Narayana B, Studies on non linear optical parameters of bis-chalcone derivatives doped polymer, Polymer, 47, 2006, 3565-3567.
6. Rajendraprasad Y, Lakshmanarao A, Rambabu R, Sythesis and Antimicrobial Activity of some chalcone Derivatives, E.J.Chem. 5(3):461-466.
7. Silvia N, López, María V, Castelli, Susana A, Zacchino, José N, Domínguez, Gricela Lobo, Jaime Charris-Charris, Juan C G, Cortés, Juan C, Ribas, Cristina Devia, Ana M, Rodríguez, Ricardo D, Enriz, In vitro antifungal evaluation and structure-activity relationships of a new series of chalcone derivatives and synthetic analogues, with inhibitory properties against polymers of the fungal cell wall Bioorg. Med.Chem, 9, 2001, 1999-2013.
8. Bhagyesh Baviskar, Sureshbhi Patel, Bhushan Baviskar, Khadabadi, SS, Mahendra Shiradkar, Design and Synthesis of Some Novel Chalcones as Potent Antimicrobial Agent, Asian J. Res. Chem,1 (2), 2008, 67-69.
9. Felipe Herencia, Luisa Ferrandiz M, Amalia Ubeda, Jose N, Domínguez, Jaime E, Charris, Gricela M, Lobo M, Jose Alcaraz, Synthesis and anti-inflammatory activity of chalcone derivatives, Bioorg. Med. Chem. Lett, 8, 1998, 1169-1174.
10. Xiang Wu, Prapon Wilairat, Mei-Lin Go, Anti malarial Activity of Ferrocenyl Chalcones, Bioorg Med. Chem. Lett,12 (17), 2002, 2299-2302.
11. Anu Agarwal, Kumkum Srivastava, Puri SK, Prem Chauhan MS, Synthesis of 4-pyrido-6-aryl-2-substituted amino pyrimidines as a new class of antimalarial agents, Bioorg.Med. Chem, 13, 2005, 6226-6232.
12. Todigoppula Narender, Tanvir Khaliq, Shweta. Nishi, Neena Goyal, Suman Gupta, Synthesis of chrominochalcone and evaluation of their in vitro antileishmanial activity, Bioorg. Med. Chem, 13, 2005, 6543-6550.
13. Jen-Hao Cheng, Chi-Feng Hung, Shyh-Chyun Yang, Jih-Pyang Wang, Shen-Jeu Won, Chun-Nan Lin, Synthesis And Cytotoxic, Anti-Inflammatory, And Anti-Oxidant Activities Of 2′, 5′-Dialkoxyl chalcones As Cancer Chemopreventive Agents, Bioorg.Med Chem, 16(15), 2008, 7270-7276.
14. Yuh-Meei Lin, Yasheen Zhou, Michael T, Flavin, Li-Ming Zhou, Weiguo Nie. Fa-Ching Chen, Chalcones and flavonoids as anti-Tuberculosis agents, Bioorg. Med. Chem.10, 2002, 2795-2802.
15. Sivakumar PM, Prabu Seenivasan S, Vanaja Kumar, Mukesh Doble, Synthesis, antimycobacterial activity evaluation, and QSAR studies of chalcone Derivatives, Bioorg. Med. Chem. Let, 17, 2007, 1695-1700.
16. Brians Furniss, Antony Hannaford J, Peter Smith WG, AustinrTatchell Vogel's Text Book of Practical Organic Chemistry, 5th Edition, Longman, London, 1996.
17. Rajendraprasad Y, Ravikumar P, Ramesh B, Int. J. Chem. Sci, 5(2), 2007, 542-548.

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