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Synthesis of novel phenyl azo chalcone derivatives for antitubercular, anti-inflammatory and antioxidant activity

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ABSTRACT

In the present study, an attempt has been made to synthesize some novel phenyl azochalcone derivatives for biological activity chaclone were prepared from 4-aminoacetophenone, diazotization of the amino ketone followed by Claisen Schimdt condensation and finally coupling of diazo group with various reagents gave phenylazochalcone. The structure of the compounds has been confirmed by IR, NMR (^{1}H & ^{13}C), mass spectral data and elemental analysis. All the derivatives were screened for antitubercular activity by MABA method, in-vitro anti-inflammatory activity by BSA method and antioxidant activity by DPPH method.

Key words: Phenyl azochalcone , antitubercular, anti-inflammatory, antioxidant activity

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INTRODUCTION

Medicinal or pharmaceutical chemistry is a scientific discipline at the intersection of chemistry and pharmacology involved with designing, synthesizing and developing pharmaceutical drugs. Medicinal chemistry is a highly interdisciplinary science combining organic with biochemistry, computational chemistry, heterocyclic chemistry, pharmacology, moleculabiology, statistics and physical chemistry [1].

Tuberculosis (TB) is one of the most common infectious diseases known by the mankind [2]. About 32% of the world's population is infected by *Mycobacterium tuberculosis*, the main causative agent of TB. Every year, approximately 8 million of the infected people develop active TB, and 2 million individuals die. The World Health Organization estimates that about 30 million people will be infected by *M. tuberculosis* within the next 20 years. The incidence of TB infection has steadily risen in the last decade. The reemergence of TB infection has been further complicated by an increase in the prevalence of drug-resistant TB cases [3].

Non-steroidal anti-inflammatory drugs are commonly prescribed for the treatment of acute and chronic inflammation, pain and fever. Most of the NSAID's that are available in the market are known to inhibit isoforms, a constitutive form COX-1 and an inducible form, COX-2 to offer therapeutic effect. However, long term clinical usage NSAID's is associated with significant side effects of gastric lesions, bleeding and nephrotoxicity. Therefore, the discovery of new safer anti-inflammatory drugs represents a challenging goal for such a research area [4].

The search for new molecules with anti-oxidant properties is a very active domain of research, since they can protect the human body from free radicals and retard the progress of many chronic diseases such as vascular diseases, some forms of cancer and oxidative stress responsible for DNA, protein and membrane damage. Reactive oxygen species (ROS) such as superoxide anions, hydrogen peroxide, hydroxyl and nitric oxide radicals, play an important role in oxidative stress related to the pathogenesis of various important diseases. Antioxidants act as a major defence against radical mediated toxicity by protecting the damages caused by free radicals [5].

The chemistry of chalcones has generated intensive scientific studies throughout the world. Especially, interest has been focused on the synthesis and biodynamic activities of chalcones. These are considered to be precursors of flavonoids and isoflavonoids. Chalcones constitute an important group of natural products and some of them possess a wide range of biological activities such as antimicrobial [6], anticancer [7], antitubercular [8], anti oxidant [9] and anti inflammatory [10].

Synthesis of this versatile molecule can be carried out easily and conveniently by Claisen-Schmidt reaction in which acetophenone and benzaldehyde and their derivative are reacted in the presence of aqueous alkali

Chalcones can be viewed as bifunctional molecule imbibed with a keto group and a conjugated double bond. The basic skeleton of chalcone also has two aromatic rings in 1, 3-relationship. Chalcone and its derivatives have been employed extensively for the synthesis of heterocyclic targets having nitrogen, oxygen and sulphur.

Azo compounds are important structures in the medicinal and pharmaceutical fields and it has been suggested that the azoimine linkage might be responsible for the biological activities displayed by some reported Schiff bases. In addition, Evans blue and Congo Red are azo dyes being studied as HIV inhibitors of viral replications. This effect is believed to be caused by binding of azo dyes to both protease and reverse transcriptase of this virus. The existence of an azo moiety in different types of compounds has caused them to show antibacterial and pesticidal activities [11].

Hence based upon the promising biological activity of chalcones and azo compounds and in continuation for search for newer molecules for better biological activity an attempt has been made to synthesize various phenyl azo chalcone derivatives and screening for their biological activities.

MATERIALS AND METHODS

CHEMISTRY

All the melting points were determined in a Thermonik melting point apparatus and are uncorrected. The UV spectra of the synthesized compounds were recorded on UV-Visible spectrophotometer (model Shimadzu 1601) using methanol and the values of wave length (λ max) were reported in nm. The IR spectra of the synthesized compounds was recorded on a Fourier Transform IR spectrometer (model Shimadzu 8700) in the range of 400 -4000 using KBr pellets and the value of λmax were reported in cm^{-1}.^{1}HNMR and ^{13}C-NMR spectra were recorded on Amx - 400 MHz NMR spectrometer using DMSO and the chemical shifts (δ) reported are in parts per million downfield using tetramethylsilane (TMS) as internal reference. A mass spectrum was recorded on Mass spectrophotometer (model Shimadzu) by LC-MS 2010A. The purity of the compounds was checked by thin-layer chromatography on silica gel G plates of 0.5mm thickness as stationary phase and combination of n-hexane: ethyl acetate in different ratios as mobile phase. Elemental analysis were analysed by Thermo Finnigan Flash EA 1112 Series.

Synthesis of diazoketone (2)

Diazotization of 4-amino acetophenone **(1)** was carried out by dissolving the substance in ethanol-water mixture. The mixture was warmed to dissolve the solid .The solution was made alkaline by adding sodium carbonate solution and kept in an ice-bath. To this ice cold reaction mixture, solid sodium nitrite (2.1g) was added slowly with stirring followed by addition of an ice-cold solution of conc. hydrochloric acid. The solid obtained was filtered, dried and recrystallised from ethanol.

Synthesis of 4-(3-phenylacrloyl)-benzenediazonium chloride 3(a-e)

Equimolar quantity (0.01 mol) of diazotized acetophenone **(2)** and different substituted aryl aldehydes **(a-e)** were dissolved in methanol. Alcoholic KOH solution (40%) was added slowly with stirring and continued for 6 hours and kept overnight. The reaction mixture was decomposed in ice-water, and acidified with 10 % HCl to obtain azo-phenylpropenone **(3a-e).** The compounds obtained were recrystallized from ethanol.

Synthesis 3-phenyl-1-(4-phenylazophenyl) propenone 4(a-e) (I-IV)

Chalcones **(3a-e)** (0.01 mol) was dissolved in acetone and cooled to (0-5)^{0}C. To this reaction mixture, an ice-cold solution of aniline (0.01 mol) and 10% glacial acetic acid was added and stirred for 45 minutes, after which the reaction mixture was decomposed into ice-water. The solids obtained were filtered, dried and recrystallised using ethanol.

1-[4-(4-Amino-phenylazo)-phenyl]-3-(4-nitro-phenyl)-propenone 4a(I)

Mp: 150-152ºC, yield 80%. Analysis for $C_{21}H_{16}N_4O_3$. **Λmax:** 303 **IR (KBr, cm^{-1}):** 3451, 3368 (NH_2 str), 2928 (Ar CH str), 2864 (Al CH str), 1625 (C=O str), 1538 (C=C str), 1329 (C-N str)

1-[4-(4-Amino-3-methoxy-phenylazo)-phenyl]-3-(4-nitro-phenyl)-propenone 4a(II)

Mp: 148-150ºC, yield 18%. Analysis for $C_{22}H_{18}N_4O_4$. **Λmax:** 378 **IR (KBr, cm^{-1}):** 3421, 3368 (NH_2 str), 2938 (Ar CH str), 2834 (Al CH str), 1675 (C=O str), 1528 (C=C str), 1495 (Ar-NO_2 str), 1319 (C-N str).

1-[4-(4-Amino-2-methyl-phenylazo)-phenyl]-3-(4-nitro-phenyl)-propenone 4a(III)

Mp: 152-154ºC, yield 38%. Analysis for $C_{22}H_{18}N_4O_3$. **Λmax:** 350 **IR (KBr, cm^{-1}):** 3471, 3348 (NH_2 str), 2948 (Ar CH str), 2834 (Al CH str), 1665 (C=O str), 1598 (C=C str), 1495 (Ar-NO_2 str), 1349 (C-N str).

1-[4-(4-Hydroxy-naphthalen-2-ylazo)-phenyl]-3-(4-nitro-phenyl)-propenone 4a(IV)

Mp: 160-162ºC, yield 88%. Analysis for $C_{25}H_{17}N3O_4$. **Λmax:** 337 **IR (KBr, cm^{-1}):** 3548 (Ar-OH str), 2978 (Ar CH str), 1695 (C=O str), 1518 (C=C str), 1495 (Ar-NO_2 str), 1329 (C-N str).

1-[4-(4-Amino-phenylazo)-phenyl]-3-(4-methoxy-phenyl)-propenone 4b(I)

Mp: 144-146ºC, yield 78%. Analysis for $C_{22}H_{19}N_3O_2$. **Λmax:** 303 **IR (KBr, cm^{-1}):** 3450, 3363 (NH_2 str), 2925 (Ar CH str), 2854 (Al CH str), 1605 (C=O str), 1508 (C=C str), 1309 (C-N str), 1273 (C-O str). **^{1}HNMR (DMSO-d_6, δ ppm):** 7.9[d, 1H, H(C=C)], 7.5 [d,1H,H(C=C], 8.0-6.8 (m,ArH,14H), 3.83 (s, 3H, OCH_3), 3.36(s, 2H, NH_2). **^{13}CNMR (DMSO, δ ppm):** 196(C=O), 142(C=C), 130(C=C), 122(C=C), 146 (C=C), δ150 (OCH_3).; **m/e:** 358 (M+1) **CHN:** Calculated % = 11.69(N), 73.81(C), 5.39(H) Found % = 11.73(N), 73.78(C), 5.42(H)

1-[4-(4-Amino-3-methoxy-phenylazo)-phenyl]-3-(4-methoxy-phenyl)-propenone 4b(II)

Mp: 154-156ºC, yield 20%. Analysis for $C_{23}H_{21}N_3O_3$. **Λmax:** 338 **IR (KBr, cm^{-1}):** 3456, 3373 (NH_2 str), 2928 (Ar CH str), 2853 (Al CH str), 1645 (C=O str), 1538 (C=C str), 1329 (C-N str), 1228 (C-O str).

1-[4-(4-Amino-2-methyl-phenylazo)-phenyl]-3-(4-methoxy-phenyl)-propenone 4b(III)

Mp: 156-158ºC, yield 40%. Analysis for $C_{23}H_{20}N3O_2$. **Λmax:** 347 **IR (KBr, cm^{-1}):** 3416, 3323 (NH_2 str), 2921 (Ar CH str), 2852 (Al CH str), 1649 (C=O str), 1535 (C=C str), 1328 (C-N str), 1223 (C-O str).

1-[4-(4-Hydroxy-naphthalen-2-ylazo)-phenyl]-3-(4-methoxy-phenyl)-propenone 4b(IV)

Mp: 162-164ºC, yield 63%. Analysis for $C_{21}H_{20}N_2O_3$. **Λmax:** 312 **IR (KBr, cm^{-1}):** 3518 (Ar-OH str), 2918 (Ar CH str), 2752 (Al CH str), 1635 (C=O str), 1538 (C=C str), 1339 (C-N str), 1243 (C-O str)

1-[4-(4-Amino-phenylazo)-phenyl]-3-*p*-tolyl-propenone 4c(I)

Mp: 142-144ºC, yield 68%. Analysis for $C_{22}H_{19}N_3O$. **Λmax:** 304 **IR (KBr, cm^{-1}):** 3417, 3322 (NH_2 str), 2971 (Ar CH str), 2862 (Al CH str), 1639 (C=O str), 1534 (C=C str), 1388 (C-N str).

1-[4-(4-Amino-3-methoxy-phenylazo)-phenyl]-3-*p*-tolyl-propenone 4c(II)

Mp: 140-142ºC, yield 57%. Analysis for $C_{23}H_{21}N_3O_2$. **Λmax:** 340 **IR (KBr, cm^{-1}):** 3419, 3329 (NH_2 str), 2978 (Ar CH str), 2863 (Al CH str), 1669 (C=O str), 1532 (C=C str), 1381 (C-N str), 1247 (C-O str)

1-[4-(4-Amino-2-methyl-phenylazo)-phenyl]-3-*p*-tolyl-propenone 4c(III)

Mp: 144-146ºC, yield 31%. Analysis for $C_{23}H_{21}N_3O$. **Λmax:** 303 **IR (KBr, cm^{-1}):** 3449, 3389 (NH_2 str), 2998 (Ar CH str), 2861 (Al CH str), 1668 (C=O str), 1537 (C=C str), 1387 (C-N str).

1-[4-(4-Hydroxy-naphthalen-2-ylazo)-phenyl]-3-*p*-tolyl-propenone 4c(IV)

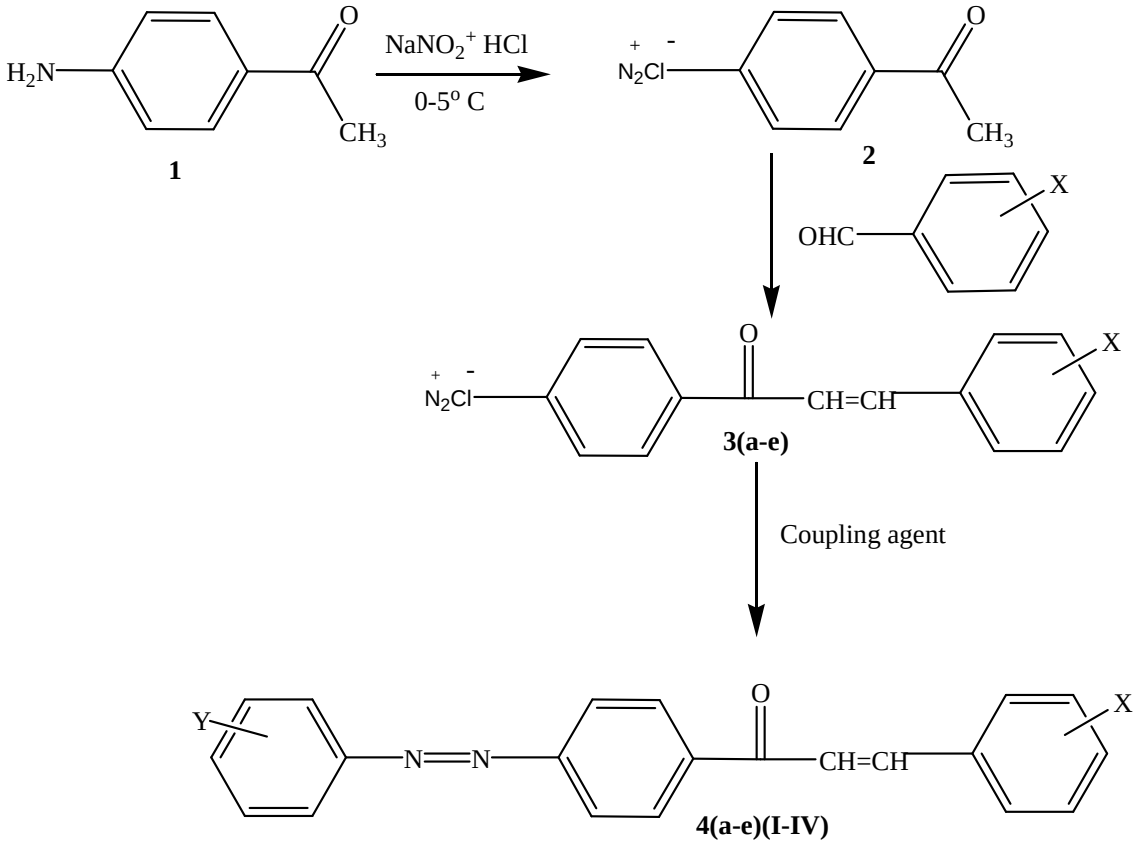
Mp: 158-160ºC, yield 27%. Analysis for $C_{26}H_{20}N_2O_2$. **Λmax:** 312**; IR (KBr, cm^{-1}):** 3480 (Ar-OH str), 2960 (Ar CH str), 2754 (Al CH str), 1695 (C=O str), 1598 (C=C str), 1315 (C-N str), 1253 (C-O str). **^{1}HNMR (DMSO-d_6, δ ppm):** 10.20[d, 1H, H(C=C)], 8.012 [d, 1H, H(C=C], 7.99-6.70 (m, ArH,14H), 2.49 (s, 3H, CH_3). **^{13}CNMR (DMSO, δ ppm):** 197(C=O), 158(C=N), 146(C=C), δ137 (CH_3), δ134 (Phenyl), 130 (C=C), 129 (C=C), 128, 127(napthyl ring), 126 (C=C), **m/e:** 478 (M+1). **CHN:** Calculated % = 5.87 (N), 65.40 (C), 4.19(H) Found % = 5.33(N), 65.89(C), 4.42(H).

1-[4-(4-Amino-phenylazo)-phenyl]-3-(4-hydroxy-phenyl)-propenone 4d(I)

Mp: 138-140ºC, yield 57%. Analysis for $C_{21}H_{17}N_3O_2$. **Λmax:** 378 **IR (KBr, cm^{-1}):** 3418, 3321 (NH_2 str), 3485 (b Ar-OH str), 2971 (Ar CH str), 1689 (C=O str), 1535 (C=C str), 1371 (C-N str), 1244 (C-O str)

1-[4-(4-Amino-3-methoxy-phenylazo)-phenyl]-3-(4-hydroxy-phenyl)-propenone 4d(II)

Mp: 146-148ºC, yield 46%. Analysis for $C_{22}H_{19}N_3O_3$. **λmax:** 324 **IR (KBr, cm^{-1}):** 3412, 3311 (NH_2 str), 3483 (b Ar-OH str), 2975 (Ar CH str), 1686 (C=O str), 1531 (C=C str), 1375 (C-N str), 1284 (C-O str)



	X	Y
4a(I)	NO_2	NH_2
4a(II)	NO_2	OCH_3
4a(III)	NO_2	CH_3
4a(IV)	NO_2	C_6H_5-OH
4b(I)	OCH_3	NH_2
4b(II)	OCH_3	OCH_3
4b(III)	OCH_3	CH_3
4b(IV)	OCH_3	C_6H_5-OH
4c(I)	CH_3	NH_2
4c(II)	CH_3	OCH_3
4c(III)	CH_3	CH_3
4c(IV)	CH_3	C_6H_5-OH
4d(I)	OH	NH_2
4d(II)	OH	OCH_3
4d(III)	OH	CH_3
4d(IV)	OH	C_6H_5-OH

Scheme for the synthesis of novel phenyl azo chalcone derivative

1-[4-(4-Amino-2-methyl-phenylazo)-phenyl]-3-(4-hydroxy-phenyl)-propenone 4d(III)

Mp: 130-132ºC, yield 45%. Analysis for $C_{22}H_{19}N_3O_2$. **λmax:** 309 **IR (KBr, cm^{-1}):** 3528, 3411 (NH_2 str), 3383 (b Ar-OH str), 2875 (Ar CH str), 2654 (Al CH str) 1709 (C=O str), 1631 (C=C str), 1575 (C-N str), 1281 (C-O str).

1-[4-(4-Hydroxy-naphthalen-2-ylazo)-phenyl]-3-(4-hydroxy-phenyl)-propenone 4d(IV)

Mp: 166-168ºC, yield 37%. Analysis for $C_{25}H_{18}N2O_3$. **λmax:** 337 **IR (KBr, cm^{-1}):** 3542 (b Ar-OH str), 2968 (Ar CH str), 1698 (C=O str), 1538 (C=C str), 1328 (C-N str).

1-[4-(4-Amino-phenylazo)-phenyl]-3-(3,4,5-trimethoxy-phenyl)-propenone 4e(I)

Mp: 174-176ºC, yield 27%. Analysis for $C_{24}H_{23}N_3O_4$. **λmax:** 301 **IR (KBr, cm^{-1}):** 3489, 3369 (NH_2 str), 2978 (Ar CH str), 2831 (Al CH str), 1698 (C=O str), 1531 (C=C str), 1385 (C-N str), 1288 (C-O str).

1-[4-(4-Amino-3-methoxy-phenylazo)-phenyl]-3-(3,4,5-trimethoxy-phenyl)-propenone 4e(II)

Mp: 178-180ºC, yield 34%. Analysis for $C_{25}H_{25}N_3O_5$ **λmax:** 332 **IR (KBr, cm^{-1}):** 3528, 3311 (NH_2 str), 2975 (Ar CH str), 2861 (Al CH str), 1698 (C=O str), 1631 (C=C str), 1385 (C-N str), 1288 (C-O str).

1-[4-(4-Amino-2-methyl-phenylazo)-phenyl]-3-(3,4,5-trimethoxy-phenyl)-propenone 4e(III)

Mp: 168-170ºC, yield 48%. Analysis for $C_{25}H_{25}N_3O_4$. **λmax:** 336 **IR (KBr, cm^{-1}):** 3484, 3389 (NH_2 str), 2918 (Ar CH str), 2867 (Al CH str), 1675 (C=O str), 1525 (C=C str), 1312 (C-N str), 1261 (C-O str).

1-[4-(4-Hydroxy-naphthalen-2-ylazo)-phenyl]-3-(3,4,5-trimethoxy-phenyl)-propenone 4e(IV)

Mp: 162-164ºC, yield 16%. Analysis for $C_{28}H_{24}N_2O5$. **λmax:** 339 **IR (KBr, cm^{-1}):** 3548 (Ar-OH str), 2978 (Ar CH str), 1695 (C=O str), 1518 (C=C str), 1495 (Ar-NO_2 str), 1329 (C-N str), 1261 (C-O str).

Antitubercular Activity [12]

The antitubercular activity of compounds was assessed against *M. tuberculosis* using Microplate Alamar Blue Assay (MABA). 200µl of sterile 96 wells plate was taken to minimize evaporation of medium in the test wells during incubation. The 96 wells plate received 100µl of the Middlebrook 7H9 broth and serial dilution of compounds were made directly on plate. The final drug concentrations tested were 100 to 0.2 µg/ml. Plates were covered and sealed with parafilm and incubated at 37°C for five days. After this time, 25µl of freshly prepared 1:1 mixture of Almar Blue reagent and 10% tween 80 was added to the plate and incubated for 24 hrs. The minimum concentration in which the drug inhibited the growth of *M. tuberculosis* was observed

Anti-Inflammatory Activity [13]:

A solution of 0.2% w/v of BSA was prepared in tris buffer saline and pH was adjusted to 6.8 using glacial acetic acid. Stock solutions of 1000µg/ml of all test samples were prepared by using methanol as a solvent. From the stock solutions two different concentrations of 100µg/ml and 200µg/ml were prepared by using methanol as a solvent. 100µg/ml (0.1ml) of each test sample was transferred to which 5ml of 0.2% BSA was added . The control consists of 5ml 0.2% w/v BSA solution with 0.1ml methanol. The volumetric flasks were heated at 72˚C for five minutes and then cooled for 10 min. The absorbance of these solutions was observed at a wavelength of 660 nm. The % denaturation of the protein (% inhibition) was determined by the formula

$$\%\text{Inhibition}=\frac{\text{Absorbance(control)-Absorbance(test)}}{\text{Absorbance(control)}}\times 100$$

Antioxidant Activity by 2, 2-diphenyl-1-picryl hydrazine (DPPH method) [14]:

10 mg of standard ascorbic acid was dissolved in methanol. From this stock solution dilutions were made to obtain concentrations of 10 to 40 µg/ ml. 1 ml from each of these solutions was taken in different volumetric flasks to which 1 ml of DPPH solution was added and volume was made up to 10 ml. The test solution were prepared in similar manner as that of standard ascorbic acid and the absorbance were recorded at 516 nm after duration of 30 min. The results of antioxidant activity is expressed as percentage inhibition and is given by the

formula$\%\text{Inhibition}=\frac{\text{Absorbance(control)-Absorbance(test)}}{\text{Absorbance(control)}}\times 100$

RESULTS AND DISCUSSION

Chemistry

Chalcones were prepared from diazotized 4-amino acetophenone with various substituted aldehydese. These compounds were treated with different coupling agents to obtain phenylazo dyes of chalcones **4(a-e)(I-IV).** The formation of chalcone moiety is proved by spectral studies. The IR absorption peaks are seen at 1672cm^{-1} of

carbonyl group, 1640cm^{-1} for double-bonded carbon and 1274cm^{-1} for C-N linkage. These were supported by the respective ^{1}HNMR and ^{13}CNMR values; the carbonyl carbon showed a peak at δ 196, olefinic carbons were seen at δ 142 and 130, their respective proton peaks were seen as doublet at δ 7.9 and 7.5 which supports the formation of the propenone moiety. The downfield shift at δ 138 and δ 147 for the aryl carbons indicated the presence of phenylazo moiety linked to the chalcone moiety.

Table1: Anti inflammatoryactivity of 3-phenyl-1-(4-phenylazophenyl) propenone 4(a-e)(I-IV)

Compound Code	% Inhibition	
	100 µg/ml	200µg/ml
4a(I)	40.52	50.68
4a(II)	10.34	60.10
4a(III)	-	-
4a(IV)	-	-
4b(I)	30.41	20.19
4b(II)	50.60	40.89
4b(III)	40.76	30.03
4b(IV)	-	-
4c(I)	50.98	40.76
4c(II)	30.25	20.12
4c(III)	70.59	40.43
4c(IV)	40.90	30.65
4d(I)	50.87	40.51
4d(II)	60.07	30.99
4d(III)	20.73	10.88
4d(IV)	40.75	40.41
4e(I)	40.99	10.06
4e(II)	-	-
4e(III)	20.11	10.68
4e(IV)	-	-
4e(V)	-	-
Standard	90	91

Antitubercular activity

It was found that the chalcone derivatives have shown inhibition for *M. Tuberculosis* H37 RV at 50 and 100 µg/ml concentrations due to the presence of electron releasing substituents on different aryl rings.

Table 2: Antioxidant activity of 3-phenyl-1-(4-phenylazophenyl) propenone 4(a-e)(I-IV)

Compound Code	% Inhibition		
	100 µg/ml	200 µg/ml	500 µg/ml
4a(I)	-	-	-
4a(II)	34.18	45.68	53.14
4a(III)	21.62	27.58	38.76
4a(IV)	57.83	54.10	-
4b(I)	26.2	24.4	17.78
4b(II)	34.82	52.93	39.4
4b(III)	27.05	52.28	33.44
4b(IV)	29.4	29.9	31.8
4c(I)	-	-	-
4c(II)	27.58	59.32	21.94
4c(III)	30.88	32.59	41.32
4c(IV)	36.10	26.30	36.31
4d(I)	55.37	55.58	56.55
4d(II)	30.67	35.89	36.84
4d(III)	38.02	37.16	25.66
4d(IV)	54.42	50.05	51.54
4e(I)	50.16	47.39	44.62
4e(II)	52.29	50.05	45.58
4e(III)	50.90	57.19	39.72
4e(IV)	11.18	13.21	10.97
4e(V)	-	-	-
Ascorbic acid	90.1	90.6	91.1

Anti-inflammatory activity

Chalcone derivatives have shown moderate anti-inflammatory activity.(see table 1) Among them, compounds with nitrochalcone coupled with aniline **4a(I),** anisidine **4a(II)** and methoxy chalcone coupled with anisidine **4b(II);** hydroxyl chalcone coupled with aniline **4d(I)** and anisidine **4d(II);** and methyl chalcone coupled with toluidine

4c(III) have shown moderate to good activity. These results may be attributed to the phenyl ring having electron releasing groups (OCH_3, NH_2, OH, CH_3). While the trimethoxy chalcones, **4e(II), 4e(IV)** irrespective of any coupling agent have failed to show activity. No significant activity was observed for phenylazophenylpropenone series having nitro group as substituent on the aryl ring. The effect of these 2 substituents may be due to the electron withdrawing nature of the nitro group and bulkiness of the trimethoxy group.

Antioxidant activity

Chalcone derivatives, **4a(IV), 4b(II), 4b(III), 4d(I), 4d(IV), 4e(II,III)** have shown 50 % free radical inhibition while other compounds have shown moderate activity.(see table 2)

CONCLUSION

The present study describes the synthesis of 3-phenyl-1-(4-phenylazophenyl) propenone. All the compounds have been obtained in good yields and purity. The structure of the compounds was confirmed by IR, NMR, mass and CHN spectral data. All the derivatives were evaluated for antitubercular, antioxidant and anti-inflammatory activities and it was found that the compounds have exhibited moderate to good activity.

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