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SYNTHESIS AND CHARACTERIZATION OF 1-(4-CHLORO-PHENYL)-5-PHENYL-PENT-1-EN-3-ONE SUBSTITUTED CHALCONES USING ALDOL CONDENSATION BY H_2SO_4 / ETOH

S. MOHAMED RABEEK[1*], A. SAMSATHBEGUM[1], C. SUJITHA[2], V. SARATHA[2], M. SEENI MUBARAK[3]

1: Assistant Professor in Chemistry, PG and Research Department of Chemistry, Jamal Mohamed College (Autonomous), (Affiliated to Bharathidasan University) Tiruchirappalli, Tamil Nadu, India

2: Research Scholars in Chemistry, PG and Research Department of Chemistry, Jamal Mohamed College (Autonomous), (Affiliated to Bharathidasan University) Tiruchirappalli, Tamil Nadu, India

3: Associate Professor in Chemistry, PG and Research Department of Chemistry, Jamal Mohamed College (Autonomous), (Affiliated to Bharathidasan University) Tiruchirappalli, Tamil Nadu, India

***Corresponding Author: S. Mohamed Rabeek; E Mail: smrabeek@jmc.edu**

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ABSTRACT

A novel method for the synthesis of 1-(4-Chloro-phenyl)-5-phenyl-pent-1-en-3-one substituted chalcone via aldol condensation is introduced. In the presence of H_2SO_4 as a catalyst, Various substituted chalcones are synthesized by aldol condensation. The structures of the synthesized compounds were confirmed by IR, ^{1}H and ^{13}C-NMR spectroscopy.

Key words: Chalcone, Aldol condensation, IR, ^{1}H-NMR, ^{13}C-NMR

INTRODUCTION

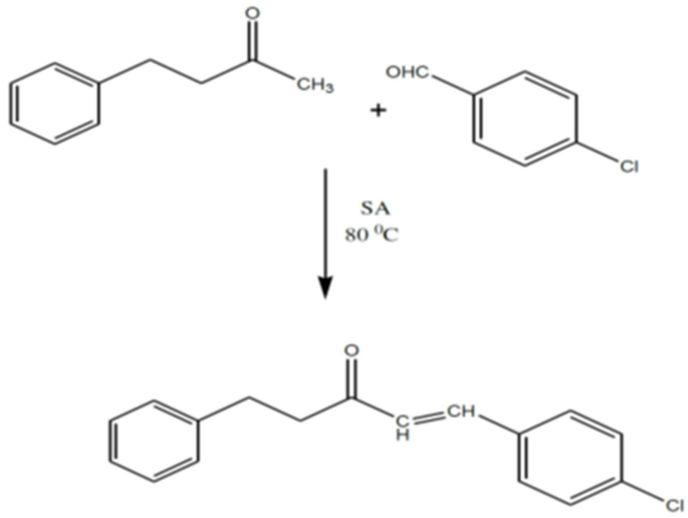
Chalcones are well known intermediates for synthesizing various heterocyclic compounds. The compounds with the backbone of chalcones have been reported to possess various antimicrobial, anti-inflammatory, analgesic, anti-platelet, anti-ulcerative, anti-malarial, anticancer, antiviral, activities. The presence of a

reactive 2,6 - unsaturated ketone function in chalcones is found to be responsible for their antimicrobial activity. Several strategies for the synthesis of these system, based on the formation of carbon-carbon bond have been reported. Among them the direct Aldol condensation still occupy prominent positions **[1]**. The main method for the synthesis of chalcones is the direct Aldol condensation in the presence of alkaline bases.

The aldol reaction is also performed under acidic medium using H_2SO_4, *p*-toluene sulfonic acid etc. Recently various modified methods for the synthesis of chalcones has been reported, such as by using $SOCl_2$, natural phosphate, lithium nitrate, zinc oxide, water, Na_2CO_3 and $ZrCl_4$ etc. Jhala *et al*. synthesized chalcone using basic alumina under micro wave irradiation. However, many of these methods suffered from harsh reaction condition, toxic reagents, strong acidic or basic conditions, prolonged reaction-times, poor yields and low selectivity. Although, several modifications have been made to counter these problems. There is still a need for the development of selective and better strategies for the synthesis of 2,6-unsaturated carbonyl compounds. However, many of these methods suffered from harsh reaction condition, toxic reagents, strong acidic or basic conditions, prolonged reaction times, poor yields and low selectivity **[2-4]**. Although, several modifications had been made to counter these problems. There is still a need for the development of selective and better strategies for the synthesis of 2,6-unsaturated carbonyl compounds.

EXPERIMENTAL SECTION

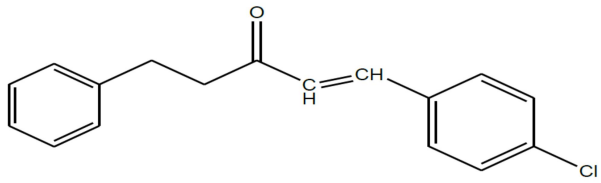
All the products were synthesized and characterized by their spectral analysis chemicals, 4-Phenyl-2-butanone (10mmol), *P*-Chlorobenzaldehyde (10mmol) were purchased from S.D. fine Chemicals (India). Melting points were uncorrected and determined in an open capillary tube. IR spectra were recorded in KBr on al JASCO FT /IR- 5300. The mass spectra were recorded on LCMS-2010 DATA REPORT SHIMADZU. Chalcones were synthesized by aldol condensation using H_2SO_4 / EtOH. The chemicals and solvents used were of laboratory grade and were purified completion of the reaction was monitored by thin layer chromatography on precoated sheets of silica gel-G (Merck, Germany) using iodine vapour for detection **[5]**. The synthetic pathway is presented in **Scheme 1** and physicochemical data and spectroscopic data for the synthesized compounds are given **Table (1-3)**.



Scheme 1: Synthetic diagram of 1-(4-Chloro-phenyl)-5-phenyl-pent-1-en-3-one substituted chalcones

Synthesis of 1-(4-Chloro-phenyl)-5-phenyl-pent-1-en-3-one

To a stirred mixed of 2, 4-hydroxyacetophenone (0.01 mol) and 2-chlorobenzaldehyde (0.01 mol) in absolute ethanol (5 ml) and Sulphuric acid (0.05ml) dropwise and continue stirring for two hours at room temperature **[6-8]**. Allow to stand reaction mixture for 12 Hr. Precipitate the reaction mixture by addition of water. Filter the product, wash with cold ethanol and allowed to afford.



RESULTS AND DISCUSSION

This paper reports a simple and effective method for the synthesis of chalocnes by an acid catalyzed aldol reaction were used H_2SO_4, as a convenient alternative to the gaseous HCl in the Aldol condensation. Chalcones are obtained in good too good to excellent yields. Our purpose was to synthesize a series of chalcones, starting from Chlorobenzaldehyde and acetophenone or their substituted derivatives using H_2SO_4/ EtOH as a catalyst **[9-11]**. Synthesis of chalcone is a single step method. The yields of the synthesized compounds were found to be significant. The structure of the

synthesized compounds was confirmed by IR, Mass analysis.

All the compounds give the characteristic IR peak that proved that the presence of particular functional group **(Table 1)** and NMR spectroscopy helps to find the carbon and hydrogen of the synthesized compounds **(Table 2)**. The Chalcone derivatives showed that the molecular ion peak that equivalent to the molecular weight of proposed compound. Hence m/z value confirms the molecular weight of the respective synthesized compound **[12]**.

The absorption band at 1725 cm^{-1} indicates the presence of C=O group and this value is nearer to the values reported in the literature for ketone **[13]**. The absorption band at3040 cm^{-1} is assigned to aromatic C-H. The absorption bands at 1481 and 1446 cm^{-1} are due to aromatic C·····C. The absorption band at 2934 cm^{-1} is assigned to aliphatic C-H. The absorption band at 753 cm^{-1} is assigned to C – Cl bond.

^{1}H-NMR & ^{13}C-NMR spectral analysis:

Figure 2 is the ^{1}H-NMR spectrum of the product molecule obtained from the crossed Aldol condensation reaction with the catalyst sulphuric acid.

The multiple at δ 7.12 – 7.30 corresponds to aromatic protons. The doublet at δ 4.17 & 4.51 is assigned to Methine protons at C1 & C2. The methylene protons at C4 are assigned the chemical shift value of 2.66 ppm. All the above spectral evidences suggest the following structure for the product **[13]**.

Figure 3 is the ^{13}C-NMR spectrum of the product molecule obtained from the crossed Aldol condensation reaction with the catalyst ionic liquid as silica sulphuric acid.

The chemical shift value at 206.6 ppm corresponds to C=O carbon. The peak at δ 136.1 – 127.7 shows the presence of aromatic carbons. The methylene carbon at C4 is attributed to the chemical shift value at 48.8 ppm **[14]**.

Table 1: FT-IR spectral data obtained for 1-(4-chloro-phenyl)-5-phenyl-pent-1-en-3-one

Functional Group	Frequency (Cm^{-1})
C-C	1481,1446
C H (aromatic)	3040
C – H (aliphatic)	2934
C = O——	1725
C – Cl	753

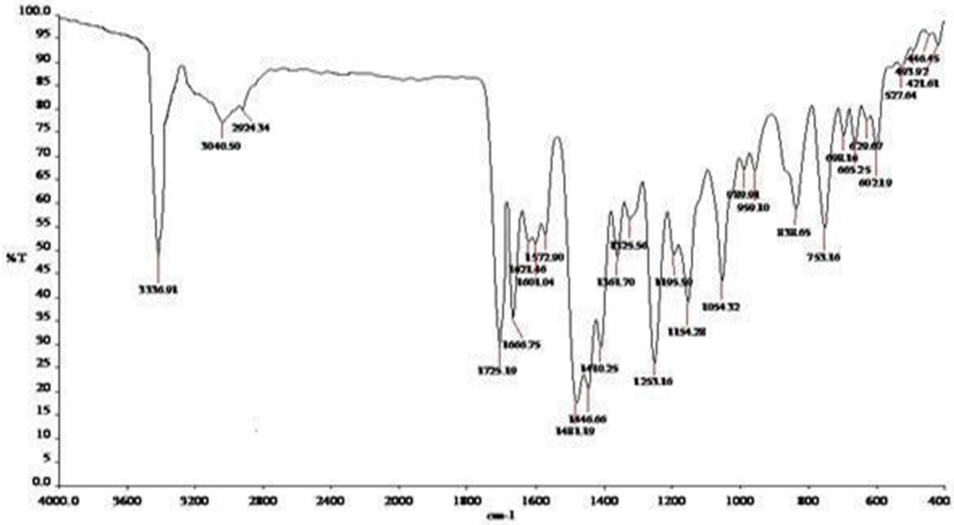


Figure 1: FT-IR spectrum for 1-(4-chloro-phenyl)-5-phenyl-pent-1-en-3-one

Table 2: ^{1}H-NMR spectrum data obtained for 1-(4-chloro-phenyl)-5-phenyl-pent-1-en-3-one

CHEMICAL SHIFT(ppm)	NATURE OF PEAK	ASSIGNMENT
2.66	Doublet	Methylene protons at C_4
4.17 & 4.51	Doublet	Methine protons at C_1 & C_2
7.12 – 7.30	Multiple	Aromatic protons

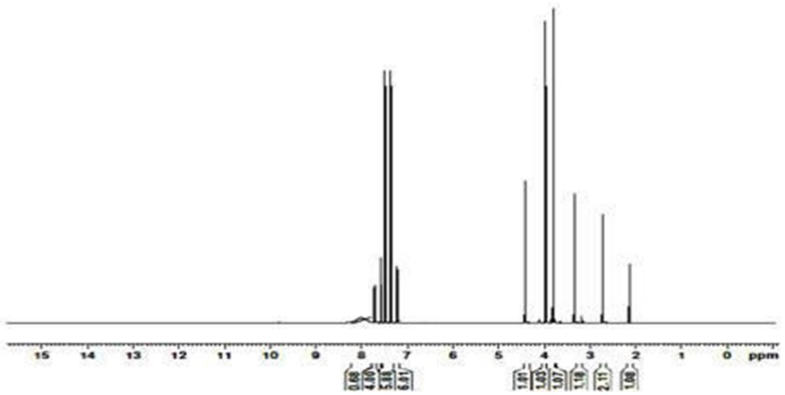


Figure 2: ^{1}H-NMR spectrum for 1-(4-chloro-phenyl)-5-phenyl-pent-1-en-3-one

Table 3: ^{13}C spectral data obtained for 1-(4-chloro-phenyl)-5-phenyl-pent-1-en-3-one

CHEMICAL SHIFT(ppm)	ASSIGNMENT
136.1 – 127.7	Aromatic carbons
48.8	Methylene carbon at C_4
206.6	C=O carbon

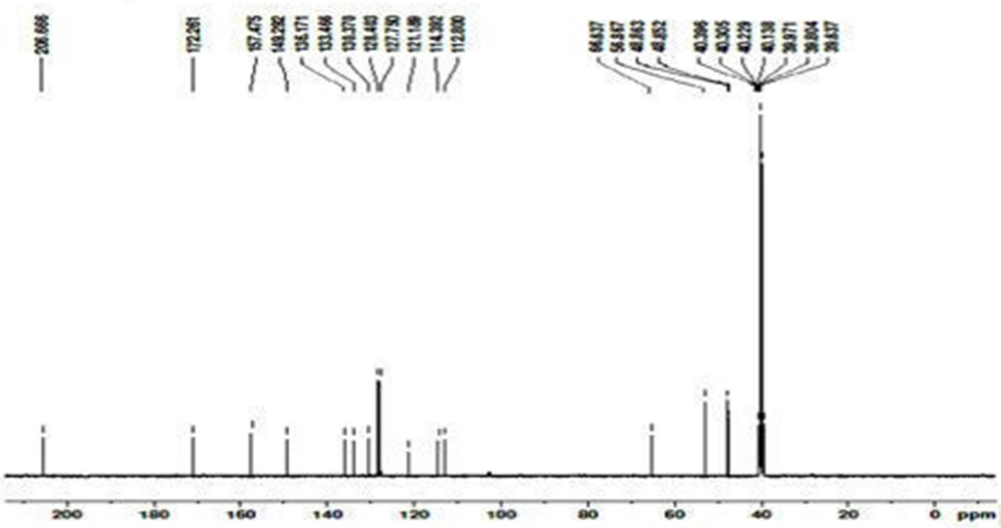


Figure 3: ^{13}C-NMR spectrum for 1-(4-chloro-phenyl)-5-phenyl-pent-1-en-3-one

CONCLUSION

In conclusion, we found that chalcones can be synthesized in good yields 2,4-hydroxy acetophenone (0.01 mol) and 2-chloro benzaldehyde (0.01 mol) in absolute ethanol (5 ml) and Sulphuric acid (0.05ml). The synthesized 1-(4-chloro-phenyl)-5-phenyl-pent-1-en-3-one compound were char IR spectroscopy and ^{1}H and ^{13}C-NMR spectroscopy. The results obtained from this study confirmed that the product has formed. Henceforth viewing these characteristic properties more compounds can be synthesized and subjected to pharmacological evaluation. These Chalcone derivatives may have variety synthesis and characterization of some new chalcone derivatives.

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REFERENCES

[1] Koniezny M.T.; Konieczny W.; Sabisz M.; Skladanowski A.; Wakiec R.; Augustnowicz Kopec E. And Zwolska Z., Acid-catalyzed synthesis of oxathiolone fused chalcones. Comparison of their activity toward various microorganisms and human cancer cells line, *European Journal of Medicinal Chemistry*, 2007, 42(5), 729-733.

[2] Petrov O. Ivanova Y.and Gerova M., SOCl2/EtOH: Catalytic system for synthesis of chalcones, *Infona portal komunikacji naukowej*, 2008, 9(2), 315-316.

[3] Said Sebti Abderrahim Solhy, Rachid Tahir, Abdellatif Smahi Modified hydroxyapatite with

sodium nitrate: An efficient new solid catalyst for the Claisen-Schmidt condensation, *Applied Catalysis A: General,* 235(1-2):273-281

[4] S. R. Sarda, W. N. Jadhav, S. R. Bhusare, S. K. Wasmatkar, S. A. Dake, R. P. Pawar, Solvent-free NaOH-Al_2O_3 supported synthesis of1,3-diaryl-2-propene-1-ones, *International Journal of ChemTech Researc*h, 2009, 1(2), 265-269

[5] Craig M.; Comisar P. and Savage E. Kinetics of crossed aldol condensations in high-temperature water, *Green Chemistry*, 2004, 6, 227-231

[6] Zhang Z.; Dang Y.W.; Guan-Wu.and Wang G.W., Efficient and Clean Aldol Condensation Catalyzed by Sodium Carbonate in Water, *Chemistry Letters*, 2003, 32, 10.

[7] Tanemura K.; Suzuki T.; Nishida Y. and Horatguchi T., Aldol Condensation in Water Using Polyethylene Glycol 400, *Chemistry Letters*, 2005, 34,4.

[8] Mokle SS, Sayyee MA, Chopde K. Studies on synthesis and antimicrobial activity of some new iodochalcones, flavones and flavonols, *Int.J.* of *Chemical* Scienc es 2004; 2(1): 96–100.

[9] Viana G.S; Bandeira M.A. and Matos F. *J.,* Analgesic and anti-inflammatory effects of chalcones isolated from Myracrodruon urund-euva Allemão, *Phytomedicine*, 2003, 10, 185-195.

[10] Mukarami S; Muramatsu M,Aihara H and Otomo S. Inhibition of gastric H+, K(+)-ATPase by the anti-ulcer agent, sofalcone, *Biochemical Pharmacology*,1991, 42, 1447.

[11] Liu M; Wilairat P and Go LM. Antimalarial alkoxylated and hydroxylated chalcones [corrected]: structure-activity relationship analysis, *Journal of medicinal chemistry,* 6;44(25):4443-52

[12] Rajendra Prasad , A. Lakshmana Rao And R. Rambabu, Synthesis and Antimicrobial Activity of Some Chalcone Derivatives Synthesis and Antimicrobial Activity of Some Chalcone Derivatives, *E-Journal of Chemistry*,5, 3, 461-466, 2008

[13] Siva Kumar PM; Geethat Basu SK and Mukesh D, QSAR studies on chalcones and flavonoids as anti-tuberculosis agents using genetic function approximation (GFA) method, *Chemical and Pharmaceutical Bulletin,* 2007, 55(1), 44-49.

[14] Satyanarayana M, Priti Tiwari; Tripathi K, Srivastava A.K. and Ram Pratap, Synthesis and antihyperglycemic activity of chalcone based aryloxypro-panolamines, *Bioorganic and Medicinal Chemistry Letters,* 2004, 1,12(5),883-889.