TechnoChem

International Journal of TechnoChem Research
ISSN:2395-4248 www.technochemsai.com
Vol.01, No.02, pp 97-101, 2015

Synthesis and characterization of 1,3-diphenylallylidenebenzothiazol-2-amine derivatives

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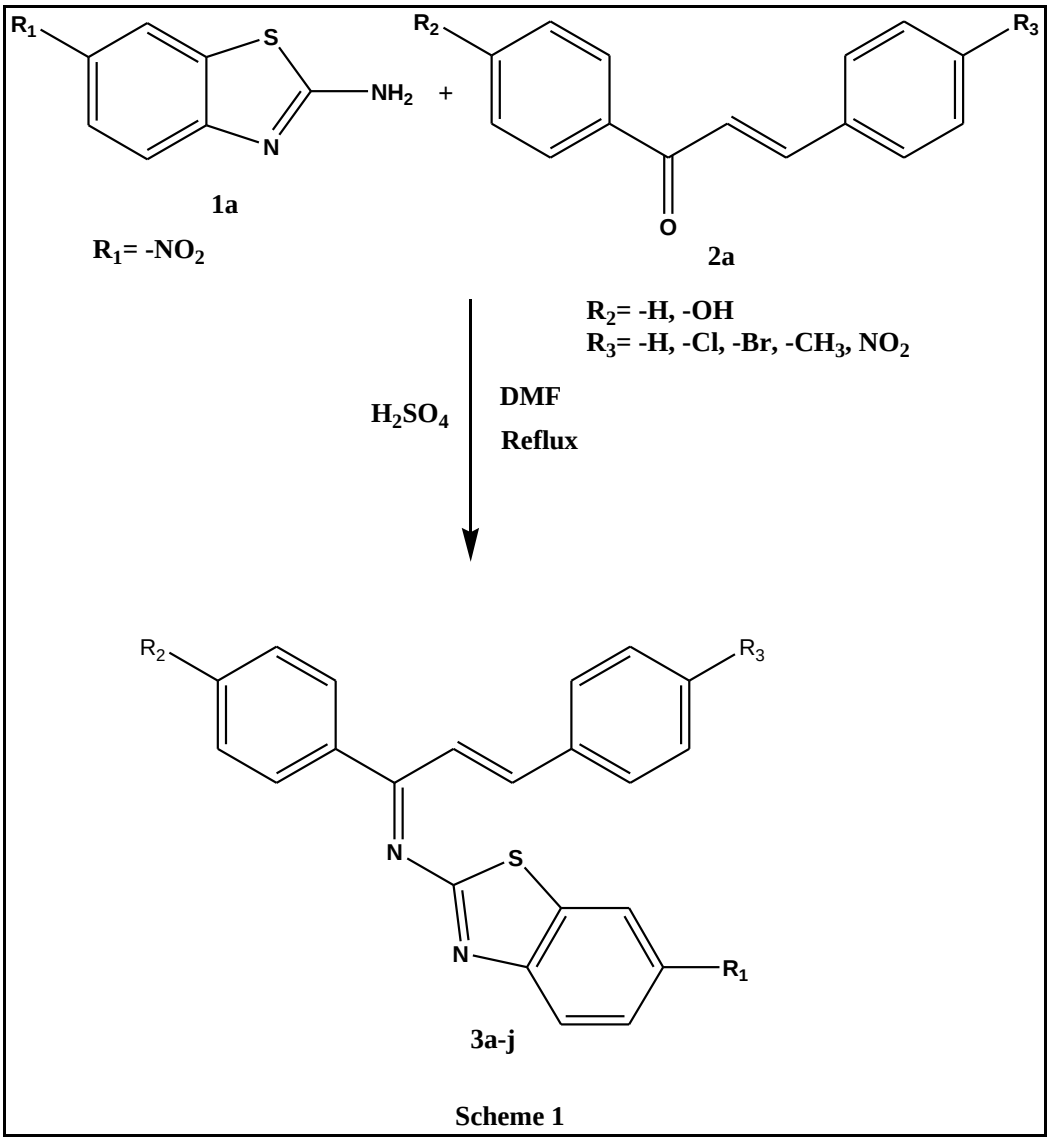
Abstract: Diphenylallylidenes are the compounds of immense biological importance. The presentwork starts with the synthesis of substituted chalcones and 2-amino-benzothiazoles. The chalcones were synthesized from substituted benzaldehyde and acetophenone. 2-amino-benzothiazoles were synthesized from substituted aniline with potassium thiocyanate. The reaction of substituted chalcones and 2-aminobenzothiazoles gives corresponding 1,3-diphenylallylidene derivative by using conc. sulfuric acid in dimethylformamide solvent at reflux condition. All the newly synthesized compounds were characterized on the basis of their physical, spectral and analytical data.
Keywords: Diphenylallylidene, Chalcone, 2-aminobenzothiazole, Sulfuric acid.

Introduction:

Owing to importance in pharmaceutical utilities, the synthesis of various benzothiazole derivatives has charming considerable interests.The small and simple benzothiazole nucleus is present in compounds involved in research aimed at evaluating new products that possess interesting biological activities like antitumor[1], antimicrobial[2], antifungal agents[3]. On the other hand, the function of the amidinic group present in a variety of antimicrobial and anti-parasitic agents is also well known[4]. Here we reacted (**Scheme 1**) substituted 2 -amino-benzothiazole with substituted chalcones to form the 1,3-diphenylallylidene derivatives of benzothiazoles which possess various biological activities such as,antibacterials[5], antitubercular[6], antifungal[7], anti-inflammatory[8], antipyretic[9], 5-HT antagonist[10], antihypertensive[11], anticancer[12], anticonvulsant[13], anticoagulant[14], α-amylase inhibitor[15], anaesthetic[16], antidiuretic[17] and antiviral[18] properties etc.

Experimental:

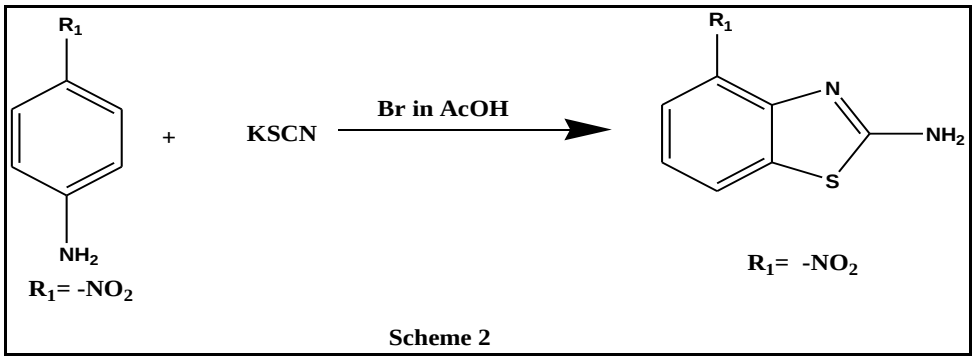
Reagent grade chemicals were used without further purification. Melting points were taken in open capillary tubes and are uncorrected. The purity of the synthesized compounds was checked by Thin Layer Chromatographic studies. IR spectra were scanned on FTIR Perkins Elmer (Spectrum RX1) spectrophotometer (cm^{-1}) using a KBr disc. ^1H NMR spectra was recorded in tetramethylsilane (TMS) as the internal standard at 300 MHz on a Bruker DRTX-300 spectrophotometer. The reaction for the synthesis of 1,3-diphenylallylidene benzothiazole-2-amine derivatives is given in **Scheme 1**. The reaction for synthesis of substituted benzothiazole and chalconesare given in **Scheme 2** and **Scheme 3**.



Scheme 1

General procedure for synthesis of 2-amino-6-nitro-benzothiazole:

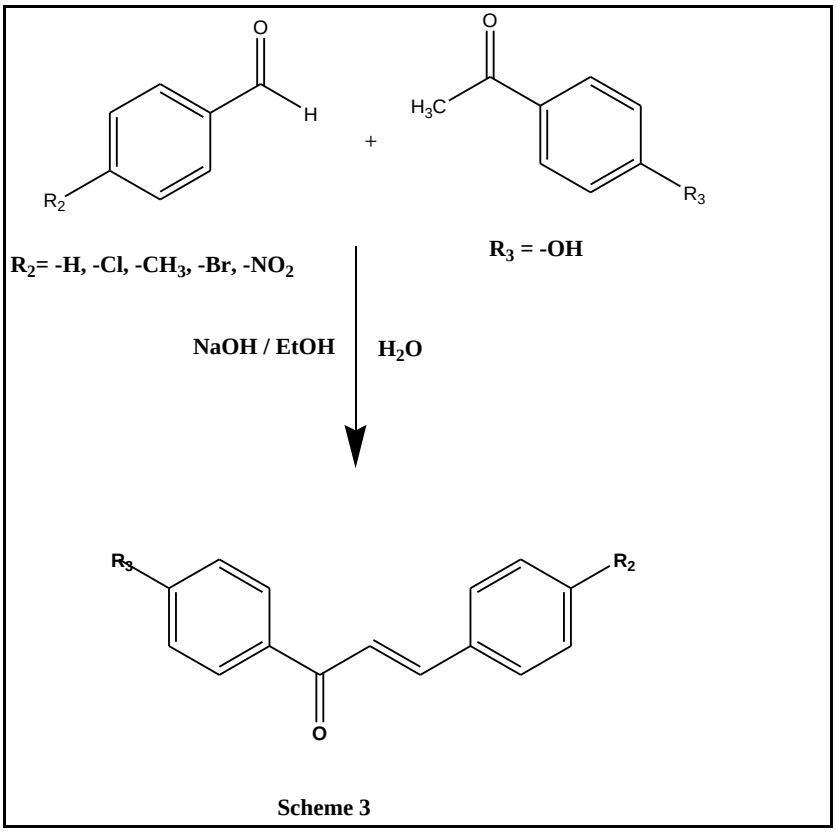
One step process for synthesis of 2-aminobenzothiazole have been reported using substituted aniline, potassium thiocyanate and bromine in acidic condition at low temperature (0-5^{O}C). For the acidic media acetic acid as solvent is used for the synthesis of Substituted 2-aminobenzothiazole[19].



Scheme 2

General procedure for synthesis of substituted chalcones:

0.01 molof acetophenone was mixed with 0.01 mol of aryl aldehyde and then the reaction mixture was stirred in 30 ml of ethanol. Then add aqueous Solution of 15 ml NaOH. The reaction mixture was kept for overnight at room temperature. The mixture was poured into crushed ice, acidified with dilute HCl and the chalcones were precipitated out as solid. It was filtered and crystallized fromethanol[20].



Scheme 3

General procedure for synthesis of 1,3-diphenylallylidene benzothiazole-2-amine derivatives:

In 50ml round bottom flask, take 20ml of DMF, to this solution add 1.5mmol of Chalcone and 1 mmol of 2-amino-6-nitro-benzthothiazole. In this mixture, add 4-5 drops of conc. H_2SO_4 and reflux the mixture at 80-100^oC for 4 hrs. Progress of the reaction was monitored by using thin layer chromatography. After completion of reaction mixture was cooled and poured on crushed ice and stirred. After stirring, the reaction mixture was filtered and dried it to obtain the crude product. Pure product was obtained after silica gel chromatography (Ethyl acetate: Pet ether). Results of the pure products were summarized in **Table 01**.

Spectral data of some compounds:

1.(15E)-N-((E)-3-(4-chlorophenyl)-1-phenylallylidene)-6-nitrobenzo[d]thiazol-2-amine (Table 1, entry 2):KBr ν in cm^{-1} = 3536, 3109, 1657, 1609, 1538, 1499, 889, 754,

^{1}HNMR (DMSO) δ = 7.57-7.76 (3H, m), 7.40-7.54 (2H, m), 5.430(1H, d), 6.40 (1H, d), 8.68-8.69 (1H, d), 7.93-7.95 (2H, d), 8.00-8.07 (2H, d), 8.10-8.11 (1H, d), 8.155-8.17 (1H, d).

m/z = 439.2 (M^++18)

Result and Discussion:

As part of our efforts in synthesis of 1,3-diphenylallylidene benzothiazole-2-amine derivatives, we have developed an efficient and simple one pot synthesis of 1,3-diphenylallylidene-2-amino-benzothiazole derivatives using 2-amino-6-nitrobenzothiazole by using conc. H_2SO_4 in dimethyl formamide at reflux condition.

For our initial studies, selecting the reaction of chalcones of benzaldehyde and acetophenone with 2-amino-6-nitro benzothiazole **(Table 1, entry 1)**in DMF solvent by using conc. H_2SO_4 4-5 drops at reflux condition, the corresponding product was obtained after 7 Hours with 73 % yield of the product**(Table 1, entry 1)**. With the optimized condition established above under reflux condition a wide range of substituted chalcones were treated with 2-amino-6-nitro benzothiazole for the synthesis of 1,3-diphenylallylidene benzothiazole-2-amine derivatives has been summarized in **Table 1**. The chalcones with electron withdrawing substituents **(Table 1, Entry 2,4,5,7,9,10)** produce 70%-80% yields. The chalcones with electron donating or releasing substituents **(Table 1, Entry 1,3,6,8)** produce good yields 73%-78%. These suggest that method is suitable for synthesis of 1,3-diphenylallylidene benzothiazole-2-amine derivatives by using catalytic amount of concentrated sulfuric acid in dimethylformamide solvent.

Conclusion:

The main focus of this research work was to synthesize, purify and characterize the newly synthesized Diphenylallylidenederivatives.In conclusion, we have described an efficient protocol for synthesis of 1,3-diphenylallylidene benzothiazole-2-amine derivativesby using catalytic amount of concentrated sulfuric acid in dimethylformamide solvent. The advantages of the present method lie in using easily available, cheap catalyst, reflux conditions and good yields. All the synthesized compounds were characterized byFTIR, NMR and MASS spectroscopy.

Table 01: Synthesis of 1,3-diphenylallylidene benzothiazole-2-amine derivativesby usingconc. H_2SO_4 at reflux condition in DMF.

Sr.No	Chalcone		Benzothiazole	Product	Time in hr.	Yields(%)
	R_2	R_3	R_1			
1	-H	-H	1a	3a	7	73
2	-Cl	-H	1a	3b	5	80
3	$-CH_3$	-H	1a	3c	4	78
4	-Br	-H	1a	3d	6	81
5	$-NO_2$	-H	1a	3e	5	84
6	-H	-OH	1a	3f	6	72
7	-Cl	-OH	1a	3g	5	81
8	$-CH_3$	-OH	1a	3h	4	77
9	-Br	-OH	1a	3i	7	74
10	$-NO_2$	-OH	1a	3j	7	81

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