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ZEOLITE CATALYSED SYNTHESIS OF 1-(4-AMINOPHENYL)-2-PHENYL-4-(4-SUBSTITUTED BENZYLIDENE)-5-IMIDAZOLONES.

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ABSTRACT

Imidazolones have gained immense significance due to their variety of applications as well as their diverse pharmacological action. In this work we have reported twelve newly synthesized imidazolones from oxazolones and phenylene diamine in presence of zeolite as a catalyst. The oxazolones in turn were obtained from benzoyl glycine and variedly substituted aromatic aldehydes in presence of acetic anhydride and sodium acetate .The characterization of these compounds was made by chemical properties, elemental analysis and spectral data like IR, ^{1}H-NMR.The use of zeolite as a catalyst afforded us rapid synthesis of imidazolones and increase in their percent yield.

KEYWORDS: **Benzoyl gylcine, oxazolones, zeolite catalyst, 5- imidazolones**.

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INTRODUCTION

Imidzolones are well know bioactive heterocyclic compounds containing three carbon and two nitrogen atoms at 1 and 3 position .The carbonyl group is present at 5th position. However imidazolones having carbonyl group at 2 and 4 position have also been reported. imidazolones are believed to be associated with several pharmacological activities. Many natural products are believed to contain imidazolone. For example Leucetta[1,2] and the Oroidin families of alkaloids[3] have been reported to contain either 2-aminoimidazole or 2-imidazolone moiety. Some substituted imidazolones are reported to possess monoamine oxidase(MAO)inhibitary and anticonvulsant activities[4,6] Mukerji et al[7] reported some new 5-imidazolones as CNS depressant. A more convenient method[8] for the direct conversion of imidazolium salts to the corresponding 2- imidazolones was developed . Treatment of the salt with the commercial bleach led to effective oxidation at C_2 and the formation of corresponding imidazolone. A straight forward preparation of [3,4-d] imidazolones[9] was described by employing either quaternization or anion metathesis strategy .Hebash[10] reported synthesis and biological evaluation of some new imidazolone derivatives. Alnashef and co-workers[11] reported the formation of 2- imidazolones by the reaction of potassium superoxides with alkyl imidazolium cations of imidazolium based ionic liquids at room temperature and atomospheric pressure.Anitha sadula[12] reported chalcone linked arylidene imidazolones and studied their antimicrobial and antioxidant properties. Sandra et al[13] synthesized 4-arylidene-5-imidazolones by reaction of arylpropiolates with amidine in presence of phosphine catalyst. Chopra and co-workers[14] reported microwave assisted synthesis of some -5-substituted imidazolone analogues as the most active xanthine oxidase inhibitors. Sadula and subhashini[15] reported "synthesis, characterization and biological evaluation of novel chalcone derivatives of imidazolones."Most of these methods required longer reflux time and percent yield was low. Therefore it was thought interesting to work out the reaction in such a manner as to reduce the reflux time and increase percent yield of the product also.

MATERIALS AND METHODS

Benzoyl glycine ,substituted aromatic aldehyde,p-phenylene diamine ,sodium acetate,acetic anhydride are required chemicals purchased from sd fine chemicals. All the chemicals used were of AR grade .Melting points were meseaured in open capillary tube .The purity of the compounds was checked by TLC on silica gel in petroleum ether and ethyl acetate (80:20). The IR spectra were recorded on Agilent Technologies Cary 630 FTIR.^{1}HNMR was recorded on Bruker AVANCE 400 MHz spectrometer using TMS as internal standard.In this work, condensation of benzoyl glycine with substituted aldehydes in acetic anhydride in presence of anhydrous sodium acetate was carried out to obtain variedly substituted oxazolones. Oxazolones thus obtained were further reacted with p-phenylene diamine in presence of zeolite as catalyst, to afford the formation of 1-(substituted phenyl)-2-phenyl-4-(substituted benzylidene)-5-imidazolones.

Step I : synthesis of 2-phenyl -4-(4-methoxybenzylidene-5-oxazolone)

4-methoxybenzaldehyde and benzoyl glycine were taken in equimolar(0.05mol)proportion in acetic anhydride. To this solution added 4gms of anhydrous sodium acetate. The reaction mixture was refluxed for two hours and kept overnight. The crystalline solid formed was washed with water ethanol mixture and recrystallised from ethanol.

Yield : 65% Melting point : 120^{0}C Molecular Weight : 279 Molecular formula: $C_{17}H_{13}NO_3$

IR : 2997 cm^{-1}(Ar,C-Hstr);2843 cm^{-1}(Aliph C-Hstr);1784(C=Ostr);1650 cm^{-1} (C=Nstr);1594(C=Cstr);1310(C-Ostr);1260(C-Nstr).

^{1}HNMR : 8.29(d,2H,Ar-H); 8.09(d,2H,Ar-H); 7.71(t,1H,Ar-H); 7.63(t,2H,Ar-H); 7.10(d,2H,Ar-H); 3.85(s,3H,-OCH_3);

Elemental analysis for $C_{17}H_{13}NO_3$(279) : C:73.12%,H :4.66%,N :5.02%,Found : C:73.10%,H :4.60%,N :5.00%.

Step II : Synthesis of 1-(4-aminophenyl)-2-phenyl-4-(4-methoxybenzylidene)-5-imidazolone.

Equimolar mixture of 2-phenyl-4-(4-methoxybenzylidene)-5-oxazolone and P-phenylene diamine (0.005mol) was dissolved in ethanol. One gram of zeolite was added to this solution .The reaction mixture was refluxed for two and half hours and was allowed to cool, acidified with dil HCl. An yellowish solid formed was washed with cold water and recrystallised from ethanol.

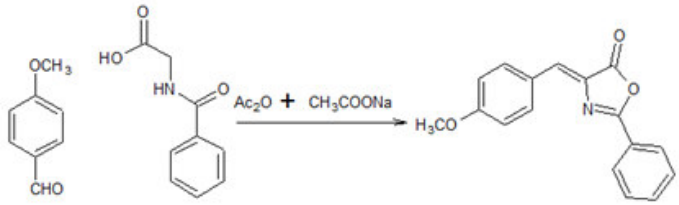
Yield : 60% Melting Point : 230^{0}C Molecular weight : 369 Molecular formula : $C_{23}H_{19}N_3O_2$

IR : 3225 cm^{-1}(N-Hstr);2918 cm^{-1}(Ar,C-Hstr);2848 cm^{-1}(Aliph C-Hstr);1712(C=Ostr);1642 cm^{-1} (C=Nstr);1602(C=Cstr);1510(N-H bending);1372(C-Ostr);1241(C-Nstr)

^{1}HNMR : 9.92(s,1H,Ar-H); 7.99(d,2H,Ar-H); 7.62(d,2H,Ar-H); 7.57(t,1H,Ar-H); 7.49(t,2H,Ar-H); 7.39(s,1H,Ph-CH); 6.91(d,2H,Ar-H); 4.17-4.23(q,2H,-NH_2); 3.76(s,3H,-OCH_3);1.25-1.28(t,3H,Ar-H);

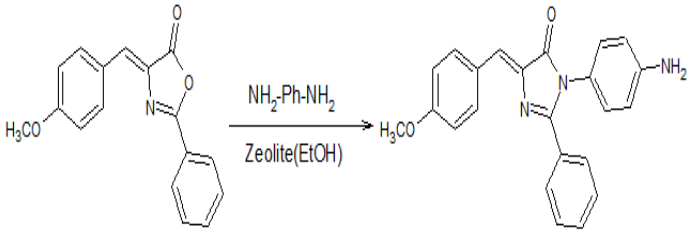
Elemental analysis for $C_{23}H_{19}N_3O_2$(369) : C:74.80%,H :5.15%,N :11.38%.Found : C:74.78%,H :5.12%,N :11.30%.

REACTIONS



(1a)

Step I
Synthesis of oxazolone



(1a) (2a)

Step II
Synthesis of Imidazolone

RESULTS

The precursors,2-phenyl-4-(substituted arylidene)-5-oxazolones required for the synthesis of imidazolones were prepared by the condensation of benzoyl glycine with variedly substitued aldehydes in presence of anhydrous sodium acetate in acetic anhydride. Their formation was confirmed by physical as well as chemical tests. Thus twelve variedly substituted oxazolones were obtained from different aldehydes and benzoyl glycine.The target compounds,1-(4-aminophenyl)-2-phenyl -4-(substituted arylidene)-5-imidazolones were synthesized by reacting each of these oxazolones with p-phenylne diamine in ethanolic medium in presence of zeolite as catalyst. By employing zeolite as a catalyst we could reduce reflux time substantially to two and half hours. Moreover it also offer easy to work out process for the isolation of the products. The compoud 2a gave orange colour with ethanolic solution of 2,4-dinitro phenyl hydrazine in presence of conc.H_2SO_4 confirming the presence of C=O.IR spectrum of1-(4-aminophenyl)-2-phenyl -4-(substituted arylidene)-5-imidazolone(2a) showed absoption band at 3225 cm-1 (due to N-H stretching), 2918 cm^{-1}(Ar,C-Hstr);2848 cm^{-1}(Aliph C-Hstr);1712(C=Ostr);1642 cm^{-1}(C=Nstr);1602(C=Cstr);1510(N-H bending);1372(C-Ostr);1241(C-Nstr)vibrations. Similarly ^1H NMR spectrum of 2a showed the following chemical shifts (δ) 9.92(s,1H,Ar-H); 7.99(d,2H,Ar-H); 7.62(d,2H,Ar-H); 7.57(t,1H,Ar-H); 7.49(t,2H,Ar-H); 7.39(s,1H,Ph-CH); 6.91(d,2H,Ar-H); 4.17-4.23(q,2H,-NH_2); 3.76(s,3H,-OCH_3);1.25-1.28(t,3H,Ar-H); which tallies with the molecular formula of 2a ($C_{23}H_{19}N_3O_2$).This was also supported by elemental analysis, experimental values of which are in agreement with calculated ones. All these evidences support the formation of 2a.Similar procedure was followed in the synthesis of other target compounds (2b to 2l) and the results are given in the following.

DISCUSSION

In order to develop more convenient, less time consuming and yield improving methodology ,we have undertaken this work covering variety of aldehydes and aromatic amines. We could achieve these objectives almost cent percent . We are pleased to communicate that we succeeded in synthesizing some hitherto unreported imidazolones. Most of the workers reported 6-8 hours for completion of the reaction but we could reduce it to as low as two and half hours .The catalyst (Zeolite) that we employed is inert and nontoxic due to which isolation of the product became quite easy .Unlike other workers we could improve % yield up to 70%. By employing zeolite as a catalyst probably activation energy needed for the conversion of reactants into transition state might have been lowered . By choosing basic medium, deprotonation of aromatic amines could be prevented .

Table
list of synthesized compounds their % yield and melting points

Sr. No	Compound	Percent yield (%)	Melting point (^oC)
1	1-(4-aminophenyl)-2-phenyl-4-(4-methoxybenzylidene)-5-imidazolone(2a)	58	230
2	1-(4-aminophenyl)-2-phenyl-4-(2-hydoxybenzylidene)-5-imidazolone(2b)	62	180
3	1-(4-aminophenyl)-2-phenyl-4-(4-nitrobenzylidene)-5-imidazolone(2c)	69	140
4	1-(4-aminophenyl)-2-phenyl-4-(4-hyoxybenzylidene)-5-imidazolone(2d)	60	130
5	1-(4-aminophenyl)-2-phenyl-4-(4-hyoxy3-methoxybenzylidene)-5-imidazolone(2e)	64	120
6	1-(4-aminophenyl)-2-phenyl-4-(2-nitrobenzylidene)-5-imidazolone(2f)	65	145
7	1-(4-aminophenyl)-2-phenyl-4-(4-chlorobenzylidene)-5-imidazolone(2g)	68	190
8	1-(4-aminophenyl)-2-phenyl-4-(4-dimethylaminobenzylidene)-5-imidazolone(2h)	65	230
9	1-(4-aminophenyl)-2-phenyl-4-(3,4,5,trimethoxybenzylidene)-5-imidazolone(2i)	70	140
10	1-(4-aminophenyl)-2-phenyl-4-(2-furanylidene)-5-imidazolone(2j)	60	130
11	1-(4-aminophenyl)-2-phenyl-4-(benzylidene)-5-imidazolone(2k)	55	120
12	1-(4-aminophenyl)-2-phenyl-4-(2-nitrobenzylidene)-5-imidazolone(2l)	60	150

CONCLUSION

Thus this method offers the most convenient route for the synthesis of 5-imidazolones.The use of zeolite as a catalyst reduces the reflux time to as low as two and half hours and increases the percent yield of the products. Moerover,it is non toxic and inert which makes isolation of target compounds more easy. all the target compounds reported herein are expected to show antimicrobial activity and therefore need to be tested against several microorganisms.

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