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Eco friendly synthesis and biological activity of novel 1-(3-methoxyphenyl)-3-(substituted aryl) prop-2-en-1-one

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ABSTRACT

*Derivatives of chalcones are found to be the precursors for the synthesis of many vital organic compounds. They are known to posses wide range of biological activities such as antiviral, anti-inflammatory, antioxidant , antimicrobial , analgesics , antileishmanial, antiplatelet and anticancer activities. A series of chalcones are prepared by Claisen-Schmidt condensation of substituted benzaldehyde with p-methoxy acetophenone in the presence of ethanol and 10% sodium hydroxide using ultrasonic irradiation. The synthesized chalcones are good to excellent yields (64-92%). The structures of the compounds (3a-e) are characterized by IR, NMR spectra and screened for antimicrobial activity. Among the microbes, Staphylococcus epidermidis, Methicillin-resistant Staphylococcus aureus, Serratia marcescens, E.coli. Maximum inhibition occured at E.coli in chloroform than methanol and ethanol for compound **3a** when compared to other synthesized compounds.*

***Keywords**: Antimicrobial activity, Chalcones, Claisen-Schmidt condensation, E.coli, Ultrasonic irradiation.*

1. Introduction

Chalcone and its derivatives constitute a distinctive group of compounds which attracted the organic chemist and biologist due its unique features . An interesting characteristic of the chalcones is they serve as the starting materials for synthesis of various heterocyclic compounds such as flavones, pyrimidines,, aurones, prazolines and benzoyl coumarones as well as certain compounds like hydantions and deoxybenzoins which are of some biologically important. [1] A wide range of therapeutic activities covering antimicrobial, anticoagulant, anti-inflammatory , antiviral , antioxidant , antihepatotoxic activity , anticancer activities and antituberculosis etc.[2-9]

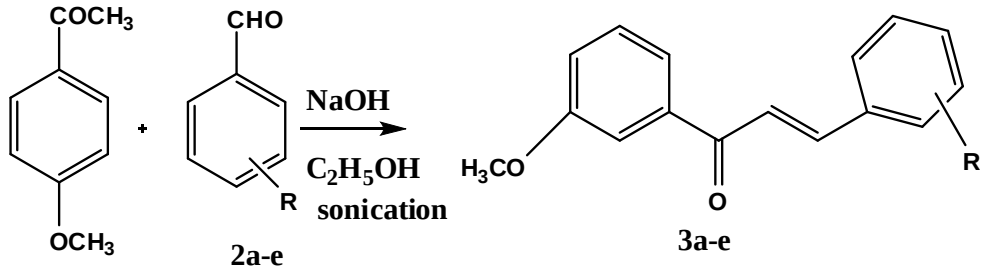
The basic structure of chalcones are made of two aromatic rings A and B which are linked by an aliphatic three carbon chain.They are α, β -unsaturated ketones containing the reactive keto-ethylenic group (-COCH=CH-). These compounds are coloured due to the presence of the chromophore (-COCH=CH-). The pharmacological properties occurs because of both α, β- unsaturation.

` Chalcones are natural compounds that are largely distributed in plants, fruits, and vegetables. They belong to the flavonoid group of molecules and some of them exhibit many biologically activity. There are a number of methods for the synthesis of chalcones including the classical methods of Claisen-Schmidt, Wittig reaction, Friedel-Crafts acylation and Aldol condensation . In search of improved antimicrobial compounds, we have synthesized **3a-e** by sonication method which involves Claisen-Schmidt condensation. [10]

2. Experimental section

The raw materials required for the synthesis 1-(3-methoxyphenyl)-3-(substituted aryl) prop-2-en-1-one are p-methoxy acetophenone, benzaldehyde, 2-chlorobenzaldehyde, p-methoxybenzaldehyde, 2-nitro benzaldehyde , 3-nitrobenzaldehyde, sodium hydroxide and ethanol were purchased from S.D Fine chemicals.

In an attempt to prepare chalcone analogues as 1-(3-methoxyphenyl)-3-(substituted aryl) prop-2-en-1-one we have condensed p-methoxyacetophenone with substituted benzaldehyde derivatives in the presence of ethanol by using sonication **(3a-e). (**scheme 1**)**



1 2a-e 3a-e

R= **a)2-chloro**
b)-H
c)4-methoxy
d)2-nitro
e)3-nitro

2.1 General procedure for the synthesis of 1-(3-methoxyphenyl)-3-(substituted aryl) prop-2-en-1-one

An alcoholic solution of (0.01 mol) of p-methoxyacetophenone (1) and the corresponding 2-substituted benzaldehyde (0.010) mol were taken in beaker and 10% NaOH (5ml) solution was added to it. The reaction mixture was stirred and irradiation through ultrasonication for 9s to 20econds .The contents were filtered and recrystallised from aqueous ethanol gave **3a-e.**

2.2 Characterization of the synthesized compounds (3a-e)

Fourier transform infrared (FT-IR) spectrometer using $CHCl_3$ and KBr. All ^1H spectra were recorded on 500 MHz (Brucker) spectrometers, respectively. The synthesized compounds were analysed for antimicrobial activity.

3-(2-chlorophenyl)-1-(3-methoxyphenyl)prop-2-en-1-one, 3a

Yield : 92.69% , Melting point 70^O C, IR ($CHCl_3$): 2928, 1653, 1510, 1385, 1463, 1421, 1125, 1108, 973, 454 cm-1. ^1H NMR (500 MHZ, $CDCl_3$**):** δ/ppm 8.83 (s, 1H, CH=CH) 7.78(d,1H,CH= CH), 7.43(S,2H, ArH), 7.41(s ,1H,CH=CH), 7.18(d,2H, ArH), 6.97 ,6.81, 3.86(t,2H,Ar-O-CH_2), 2.09 (m,2H,CH_2) and 1.73 (t,3H,CH_3).

1-(3-methoxyphenyl)-3-phenylprop-2-en-1-one, 3b

Yield : 91.3% , Melting point 82^o C, IR Spectrum : 2933, 1654, 1571, 1258, 1016, 973, 656 cm-1 ^1H NMR (500 MHZ, CDCl3): δ/ppm: 8.03 (s, 1H, CH=CH), 7.78(s ,2H,ArH) ,7.43(d,1H.CH= CH), 7.41(d,2H,ArH), 7.18(S,1H,CH=CH), , 6.81(d,4H, ArH), 3.86 (t,2H,Ar-O-CH_2).

1-(3-methoxyphenyl)-3-(4-methoxyphenyl) prop-2-en-1-one 3c

Yield: 80%, Melting point 85^o C **,** IR Spectrum **:** 2934, 1654, 1253, 1015, 984, 812 cm-1 ^1H NMR (500 MHZ, $CDCl_3$) δ/ppm **:** 8.05 (s, 1H, CH=CH) 7.78(s,2H,ArH), 7.43(d,1H,CH= CH), 7.41 (d,2H,ArH), 7.18 (s,1H, CH=CH), 6.81(d,4H,ArH), 3.86 (t,2H,Ar-O-CH_2)

1-(3-methoxyphenyl)-3-(2-nitrophenyl) prop-2-en-1-one, 3d

Yield: 64 %, melting point : 87^o C, IR Spectrum: 2926, 1665, 1599, 1525, 1442, 1348, 1261, 1021, 866 cm-1 ^1H NMR (500 MHZ, $CDCl_3$) δ/ppm: 8.082 (s, 1H, CH=CH), 7.78 (s,2H,ArH), 7.43(d,1H,CH=CH), 7.41(d,2H,ArH), 7.18 (s,1H.CH=CH), 6.81(d,4H,4XArH), 3.86 (t,2H,Ar-O-CH_2)

1-(3-methoxyphenyl)-3-(3-nitrophenyl)prop-2-en-1-one, **3e**

Yield : 81.85% melting point 95^0 C , IR Spectrum: 1662, 1528, 1217**,** 865, 657 cm-1 , ^1H NMR (500 MHZ, $CDCl_3$)δ/ppm: 8.87 (s, 1H, CH=CH), 7.78(s,2H,ArH), 7.43(d,1H,Olefinic CH), 7.41(d,2H,2XArH), 7.18(s,1H.Olefinic CH), 6.81(d,4H,4XArH), 3.86 (t,2H,Ar-O-CH_2)**.**

3. Result and discussion:

3.1 Chemistry

The synthesized chalcones 3a-e are formed by famous Clasien Schmidt condensation of the p-methoxy acetophenone with aromatic aldehydes in the presence of sodium hydroxide as a base in ethanol medium. Chalcones were synthesised using ultrasonic radiation .[11-12] The The α,β-unsaturated carbonyl group of chalcones, **3 a-e** usually appears as a prominent band in between 1665 -1645 cm^{-1} in its IR spectrum. In the NMR spectrum , the doublet and singlet around at δ =7.7,7.4 (more downfield region) indicates the presence of olefinic C-H group neighbouring to the substituted atom and keto group respectively. The Ar-O-CH2 group appears around at δ=3.86 confirm the presence of ether linkage.

3.2 **Biology**

The synthesized compounds 3a-e were tested for antimicrobial activity against *Staphylococcus epidermidis, Methicillin-resistant Staphylococcus aureus, Serratia marcescens, E.coli*. [13-15] Among the five compounds screened for biological activity, Compound 3a showed maximum zone inhibition against *E.coli*. Compound 3b-e, showed moderate activity. The significant activity of compound 3a may be attributed to the presence of aromatic rings and chlorine substitution

Antimicrobial activity of compound 3a

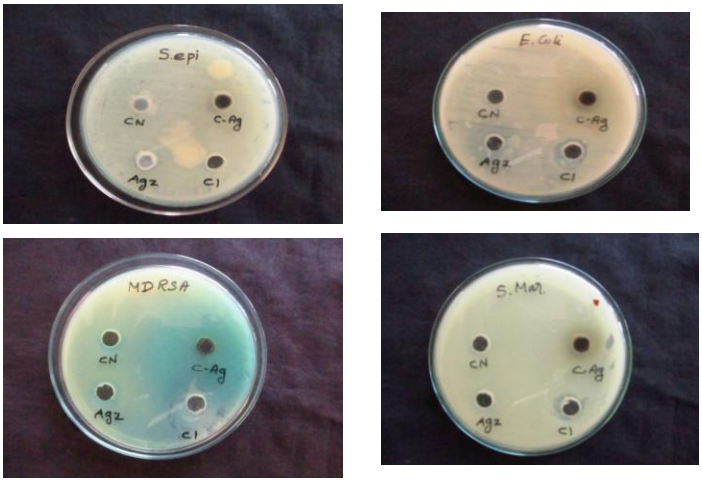


Table: Anti-microbial activity of **3a**

Micro organisms	Zone of inhibition		
	Methanol	**Ethanol**	**Chloroform**
E.coli	14	14	20
s.epi	-	12	13
s.mar	-	-	-
MRSA	-	12	11

Microbial activity for 3a-e chalcone was carried out. The maximum inhibition occur at E.coli in chloroform than methanol and ethanol

4. Conclusion

Chalcones derivatives having wide range of pharmacological properties .With this view , we have prepared the compounds **3a-e**. are prepared by Claisen Schmidt reaction of methoxy acetophenone (1) and substituted aldehyde (2a-e) irradiation of ultrasonic radiation within few seconds with a good to excellent yield . The structure of the 1-(3-methoxyphenyl)-3-(substituted aryl) prop-2-en-1-one compounds are confirmed by IR and NMR Spectra. Antimicrobial activity carried out for the synthesized chalcones. The maximum inhibition occur at E.Coli in chloroform than methanol and ethanol.

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