ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Synthesis, Characterization, and Antibacterial Activity of chalcones derivatives

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ABSTRACT

Compound A which is the starting compound was prepared by the reaction between 4-Chlorobenzaldehyde and 4-Bromoacetophenone in the presence of Ethanol. Compound A was Preparedby4-Chlorobenzaldehyde that dissolved in ethanol in presence of Sodium hydroxide with 4-Bromoacetophenone. B was prepared through addition of 4-Bromoacetophenone that dissolved in Ethanolwith4-(Dimethyl amino) Benzaldehyde by mixing compounds by presence of sodium hydroxide solution in Ethanol. The synthesized compounds were characterized through their physical properties and diagnosed by using FTIR, ^{1}H NMR and 13C NMR spectrophotometric techniques. The synthesized compounds showed antibacterial activity *in vitro* against two kinds of bacteria: *Escherichia coli (-)* and *Staphylococcus aureus (+)*.

Keywords: chalcones, 4-Bromoacetophenone, 4-Chlorobenzaldehyde, antibacterial activity.

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ISSN: 0975-8585

INTRODUCTION

Chalcones are -unsaturated ketone containing the reactive ketoethylenic. Group –CO-CH=CH-. These are coloured compounds because of the Presence of the chromophore -CO-CH=CH-, which depends in the presence of other auxochromes. Two aromatic rings are linked by aliphatic three chain of carbon [1, 2]. Different methods are available for the preparation of chalcones. The most convenient method is the Claisen-Schimdt condensation of equimolar quantities of arylmethyl ketone with aryl aldehyde in the presence of alcoholicalkali [3]. The chalcones used to synthesize many derivatives such as cyanopyridines, pyrazolines isoxazoles and pyrimidines have different hetrocyclic rings systems [4, 5]. The chalcones are known intermediates to synthesize hetrocyclic compounds .all compounds have backbone for chalcone have been reported for all biological activities such as antimicrobial [6,7], anti-inflammatory [8], antimalarial [9], antileishmanial [10], antioxidant [11] and antitubercular [12].

EXPERIMANTAL

Instruments:

I was measured melting point by a gallan kamp MFB – 600 melting point apparatus and were uncorrected FTIR spectra was recorded such as potassium bromide (KBr) disk on FTIR -8400 fourer transform infrared spectrophotometer (SHIMADZU) , 1H NMR ,13C NMR were recorded on 300 MHz ultra-shield broker spectrophotometer by using Chloroform such as a solvent in Jordan university .The purity of the compounds was Checked by TLC-using Silica gel-G (Merck).

Preparation of compound A [13]

1-(4-bromophenyl)-3-(4-chlorophenyl) prop – 2-en-1-one.

4-Chlorobenzaldehyde derivative (0.01 mol, 1.405 gm) and 4-Bromoacetophenone (0.01 mole, 1.99 gm.) were dissolved in ethanol (25 mL). Sodium hydroxide solution, 10% (25 mL) was added drop wise and the mixture stirred for 3hrs.Then it was poured into 400 mL of distilledwater with constant stirring and left overnight in Refrigerator. The precipitate obtained was filtered, washed and recrystallized from ethanol. The physical properties were listed in table 1.

Preparation of compound B [13]

1-(4-bromophenyl)-3-(4-(dimethyl amino) phenyl) prop-2-en-1-one

4-(Dimethyl amino) Benzaldehyde derivative (0.01 mole, 1.49 gm.) and 4-bromoacetophenone (0.01 mole, 1.99 gm.) were dissolved in the ethanol (25 ml) .sodium hydroxide solution, 10 % (25 ml) was added drop wise and the mixture stirred for 3 hrs. , then it was poured into 400 ml of distilled water with constant stirring and left overnight in the refrigerator The precipitate obtained was filtered, washed and recrystallized from ethanol.

Table 1: The physical properties

Comp. No.	Color	m.p^{0}C	Mol. Formula
A	White yellowish crystals	165-167	$C_{15}H_{10}BrClO$
B	Bright yellow	142-144	$C_{17}H_{16}BrNO$

Antibacterial assay [14]

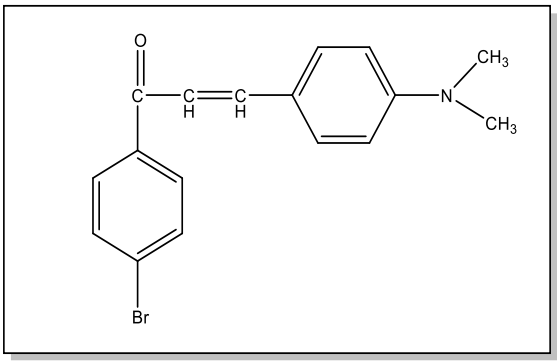
The microbial cultures was sourced from the microbial type culture collection (al- Hussein hospital / Karbala), the microbial isolates representing Gram-negative *(Escherichia coli*) and Gram-positive bacteria*(Staphylococcus aureus)* were sub-cultured on nutrient agar. The screening of eight compounds **(A)**

ISSN: 0975-8585

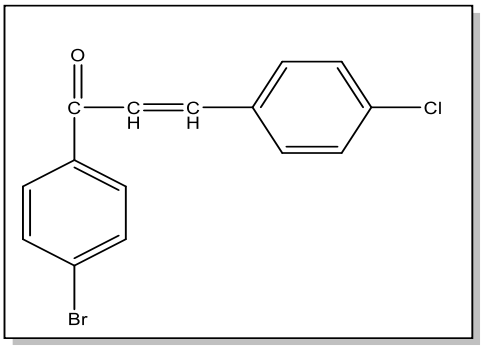
and **(B)** was done *in vitro* using the agar well diffusion method. The stock solutions (5 mg/mL) of the test compounds were prepared by dissolving 5 mg of test compound in DMSO 1 mL. All samples were sterilized through a 0.2 mm membrane filter and stored at 5°C until further use. Microbial inoculums were prepared from 24 h-old cultures by inoculating 100 µL of each test bacterial culture in 20 mL of warm, melted, autoclaved Mueller Hinton agar, seed layers were prepared (separate flasks were used for each bacterial culture). After mixing, these were poured into sterilized labeled Petri plates (150 mm × 20 mm). The 8 mm wells were punched in the solidified Petri plates with the help of a sterile cork borer. Using a micropipette, 100 mL of each test compound (stock 5, 10 and 20 mg/mL) was added aseptically to the individual wells. The loaded plates were incubated in an upright position at 37°C ± 1°C for 24 h. The diameter of the zone of growth inhibition around each well after incubation was measured in millimeters using a zone reader (HI Antibiotic zone scale). Gentamycin5, 10 and 20 mg/mL was used as the standard antibiotic, with DMSO as a negative control under similar conditions for comparison. This procedure was performed in two replicate plates for each organism.

RESULTS AND DISCUTION

All the synthesized compounds were characterized through their physical properties and diagnosed by using FTIR and ^{1}H NMR, 13C NMR spectrophotometric techniques**.**



[B]



[A]

Characterization [A]

This compound is confirmed by FT-IR spectrum which shows appearance the strong band at 1656 cm^{-1}for the stretching frequency for carbonyl of the chalcone which is conjugated with (C=C) group. And another band appears at 1604 cm^{-1} for the alkene.

^{1}H NMR spectrum shows peaks at: 1.52 ppm for chloroform solvent, 7.26-7.79 ppm for d (CHof aromatic ring), 8.37 ppm for the alkenedoublet(C=C) group.

13C NMR spectrum shows peaks at: 76.55 ppm for the CDCl3 solvent, 190.77 ppm for the ketone group of the chalcone , 120-128 ppm for the alkene group of the chalcone CH=CH , and 129-143 ppm for the two aromatic rings.

Characterization [B]

This compound is confirmed by FT-IR spectrum which shows appearance of a strong band at 1647cm^{-1} for the stretching frequency of carbonyl of the chalcone which is conjugated with (C=C) group. And another band appears at 1610 cm^{-1} for the alkene.

^{1}H NMR spectrum shows peaks at: 1.6 ppm for CDCl3 solvent, 7.13-7.88 ppm for (CHdoublet – doublet of aromatic ring), 6.70-6.54 ppm for the alkene(C=C) group doublet.

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13C NMR spectrum shows peaks at: 76.02 ppm for the CDCl3 solvent, 189.44 ppm for the ketone group of the chalcone , 111-116 ppm for the alkene group of the chalcone CH=CH , 122-152 ppm for the two aromatic rings. And 40.12 ppm for the two methyl groups. [15, 16]

Table 2: The microbial cultures

Comp.	Zone of the inhibition by (mm), concentration (µg/mL)					
	G^+*Staphylococcus*			G^-*Escherichia coli*		
	5	**10**	**20**	**5**	**10**	**20**
DMSO	-	-	-	-	-	-
Gentamycin	17	22	28	14	24	28
A	-	-	01	-	-	01
B	-	01	03	-	-	02

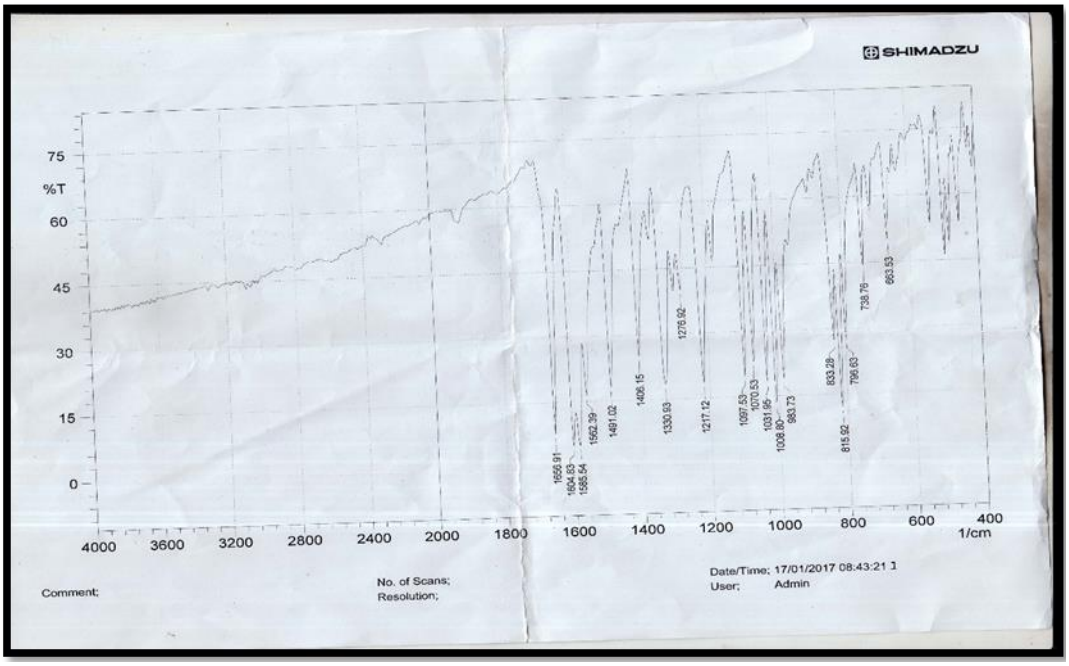

Figure 1: FTIR spectrum of compound A

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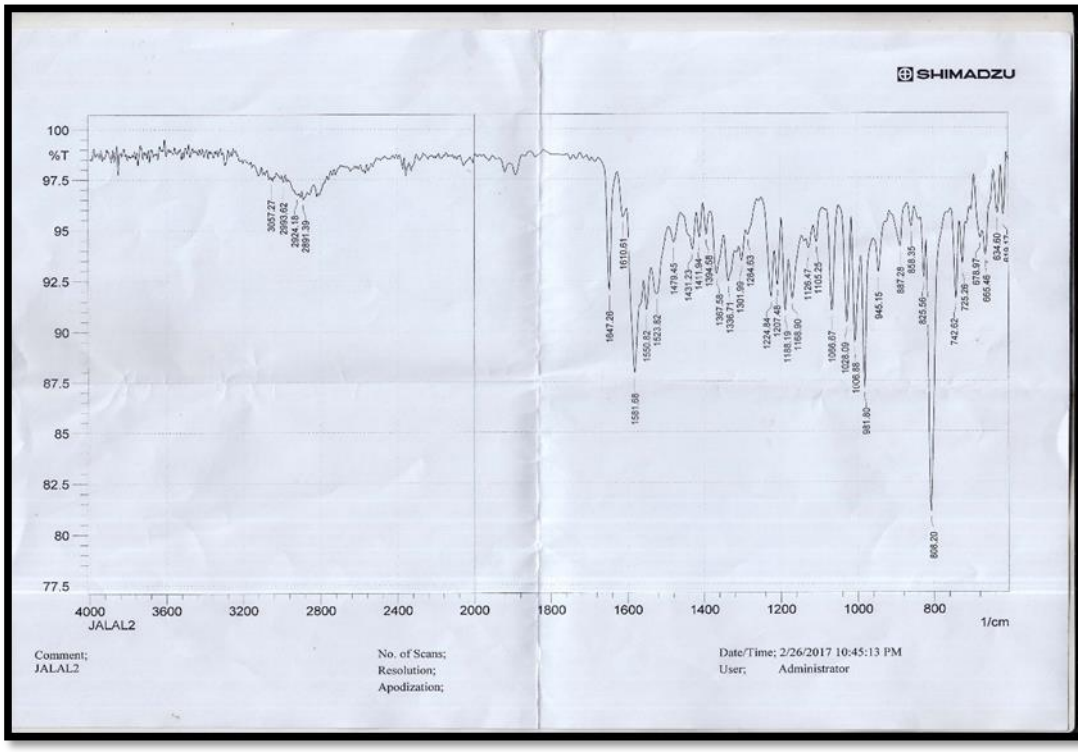

Figure 2: FTIR spectrum of compound B

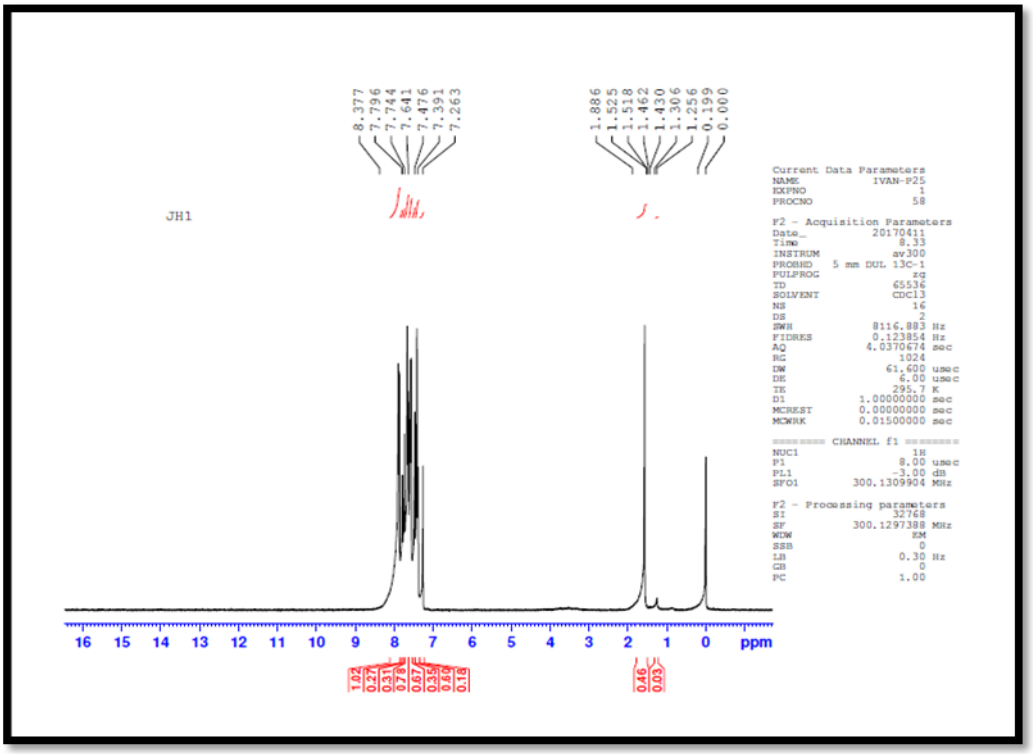

Figure 3: ^{1}H NMR spectrum of compound A

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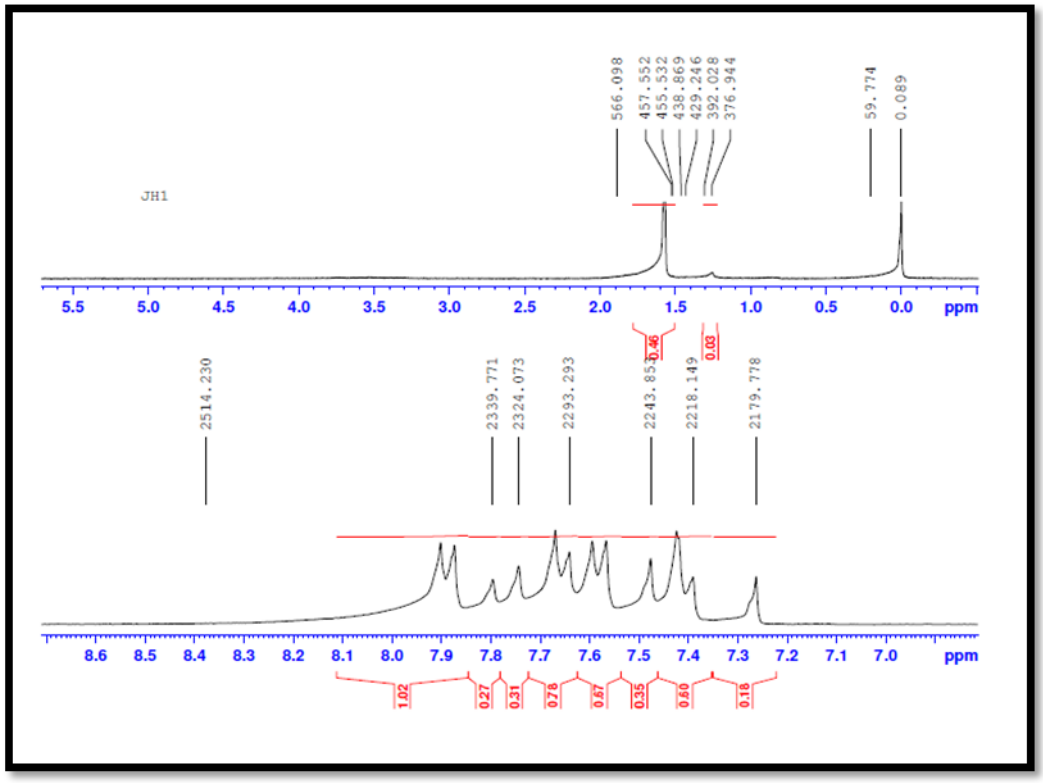

Figure 4: ^{1}H NMR Spectrum of compound A

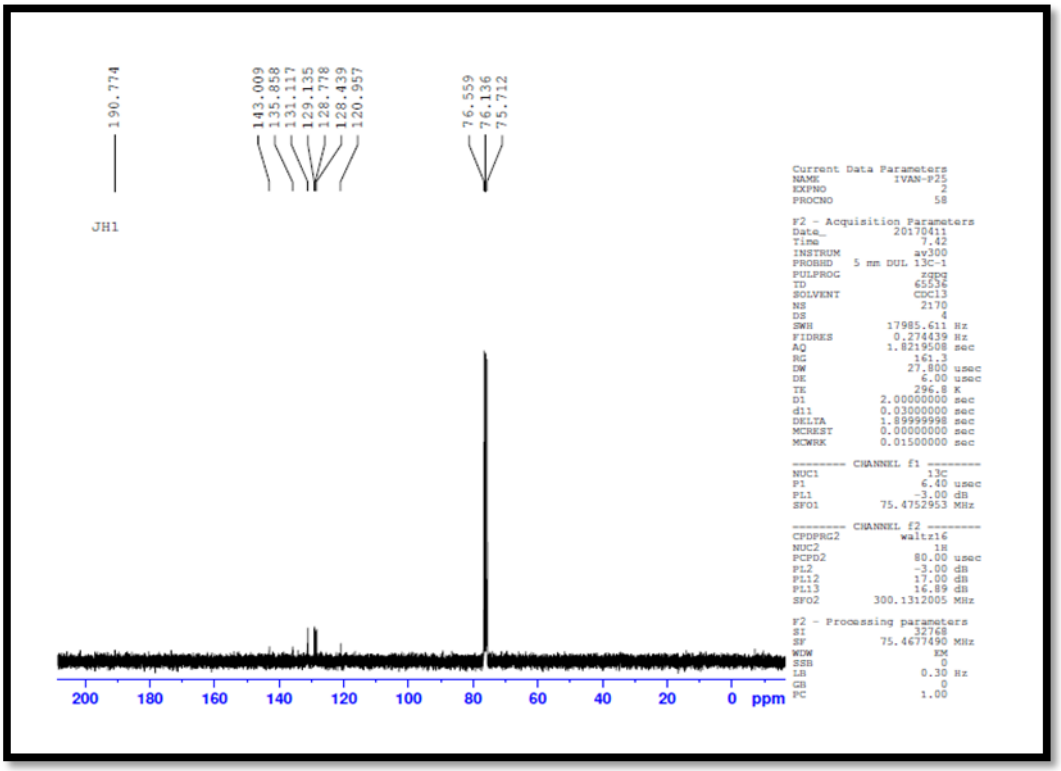

Figure 5: 13C NMR spectrum of compound A

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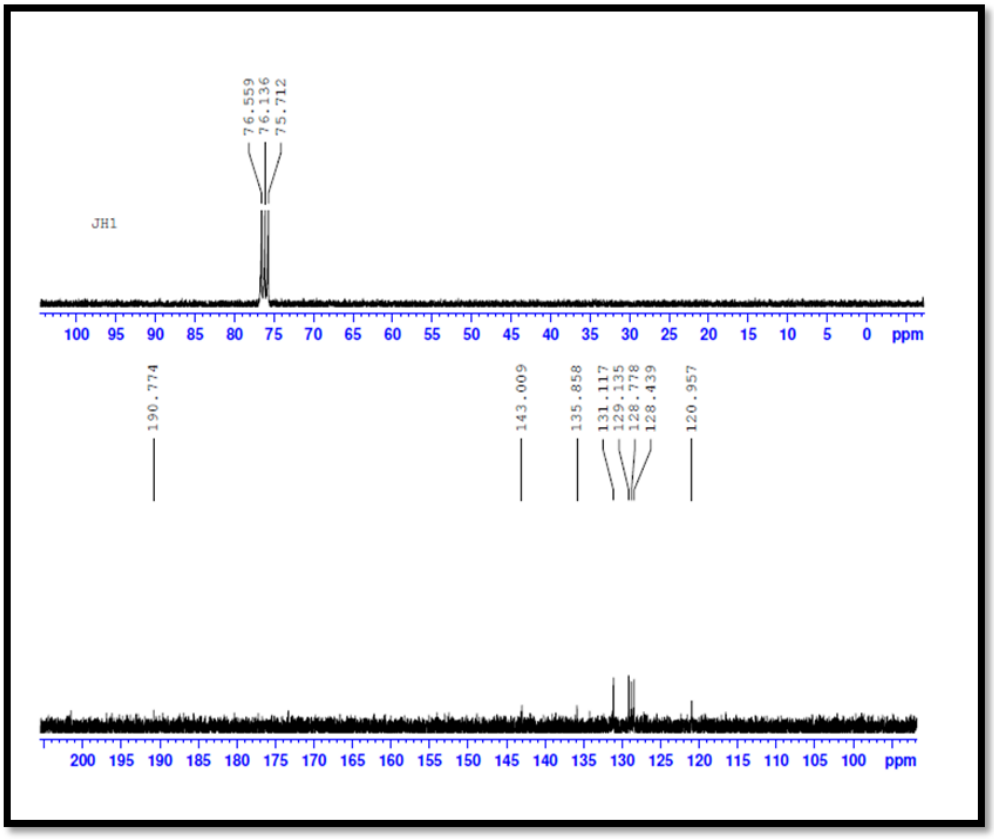

Figure 6: 13C NMR Spectrum of compound A

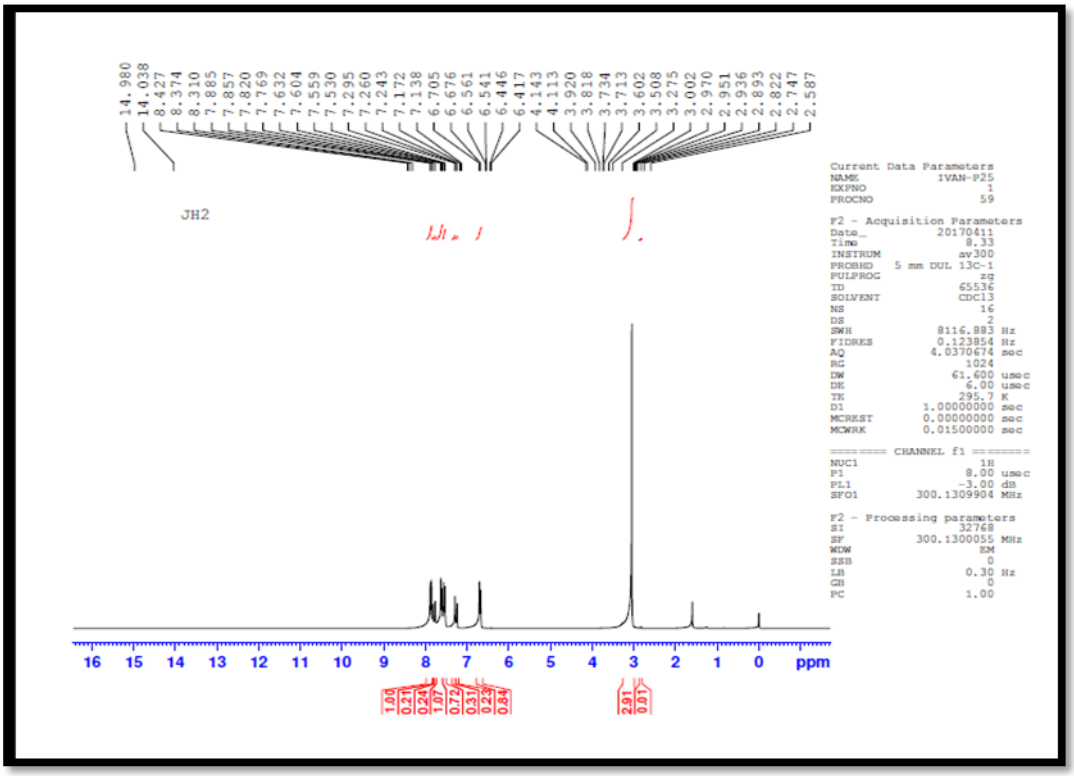

Figure 7: ^{1}H NMR Spectrum of compound B

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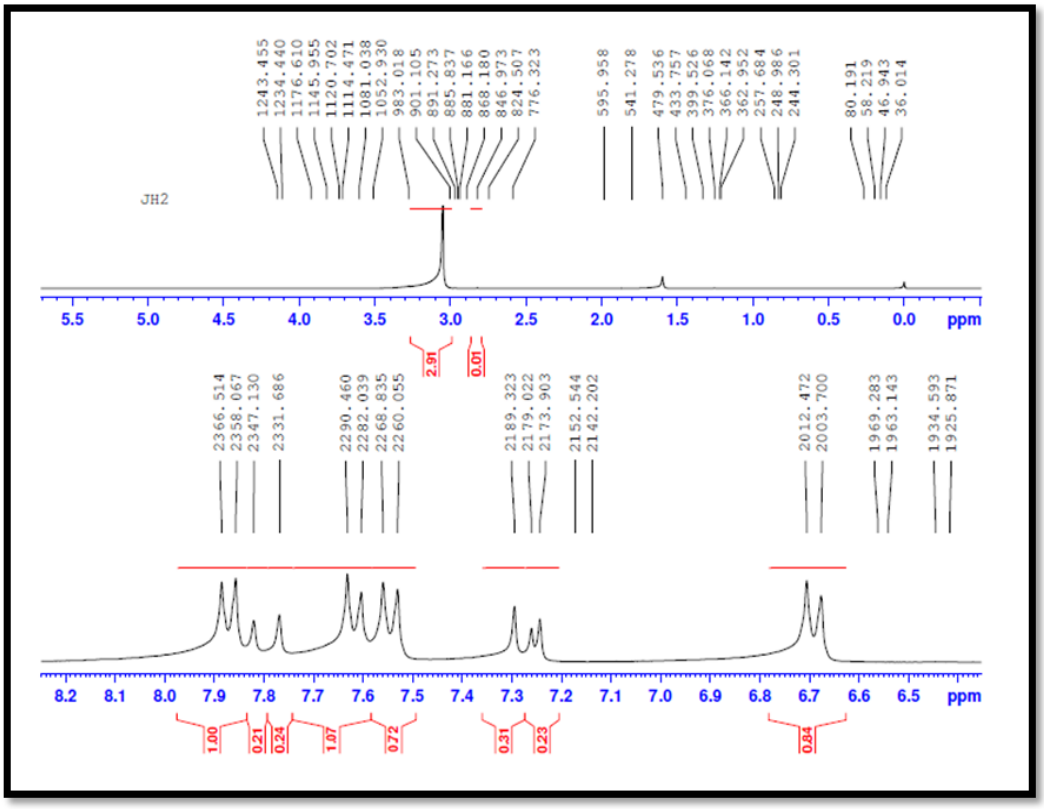

Figure 8: ^{1}H NMR Spectrum of compound B

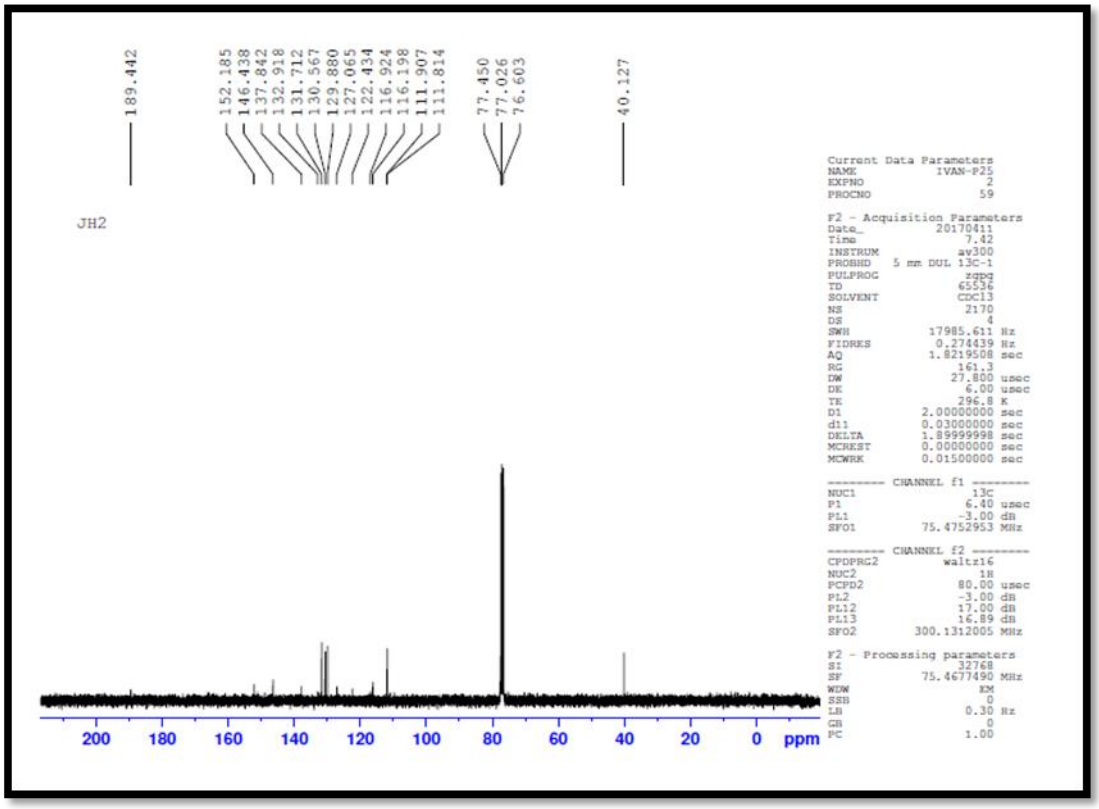

Figure 9: 13C NMR spectrum of compound B

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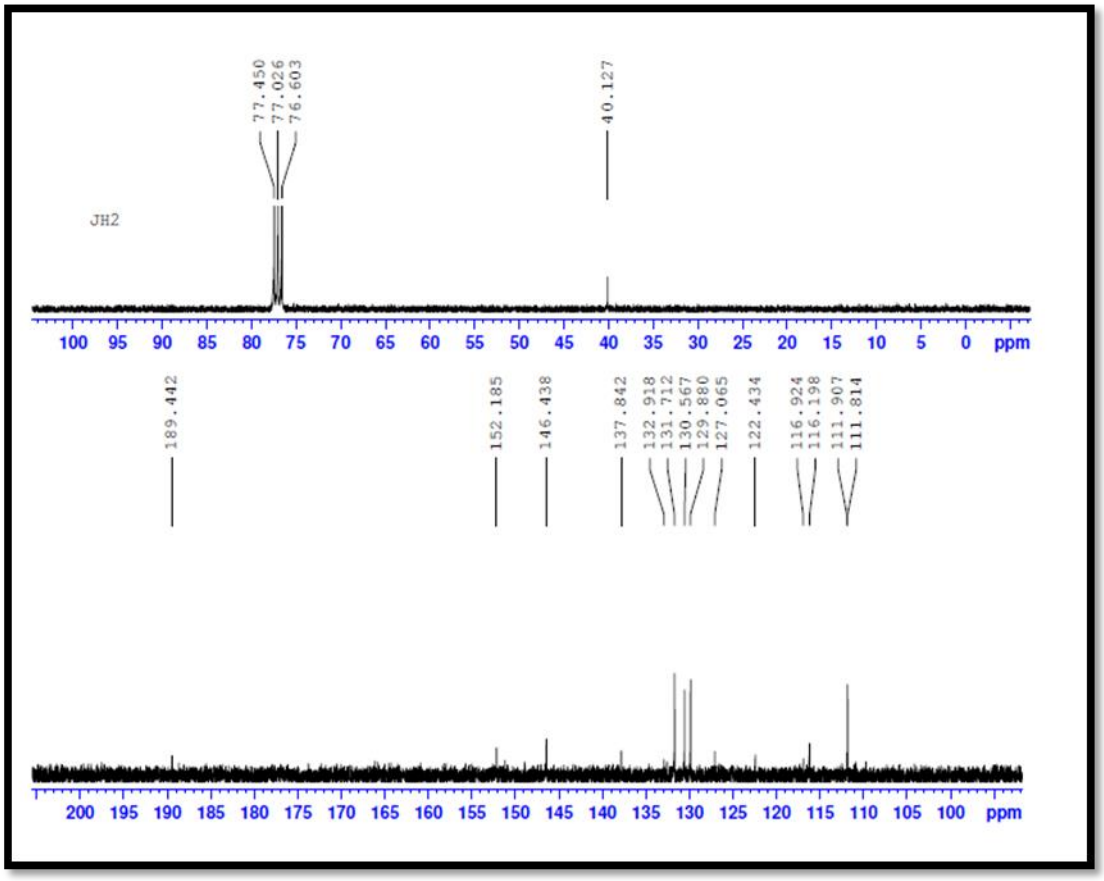

Figure 10: 13C NMR Spectrum of compound B

CONCLUSION

In summary, we have synthesized some chalcones and identified them from their spectral data. We have most of the compounds were very active biological agents, chalcones derivatives were synthesized. Showed better antibacterial activity, the synthesized substituted chalcones were confirmed from their respective IR, 1H- NMR and 13 C NMR Studies. From the antimicrobial screening it was observed that all the compounds exhibited activity against all the organisms employed.

ACKNOWLEDGMENTS

The Author would like to acknowledge the Faculty of Pharmacy, University of Karbala in carrying out this research.

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