Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2014, 6(3):1199-1204

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Synthesis of N,N^1-disubstitutedbisbenzimidazolesulphides of Potential Pharmacological Interest

S. Srinivas Rao*, Ch. Venkata Ramana Reddy and P. K. Dubey

Department of Chemistry, Jawaharlal Nehru Technological University Hyderabad College of Engineering, Kukatpally, Hyderabad (A.P.), India

---

ABSTRACT

*2-(1-chloroethyl)-1H-benzimidazole (**1a**, i.e. **1**, R=H) on condensation with (1H-benzimidazol-2-yl)methanethiol (**2a**, i.e. **2**, R^1=H) in methanol using triethylamine as a base under reflux for 3 hrs yielded bis((1H-benzimidazol-2-yl)methyl)sulfane (**3a,** i.e. **3**, R=R^1=H) which on alkylation using two equivalents of alkylating agent in dimethylformamide (DMF) as solvent and K_2CO_3 as a base using tetra-n-butylammonium bromide (TBAB) as phase transfer catalyst (PTC) gave N,N^1-dialkylbisbenzimidazolesulphides **3b-e.** Alternatively, **3b-e** could also be prepared by condensing 2-(1-chloroethyl)-1-alkyl-1H-benzimidazole (**1b-e**, i.e. **1**, R=methyl, ethyl, benzyl and n-butyl) and (1-alkylbenzimidazol-2-yl)methanethiol (**2b-e**, R^1= methyl, ethyl, benzyl and n-butyl) in a single step. Using this synthetic strategy, N,N^1- unsymmetricallydialkylbisbenzimidazolesulphides **3f-q** were prepared either by condensing 2-(1-chloroethyl)-1H-benzimidazole (**1a**, i.e. **1**, R=H) with (1-alkylbenzimidazol-2-yl)methanethiol **2b-e,** i.e. R^1=alkyl^1 to obtain **3** (R=H, R^1=alkyl^1) followed by alkylation under PTC conditions or by condensing **1a** (i.e. **1**, R=alkyl) with N-unsubstituted-2-mercaptobenzimidazole (**2a**, i.e. **2** , R^1=H) to yield **3** (R= alkyl^1, R^1=H) followed by alkylation under PTC conditions. Direct condensation of N-substituted-2-(1-chloroethyl)-1H-benzimidazole (**1b-e,** i.e. **1**, R=alkyl) with (1-alkylbenzimidazol-2-yl)methanethiol **2b-e**, i.e. **2**, R^1=alkyl^1) also gave the respective **3f-q.***

Key words: Benzimidazole, Triethylamine, 2-chloromethylbenzimidazole, triethylamine, MeOH

INTRODUCTION

Benzimidazole derivatives [1-4] play an important role in medical field with so many Pharmacological activities [5-10]. In continuation of our earlier work on synthesis of 2-substitutedbenzimidazoles [11-15], we now wish to report our studies on the synthesis of unsymmetrical, N,N^1-(dialkyl)substitutedbisbenzimidazolesulphides containing different alkyl substituents.

EXPERIMENTAL SECTION

Melting points were determined in open capillaries in sulfuric acid bath and are uncorrected. Thin-layer chromatography (TLC) analyses were done on glass plates coated with silica gel GF-254 and spotting was done using Iodine or UV lamp. IR Spectra were recorded with Jasca FT-IR 5300. ^{1}H NMR were recorded in $CDCl_3$ / DMSO using Varian 400-MHz instrument, and Mass spectra were recorded on an Agilent LC-MS instrument giving only M^+ values in Q+1 mode. Starting Materials **1a** (R=H), **2a** (R^1=H) and **3a** (R=R^1=H) were prepared using literature methods [11, 12].

Preparation of 3b-e from 3a (R=R^1=H):
A mixture of **3a** (R=R^1=H) (5 mmole), K_2CO_3 (10 mmole), TBAB (10 mg), DMF (20 ml) and two equivalents of appropriate alkylating agent were stirred at room temp for 3 hrs. At the end of this period, the reaction mixture was

poured into ice-cold water. The separated solid was filtered, washed with water (2×10ml) and dried to obtain crude **3b-e** which on recrystallization from a suitable solvent gave pure **3b-e**.

Spectral Data:
3b: IR (KBr): No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 3.76 (s, 3H, -NCH_3 of –CH_2Bz), 3.85 (s, 3H, -NCH_3 of -SBz), 6.80-7.60 (complex, m, 8H, aryl protons), 4.65 (s, 4H, -CH_2); MS (CI): m/z 323 [$M^{\cdot+}$+1]; [Found: C, 67.12; H, 5.65; N, 17.28; S, 9.98, $C_{18}H_{18}N_4S$ requires C, 67.05; H, 5.63; N, 17.38; S, 9.94].

3c: IR (KBr): No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 1.28 (q, 4H, -NCH_2 of ethyl of –CH_2Bz), 3.78 (t, 6H, -CH_3 of ethyl of –CH_2Bz), 6.50-7.62 (complex, m, 8H, aryl protons), 4.74 (s, 2H, -CH_2); MS (CI): m/z 351 [$M^{\cdot+}$+1]; [Found: C, 68.60; H, 6.37; N, 15.93; S, 9.19, $C_{20}H_{22}N_4S$ requires C, C, 68.54; H, 6.33; N, 15.99; S, 9.15].

3d: IR (KBr): No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 4.64 (s, 4H, -NCH_2 of benzyl of –CH_2Bz), 5.28 (s, 4H, NCH_2 of benzyl of -SBz), 7.24-8.40 (complex, m, 18H, 10 aromatic benzyl + 8H aryl protons), 4.89 (s, 2H, -CH_2); MS (CI): m/z 475 [$M^{\cdot+}$+1]; [Found: C, 75.85; H, 5.58; N, 11.86; S, 6.70, $C_{30}H_{26}N_4S$ requires C, 75.92; H, 5.52; N, 11.80; S, 6.76].

3e: IR (KBr): No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 1.35 (t, 4H, -NCH_2 of butyl of –CH_2Bz), 1.67 (p, 4H, -NCH_2CH_2 of butyl of –CH_2Bz), 2.56 (st, 4H, -$NCH_2CH_2CH_2$ of butyl of –CH_2Bz), 3.70 (t, 6H, -$NCH_2CH_2CH_2CH_3$ of butyl of –CH_2Bz), 6.55-7.84 (complex, m, 8H, aryl protons), 4.56 (s, 2H, -CH_2); MS (CI): m/z 407 [$M^{\cdot+}$+1]; [Found: C, 70.82; H, 7.46; N, 13.70; S, 7.92, $C_{24}H_{30}N_4S$ requires C, 70.90; H, 7.44; N, 13.78; S, 7.89].

Alternative Procedure for Preparation of 3b-e:
A mixture of **1** (R=alkyl) (0.87g, 5 mmole), **2** (R^1=alkyl) (0.95gr, 5 mmole), methanol (20 ml) and triethylamine (0.46ml) was refluxed for 3 hrs. At the end of this period, the reaction mixture was poured into ice-cold water (50ml). The separated solid was filtered, washed and dried to obtain crude **3b-e** which on recrystallization from a suitable solvent gave pure **3b-e**.

Preparation of 3f-q from 3 (R=H, R^1=alkyl) **/ 3** (R=alkyl, R^1=H) (General Procedure):
A mixture of **3**(R=H, R^1=alkyl)/ **3**(R=alkyl, R^1=H) (0.140g, 5 mmole), K_2CO_3 (1.6gr, 10 mmole), TBAB (10 mg), DMF (20ml) and alkylating agent (0.04ml, 5mmol) were stirred at room temp for 3 hrs. At the end of this period, the reaction mixture was poured into ice-cold water. The separated solid was filtered, washed with water and dried to obtain crude **3f-q** which on recrystallization from ethyl acetate gave pure **3f-q**.

Spectral Data:
3f: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H NMR(400 MHz, DMSO-d_6/ TMS): δ 3.69 (s, 6H, -NCH_3 of -CH_2Bz), 1.62 (q, 4H, -NCH_2 of ethyl of –CH_2Bz), 3.82 (t, 6H, -CH_3 of ethyl of –CH_2Bz), 6.60-7.62 (complex, m, 8H, aryl protons), 4.98 (s, 4H, -CH_2); MS (CI): m/z 337 [$M^{\cdot+}$+1], [Found: C, 67.88; H, 6.05; N, 16.73; S, 9.59, $C_{19}H_{20}N_4S$ requires C, 67.83; H, 5.99; N, 16.65; S, 9.53].

3g: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 3.62 (s, 3H, -NCH_3 of -CH_2Bz), 4.66 (s, 2H, -NCH_2 of benzyl of SBz), 7.20-8.50 (complex, m, 13H, 5H aromatic benzyl + 8H aryl protons), 4.90 (s, 4H, -CH_2); MS (CI): m/z 386 $[M+H]^+$. [Found: C, 72.40; H, 5.50; N, 14.12; S, 8.01, $C_{24}H_{22}N_4S$ requires C, 72.33; H, 5.56; N, 14.06; S, 8.05].

3h: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 3.72 (s, 3H, -NCH_3 of -CH_2Bz), δ 1.35 (t, 2H, -NCH_2 of butyl of –-CH_2Bz), 1.67 (p, 2H, -NCH_2CH_2 of butyl of –-CH_2Bz), 2.56 (st, 2H, -$NCH_2CH_2CH_2$ of butyl of –-CH_2Bz), 3.70 (t, 3H, -$NCH_2CH_2CH_2CH_3$ of butyl of –-CH_2Bz), 6.65-7.64 (complex, m, 8H, aryl protons), 4.80 (s, 4H, -CH_2); MS (CI): m/z 365 [$M^{\cdot+}$+1]; [Found: C, 69.16; H, 6.69; N, 15.42; S, 8.72, $C_{21}H_{24}N_4S$ requires C, 69.20; H, 6.64; N, 15.37; S, 8.80].

3i: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H NMR(400 MHz, DMSO-d_6/ TMS): δ 3.69 (s, 6H, -NCH_3 of -CH_2Bz), 1.62 (q, 4H, -NCH_2 of ethyl of –CH_2Bz), 3.82 (t, 6H, -CH_3 of ethyl of –CH_2Bz), 6.60-7.62 (complex, m, 8H, aryl protons), 4.98 (s, 4H, -CH_2); MS (CI): m/z 337 [$M^{\cdot+}$+1], [Found: C, 67.88; H, 6.05; N, 16.73; S, 9.59, $C_{19}H_{20}N_4S$ requires C, 67.83; H, 5.99; N, 16.65; S, 9.53].

3j: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 4.82 (s, 2H, -NCH_2 of benzyl of -CH_2Bz), 1.60 (q, 2H, -NCH_2 of ethyl of - CH_2Bz), 3.90 (t, 3H, -CH_3 of ethyl of – CH_2Bz) 7.60-8.32 (complex, m, 13H, 5H aromatic benzyl + 8H aryl protons), 4.82 (s, 4H, -CH_2); MS (CI): m/z 413 [$M^{\cdot+}$+1], [Found: C, 72.83; H, 5.93; N, 13.63; S, 7.81, $C_{25}H_{24}N_4S$ requires C, 72.78; H, 5.86; N, 13.58; S, 7.77].

3k: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 1.58 (q, 2H, -NCH_2 of ethyl of -CH_2Bz), 3.82 (t, 3H, -CH_3 of ethyl of -CH_2Bz), δ 1.35 (t, 2H, -NCH_2 of butyl of – CH_2Bz), 1.67 (p, 2H, -NCH_2CH_2 of butyl of – CH_2Bz), 2.56 (st, 2H, -$NCH_2CH_2CH_2$ of butyl of – CH_2Bz), 3.70 (t, 3H, -$NCH_2CH_2CH_2CH_3$ of butyl of – CH_2Bz), 6.62-7.62 (complex, m, 8H, aryl protons), 4.81 (s, 4H, -CH_2); MS (CI): m/z 379 [$M^{\cdot+}$+1]. [Found: C, 69.75; H, 6.99; N, 14.72; S, 8.52, $C_{22}H_{26}N_4S$ requires C, 69.80; H, 6.92; N, 14.80; S, 8.47].

3l: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 3.62 (s, 3H, -NCH_3 of -CH_2Bz), 4.66 (s, 2H, -NCH_2 of benzyl of SBz), 7.20-8.50 (complex, m, 13H, 5H aromatic benzyl + 8H aryl protons), 4.90 (s, 4H, -CH_2); MS (CI): m/z 386 $[M+H]^+$. [Found: C, 72.40; H, 5.50; N, 14.12; S, 8.01, $C_{24}H_{22}N_4S$ requires C, 72.33; H, 5.56; N, 14.06; S, 8.05].

3m: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 4.82 (s, 2H, -NCH_2 of benzyl of -CH_2Bz), 1.60 (q, 2H, -NCH_2 of ethyl of - CH_2Bz), 3.90 (t, 3H, -CH_3 of ethyl of – CH_2Bz) 7.60-8.32 (complex, m, 13H, 5H aromatic benzyl + 8H aryl protons), 4.82 (s, 4H, -CH_2); MS (CI): m/z 413 [$M^{\cdot+}$+1], [Found: C, 72.83; H, 5.93; N, 13.63; S, 7.81, $C_{25}H_{24}N_4S$ requires C, 72.78; H, 5.86; N, 13.58; S, 7.77].

3n: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 4.82 (s, 2H, -NCH_2 of benzyl of -CH_2Bz), δ 1.35 (t, 2H, -NCH_2 of butyl of –CH_2Bz), 1.67 (p, 2H, -NCH_2CH_2 of butyl of – CH_2Bz), 2.56 (st, 2H, -$NCH_2CH_2CH_2$ of butyl of – CH_2Bz), 3.70 (t, 3H, -$NCH_2CH_2CH_2CH_3$ of butyl of – CH_2Bz), 6.62-7.62 (complex, m, 8H, aryl protons), 4.81 (s, 4H, -CH_2); MS (CI): m/z 441 [$M^{\cdot+}$+1], [Found: C, 73.56; H, 6.48; N, 12.66; S, 7.33, $C_{27}H_{28}N_4S$ requires C, 73.60; H, 6.41; N, 12.72; S, 7.28].

3o: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 3.72 (s, 3H, -NCH_3 of -CH_2Bz), δ 1.35 (t, 2H, -NCH_2 of butyl of –-CH_2Bz), 1.67 (p, 2H, -NCH_2CH_2 of butyl of –-CH_2Bz), 2.56 (st, 2H, -$NCH_2CH_2CH_2$ of butyl of –-CH_2Bz), 3.70 (t, 3H, -$NCH_2CH_2CH_2CH_3$ of butyl of –-CH_2Bz), 6.65-7.64 (complex, m, 8H, aryl protons), 4.80 (s, 4H, -CH_2); MS (CI): m/z 365 [$M^{\cdot+}$+1]; [Found: C, 69.16; H, 6.69; N, 15.42; S, 8.72, $C_{21}H_{24}N_4S$ requires C, 69.20; H, 6.64; N, 15.37; S, 8.80].

3p: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 1.58 (q, 2H, -NCH_2 of ethyl of -CH_2Bz), 3.82 (t, 3H, -CH_3 of ethyl of -CH_2Bz), δ 1.35 (t, 2H, -NCH_2 of butyl of – CH_2Bz), 1.67 (p, 2H, -NCH_2CH_2 of butyl of – CH_2Bz), 2.56 (st, 2H, -$NCH_2CH_2CH_2$ of butyl of – CH_2Bz), 3.70 (t, 3H, -$NCH_2CH_2CH_2CH_3$ of butyl of – CH_2Bz), 6.62-7.62 (complex, m, 8H, aryl protons), 4.81 (s, 4H, -CH_2); MS (CI): m/z 379 [$M^{\cdot+}$+1]. [Found: C, 69.75; H, 6.99; N, 14.72; S, 8.52, $C_{22}H_{26}N_4S$ requires C, 69.80; H, 6.92; N, 14.80; S, 8.47].

3q: No diagnostic peak in IR region 3500 – 3000 cm^{-1}, indicating absence of -NH group; ^{1}H- NMR (400 MHz, DMSO-d_6/ TMS): δ 4.82 (s, 2H, -NCH_2 of benzyl of -CH_2Bz), δ 1.35 (t, 2H, -NCH_2 of butyl of –CH_2Bz), 1.67 (p, 2H, -NCH_2CH_2 of butyl of – CH_2Bz), 2.56 (st, 2H, -$NCH_2CH_2CH_2$ of butyl of – CH_2Bz), 3.70 (t, 3H, -$NCH_2CH_2CH_2CH_3$ of butyl of – CH_2Bz), 6.62-7.62 (complex, m, 8H, aryl protons), 4.81 (s, 4H, -CH_2); MS (CI): m/z 441 [$M^{\cdot+}$+1], [Found: C, 73.56; H, 6.48; N, 12.66; S, 7.33, $C_{27}H_{28}N_4S$ requires C, 73.60; H, 6.41; N, 12.72; S, 7.28].

Alternative route for preparation of 3f-q:

A mixture of N-alkyl-2-chloromethylbenzimidazole (**1,** R=alkyl) (0.95gr, 5 mmole), N-alkyl-2-mercapto benzimidazole (**2,** R^1=alkyl) (0.95gr, 5 mmole), in methanol using triethylamine (TEA) as a base under reflux for 3 hrs. **3f-q** obtained above and found to be identical in m.p., m.m.p. and tlc with the corresponding derivatives prepared earlier in the route **3** (R=H, R^1=alkyl) **/ 3** (R=alkyl, R^1=H) to **3f-q.**

RESULTS AND DISCUSSION

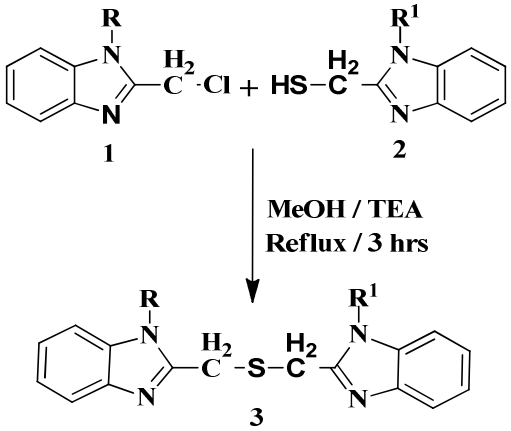
2-(1-chloroethyl)-1H-benzimidazole (**1a**, i.e. **1**, R=H) on Condensation with (1H-benzimidazol-2-yl)methanethiol (**2a** i.e.**2**, R^1=H) in methanol using triethylamine (TEA) as a base under reflux for 3 hrs gave 2-((1-(1H-benzimidazol-2-yl)ethyl)thio)-1H-benzimidazole (**3a** i.e. **3**, R=R^1=H). **3a** (i.e. **3**, R=R^1=H) on methylation using two equivalents of dimethylsulphate in dimethylformamide (DMF) as a solvent and K_2CO_3 as a base using tetrabutylammonium bromide (TBAB) as phase transfer catalyst (PTC) at RT for 3 hrs gave N,N^1-dimethylbisbenzimidazolesulphide **3b.** Using this strategy, the reactions of **3a** (i.e., **3,** R=R^1=H) could also be done with two equivalents of each of diethyl sulphate, benzyl chloride and n-butyl bromide to obtain N,N^1-diethylbisbenzimidazolesulphide **3c,** N,N^1- dibenzylbisbenzimidazolesulphide **3d** and N,N^1-dibutylbisbenzimidazolesulphide **3e** respectively**.** The structures of **3b-e** have been assigned on the basis of their spectral and analytical data. (Pl. see Experimental Section for details).

Table – 1: Physical Data of the Synthesized Compounds 3a-e:

S.No.	Substrate	Alkylating agent	Product	Yield (%)	M.P (^{0}C)
1.	**3**	-	**3a** (R=R^1=H)	78	>250
2.	**3**	DMS	**3b** (R=R^1=CH_3)	73	>250
3.	**3**	DES	**3c** (R=R^1=C_2H_5)	80	>250
4.	**3**	$PhCH_2Cl$	**3d** (R=R^1=CH_2Ph)	77	>250
5.	**3**	n-BuBr	**3e** (R=R^1= n-Bu)	68	>250

3b (i.e. **3,** R=R^1=methyl) could also be synthesized by condensing N-methyl-2-chloromethylbenzimidazole (**1b,** i.e. **1,** R=CH_3) with (1-methylbenzimidazol-2-yl)methanethiol (**2b,** i.e. **2,** R^1=CH_3) in methanol using triethylamine (TEA) as a base under refluxing conditions for 3 hrs. Similarly, **3c** (i.e. **3,** R=R^1= ethyl), **3d** (i.e. **3,** R=R^1= benzyl) and **3e** (i.e. **3,** R=R^1= n-butyl) could also be synthesized by the condensation of (1-ethylbenzimidazol-2-yl)methanethiol (**2c,** i.e. **2,** R=C_2H_5), (1-benzylbenzimidazol-2-yl)methanethiol (**2d,** i.e. **2,** R=CH_2Ph) and (1-n-butylbenzimidazol-2-yl)methanethiol (**2e,** i.e. **2,** R= n-butyl) with the corresponding 2-(1-chloroethyl)-1-ethylbenzimidazole (**1c,** i.e. **1,** R=C_2H_5), 2-(1-chloroethyl)-1-benzylbenzimidazole (**1d,** i.e. **1,** R=CH_2Ph) and 2-(1-chloroethyl)-1-n-butylbenzimidazole (**1e,** i.e. **1,** R= n-butyl) respectively. The products obtained above have been found to be identical in m.p. m.m.p. and tlc with the corresponding derivatives prepared earlier in the route **1a** (i.e.**1,** R=H) + **2a** (i.e. **2**, R^1 =H) → **3a,** (i.e. **3**, R=R^1=H) → (**3b-e,** i.e. **3,** R=R^1= methyl, ethyl, benzyl and n-butyl).

Scheme: 1



3a: R = R^1 = H
3b: R = R^1 = CH_3
3c: R = R^1 = C_2H_5
3d: R = R^1 = $PhCH_2$
3e: R = R^1 = n-Bu

3f: R = CH_3, R^1=C_2H_5
3g: R = CH_3, R^1= $PhCH_2$
3h: R= CH_3, R^1= n-Bu
3i: R = C_2H_5, R^1=CH_3
3j: R= C_2H_5, R^1= $PhCH_2$

3k: R= C_2H_5, R^1= n-Bu
3l: R= $PhCH_2$, R^1= CH_3
3m: R= $PhCH_2$, R^1= C_2H_5
3n: R= $PhCH_2$, R^1= n-Bu
3o: R= n-Bu, R^1= CH_3
3p: R= n-Bu, R^1= C_2H_5
3q: R= n-Bu, R^1= $PhCH_2$

Using the strategy described above, N,N^1-unsymmetricallydisubstituted derivatives **3f-q** (Table-2) were prepared as follows:- Condensation of 2-(1-chloroethyl)-1-methylbenzimidazole (**1b** i.e. **1,** R= CH_3) with (1-H-benzimidazol-2-yl)methanethiol (**2a** i.e.**2,** R^1=H) gave **3r** (i.e. **3**, R= CH_3, R^1=H) followed by ethylation under PTC conditions gave **3f**. Similarly **3g (**i.e. **3,** R=CH_3, R^1= $PhCH_2$) could be synthesized by condensing 2-(1-chloroethyl)-1-methylbenzimidazole [9] (**1b** i.e. **1**, R=CH_3) with (1-H-benzimidazol-2-yl)methanethiol (**2a** i.e. **2,** R^1=H) to obtain **3s** (i.e. **3,** R=CH_3, R^1=H) followed by benzylation under PTC conditions or by condensing 2-(1-chloroethyl)-1-H-benzimidazole (**1a** i.e.**1,** R=H) with (1-benzylbenzimidazol-2-yl)methanethiol (**2d,** i.e. **2,** R^1= CH_2Ph) to yield **3t** (i.e. **3,** R=H, R^1= $PhCH_2$) followed by methylation under PTC conditions. Direct condensation of 2-(1-chloroethyl)-1-methylbenzimidazole (**1b** i.e. **1,** R=CH_3) with (1-benzylbenzimidazol-2-yl)methanethiol (**2d** i.e. **2,** R^1= $PhCH_2$) also gave **3g** (i.e**. 4,** R=CH_3, R^1= $PhCH_2$). Using this synthetic strategy, **3h, 3i, 3j, 3k, 3l**, **3m, 3n, 3o, 3p, 3q** could be synthesized under PTC conditions. The structures of **3f-q** have been established on the basis of IR, ^{1}H-NMR and LC-MS (Q+1) Spectral data. (Pl. see Experimental Section for details).

Table – 2: Physical Data of the Synthesized Compounds 3f-3q:-

S. No.	Starting Materials Used		Product	Yield (%)	M.P (^{0}C)
1.	**1b** (R =CH_3)	**2c** (R^1 = C_2H_5)	**3f** (R = CH_3, R^1 = C_2H_5)	78	>250
2.	**1b** (R = CH_3)	**2d** (R^1= $PhCH_2$)	**3g** (R = CH_3, R^1= $PhCH_2$)	72	>250
3.	**1b** (R = CH_3)	**2e** (R^1= n-Bu)	**3h** (R = CH_3, R^1= n-Bu)	65	>250
4.	**1c** (R = C_2H_5)	**2b** (R^1=CH_3)	**3i** (R = C_2H_5, R^1=CH_3)	79	>250
5.	**1c** (R= C_2H_5)	**2d** (R^1= $PhCH_2$)	**3j** (R= C_2H_5, R^1= $PhCH_2$)	64	>250
6.	**1c** (R= C_2H_5)	**2e** (R^1= n-Bu)	**3k** (R= C_2H_5, R^1= n-Bu)	68	>250
7.	**2d** (R^1= $PhCH_2$)	**1b** (R =CH_3)	**3l** (R= $PhCH_2$, R^1=CH_3)	59	>250
8.	**2d** (R^1= $PhCH_2$)	**1c** (R = C_2H_5)	**3m** (R= $PhCH_2$, R^1= C_2H_5)	68	>250
9.	**2d** (R^1= $PhCH_2$)	**2e** (R^1= n-Bu)	**3n** (R= $PhCH_2$, R^1=n-Bu)	52	>250
10.	**2e** (R^1= n-Bu)	**1b** (R =CH_3)	**3o** (R= n-Bu, R^1= CH_3)	56	>250
11.	**2e** (R^1= n-Bu)	**1c** (R = C_2H_5)	**3p** (R= n-Bu, R^1= C_2H_5)	59	>250
12.	**2e** (R^1= n-Bu)	**2d** (R^1= $PhCH_2$)	**3q** (R= n-Bu, R^1= $PhCH_2$)	65	>250

Acknowledgement
The authors are indebted to the authorities of Jawaharlal Nehru Technological University Hyderabad for providing facilities.

REFERENCES

[1] a) A Spasov, IN Yozhitsa, LI Bugaeva, VA Anisimova, Pharma Chem. J, **1999,** 33, 232. b) PN Preston, In the Chemistry of Heterocyclic Compounds, Benzimidazoles and Congeneric Tricyclic Compounds, 40, Part-2 (John Wiley & Sons, New York), **1980**, 10.
[2] DA Horton, GT Bourne, ML Sinythe, *Chem. Rev*. **2003**, 103, 893.
[3] PN Preston, *Chem. Rev*., **1974**, 74, 279.
[4] I Tamm, *Science*, **1954**, 120, 3125.
[5] MJ Shiae, LM Shyu, CF Chen, *Heterocycles*, **1990**, 31, 523.
[6] SJ Hopkins, *Drugs of Today*, **1990**, 26, 295.
[7] JE harti, L Doudach, MA Faouzi, J Taoufik, M Ansar, *Journal of Chemical and Pharmaceutical Research*, **2014**, 6(2) 781-784.
[8] S Mandal; S Yadav; S Yadav; R Kumar Nema, *Journal of Chemical and Pharmaceutical Research*, **2009**, 1(1), 102-104.
[9] SG Alsabri; HM El-Basir; NB Rmeli; SB Mohamed; AA Allafi; AA Zetrini; AA Salem; SS Mohamed; A Gbaj; MM El-Baseir, *Journal of Chemical and Pharmaceutical Research*, **2013**, 5(1), 32-36.
[10] SG Alsabri; AE Zetrini; NB Ermeli; SB Mohamed; SM Bensaber; A Hermann; A Gbaj, *Journal of Chemical and Pharmaceutical Research*, **2012**, 4(8), 4028-4031.
[11] SS Rao, PK Dubey, YB Kumari, *Indian J. Heterocycl. Chem*, **2013**, 22 (1), 243.
[12] SS Rao, PK Dubey, YB Kumari, *Indian J. Chem.* **2013,** 52, 1210-1213.

[13] SS Rao, ChVR Reddy, PK Dubey, *Der Pharma Chemica*, **2013,** 5, 69-72.
[14] SS Rao, ChVR Reddy, PK Dubey, *J. Green Sci. Technol.*,**2014**, 1(2), 1-3.
[15] SS Rao, ChVR Reddy, PK Dubey, *Organic Chemistry International* **2014** (In Press).