



Research Article

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Synthesis of novel benzimidazole derivatives

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ABSTRACT

We report the synthesis of novel benzimidazole derivatives by performing following reaction and all the synthesized compounds characterized using spectroscopic techniques. The reaction of *O*-phenylenediamine (**1**) with 2-cyanoquinidine (**2**) produced 2-quinidinobenzimidazole (**3**). The compound **3** was reacted with various chalcones (**4a-f**) obtained from reaction between acetophenone and substituted benzaldehyde produced benzimidazole derivatives **6a-f** in very good yields.

Keywords: *O*-phenylenediamine, Benzimidazole, Cyanoguanidine, acetophenone, chalcones.

INTRODUCTION

Heterocyclic compounds are abundant in nature and they have great significance to life because of their structural subunits exist in many natural products such as vitamins, hormones, antibiotics etc. Benzimidazole is a bicyclic system in which benzene ring has been fused to the 4th and 5th position of the heterocyclic ring (imidazole). Benzimidazole nucleus is found in a variety of naturally occurring compounds such as vitamin B12 and its derivatives which is structurally similar to purine bases. Benzimidazole ring system known to possess numerous antimicrobial [1-8], anti-inflammatory [9], anthelmintic [10], antiviral [11-12], anti-tumour [13] and their chemotherapeutic importance [14-16]. Therefore it was enabled that compounds containing benzimidazole nucleus would result in interesting biological activities. In view of these valid observations about benzimidazole derivatives and as a continuation of our work on synthesis of novel heterocyclic compounds, we planned to synthesize some novel benzimidazole derivatives.

EXPERIMENTAL SECTION

General: Chemicals were procured from E. Merck (India), S. D. Fine Chemicals (India) and reagent/solvents were used without distillation procedure. Melting points were taken in open capillary tubes and are uncorrected. IR (KBr) spectra were recorded on a Perkin-Elmer 157 infrared spectrometer (ν in cm^{-1}) and NMR spectra were recorded on a Bruker spectrometer DPX-300MHz (Bruker, Germany) by using CDCl_3 or DMSO as solvent with tetramethylsilane (TMS) as an internal standard. All the spectral data are consistent with the assigned structures of the desired product and the progress of the reactions was monitored on silica gel G plates using iodine vapour as visualizing agent.

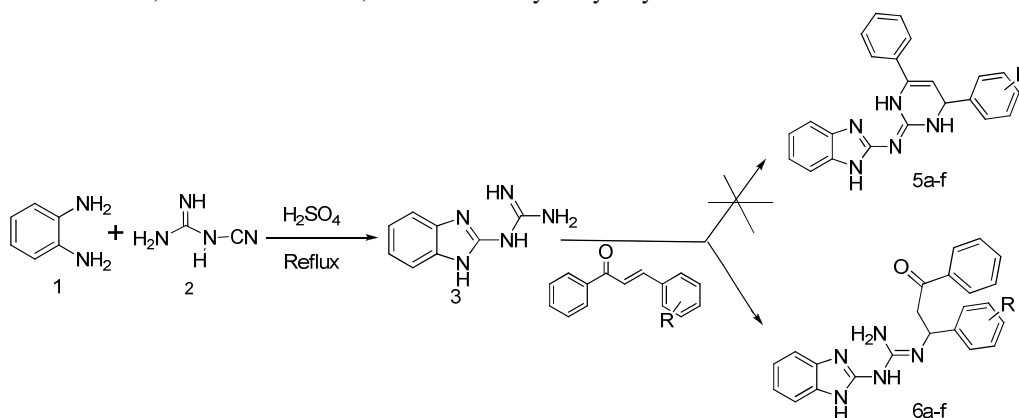
Procedure for preparation of 2-quinidinobenzimidazole (**3**):

O-phenylenediamine (10 mmol) were dissolved on heating in 10 mL of 10% sulfuric acid and 2-cyanoquinidine (20 mmol) was added. The reaction mixture was heated for 30 min and then 10 mL of 50% sodium hydroxide solution was added and heated for further 20 minutes. The reaction mixture was cooled and the obtained

solid was collected by filtration and washed with water. The prepared compounds were sufficiently pure and used without further purification with 80% yield.

Procedure for preparation of benzimidazole derivatives (6a-f):

A mixture of 2-guanidinobenzimidazole **3** (0.01 moles) and various chalcones **4a-f** was refluxed for 2-3 hr in distilled ethanol (40 mL) with catalytic amount of NaOH. The progress of the reaction was monitored by using TLC technique. After completion of the reaction indicated by TLC, the mixture was poured in crushed ice. The solid formed was filtered off, washed with water, dried and finally recrystallized from ethanol.



RESULTS AND DISCUSSION

The reaction of *O*-phenylenediamine (**1**) with 2-cyanoaniline (**2**) produced 2-guanidinobenzimidazole (**3**). The compound **3** was reacted with various chalcones (**4a-f**) produced benzimidazole derivatives **6a-f** instead of compounds **5a-f** in very good yields. The Melting point, TLC, color change during reaction and spectroscopic techniques such as IR, ¹H-NMR and ¹³C-NMR are well supported our desired products (see **Table-2**).

Table-1: Physical properties of compounds 6a-f

Comp	R	Yield (%)	Mp (°C)	R _f value
6a	4-NO ₂	90	220-222	0.55
6b	3-NO ₂	82	198-200	0.40
6c	4-CH ₃	75	>300	0.57
6d	4-Cl	80	170-172	0.58
6e	4-OCH ₃	78	230-232	0.60
6f	4-N(Me) ₂	70	140-142	0.61

Table-2: Spectral data of compounds 6a-f

Comp	IR (Cm ⁻¹)	¹ H-NMR (δ ppm)	¹³ C-NMR (δppm)
6a	3450.70, 2920.21, 1638.25, 1509.13, 1232.26, 730.06	3.04-3.05(d, 2H), 3.26-3.29(t, 1H), 5.16(NH ₂), 5.35(NH), 6.75-7.74(m, 13Ar-H), 11.79 (NH).	40.85(CH ₂), 45.20(CH), 100.1, 107.5, 128.12, 128.47, 128.64, 128.81, 128.89, 129.84, 131.83, 132.17, 133.67, 133.88, 139.45(18Ar-C), 206.90(C=O)
6b	3450.22, 2923.59, 1631.50, 1384.84, 1232.26, 727.23	3.32-3.33(d, 2H), 3.44-3.50(t, 1H), 4.5(NH ₂), 5.64(NH), 6.77-7.85 (m, 13Ar-H), 11.74(NH).	41.80(CH ₂), 45.61(CH), 100.1, 108.5, 127.4, 127.6, 128.12, 128.47, 128.64, 128.71, 128.84, 129.34, 131.83, 132.17, 133.67, 133.66, 139.45(18Ar-C), 207.06(C=O)
6c	3445.25, 2925.93, 1638.99, 1509.13, 1232.26, 730.06	2.25(s, CH ₃), 3.05-3.08(d, 2H), 3.28-3.33(t, 1H), 5.03(NH ₂), 5.07(NH), 7.12-7.99(m, 13Ar-H), 12.00 (NH).	29.73(CH ₃), 40.62(CH ₂), 45.06(CH), 100.1, 107.5, 126.6, 127.3, 128.0, 128.1, 128.6, 129.2, 129.3, 129.5, 130.0, 131.1, 133.0, 137.0, 141.6, 141.8, 149.5, 159.2(18Ar-C), 199.3(C=O)
6d	3450.70, 2920.21, 1638.25, 1579.47, 1375.75, 768.19	3.03-3.06(d, 2H), 3.27-3.32(t, 1H), 5.10(NH ₂), 5.52(NH), 7.02-7.98 (m, 13Ar-H), 11.99 (NH).	40.14(CH ₂), 44.73(CH), 99.32, 100.1, 107.5, 120.6, 125.2, 127.4, 128.6, 128.6, 128.7, 128.8, 128.9, 129.1, 129.4, 129.6, 129.8, 129.8, 132.3, 133.2, 133.7, 139.7, 142.3, 142.5(18Ar-C), 198.9(C=O)
6e	3451.77, 2925.62, 1627.50, 1578.67, 1232.17, 766.41	3.00-3.03(d, 2H), 3.26-3.33(t, 1H), 3.77(s, OCH ₃), 5.10(NH ₂), 5.20 (NH), 6.81-8.04 (m, 13Ar-H), 12.00 (NH).	41.50(CH ₂), 46.00 (CH), 55.29 (OCH ₃), 108.5, 127.4, 127.0, 128.12, 128.47, 128.64, 128.44, 129.34, 131.62, 132.11, 133.67, 133.54, 139.45(18Ar-C), 205.20(C=O)
6f	3440.50, 2930.21, 1638.25, 1509.13, 1132.26, 730.06	2.85, 2.89, (N(Me) ₂), 3.00-3.2(d, 2H), 3.32-3.34(t, 1H), 5.20(NH ₂), 6.73-7.80 (m, 13Ar-H), 11.92 (NH).	41.55(CH ₂), 42.65 (N(Me) ₂), 46.00 (CH), 107.2, 126.4, 127.42, 128.77, 128.62, 128.44, 129.34, 131.62, 132.11, 133.67, 133.54, 136.32, 139.01(18Ar-C), 200.10(C=O)

CONCLUSION

The six novel benzimidazole derivatives were synthesized in very good yields. All the compounds were characterized with help of spectroscopic techniques and these were well supported our proposed structure.

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