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Research Article

MICROWAVE ASSISTED SYNTHESIS OF 2-AMINO-3,4,5-TRISUBSTITUTED IMIDAZOLINES USING RADISZEWSKI METHOD, THEIR CHARACTERISATION AND EVALUATION FOR ANTIOXIDANT ACTIVITY

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ABSTRACT
A facile synthesis of series of 2-amino-3,4,5-triphenyl-1*H*-imidazole was carried out. In the present research work, with the help of microwave irradiations the above said compounds were synthesised and also wherever necessary their synthesis was assisted by the use of catalyst. The method possessed remarkable advantages, such as short reaction time and moderate to excellent yield. Microwaves provide environment friendly reactions by the use of lesser expensive polar solvents. Finally, all synthesised compounds were evaluated for antioxidant activity by reducing power method and DPPH free radical scavenging assay method.

Keywords: Imidazole, Microwave synthesis, Solid support, Solvent-free synthesis, Catalyst, Antioxidant activity.

INTRODUCTION

Microwave assisted organic synthesis results in tremendous rate enhancement of many chemical reactions as a consequence of heating of the reaction mixture and which can't be reproduced by conventional methods of synthesis. Application of microwave technology was proved to be successful, as it provides multi component reactions (MCRs), sometimes referred as one pot synthesis, which have opened new dimension in synthetic chemistry. This technique also introduces a new approach for processing chemical compounds in the way which reduce threats to our health and social environment. This is also known as environment friendly clean chemistry, atom economy and benign chemistry.[1-8] The fundamentals of microwave-assisted organic synthesis in polar solvents are also reported, which have supported in the development of relatively sustainable procedures for the synthesis of drugs and fine chemicals.[9-11] Bearing in mind that most biologically potent compounds are heterocyclic in nature and their importance in medicinal chemistry to identify leads and to modify structures, therefore it is confirmed from above discussion that the applications of microwaves will certainly increase in the future.

Heterocyclic compounds hold a special place among natural and synthetic pharmaceutical products. Taking this in our minds, preparation of imidazole derivatives *i.e.* 2-amino-3,4,5-triphenyl-1*H*-imidazole under microwave irradiations was carried out. For the synthesis of target compounds, a very well known method *i.e.* Radiszewski method[12-15] was used, which involves condensation of a dicarbonyl compound (benzil) and α-Keto aldehyde (benzaldehyde) or α-diketone in the presence of ammonia yield 1,4,5-triphenyl imidazole. Although other methods of synthesis of imidazole derivatives are also available but there are some complications regarding speed of reaction, percent yield, purity and use of expensive solvents while this method chosen is quite straightforward to access target molecules. Followed by microwave induced coupling reaction where diazo benzene group was introduced with the help of benzene diazonium chloride [16] to give 2-diazo-1-phenyl-(3,4,5-triphenyl-1*H*-imidazole derivatives.[17-19] These synthesised derivatives are readily cleaved by conventional methods of heating, in the presence of dithionite to yield 2-amino-3,4,5-triphenyl-1*H*-imidazole.[20-21] All the synthesised compounds were evaluated for antioxidant activity by using reducing power method and DPPH radical scavenging assay method.[22-23]

MATERIALS AND METHODS

General Information

Solvents and reagents were purchased from commercial supplier without any further purification. Chemical reagents were purchased from the Hi-media, Mumbai, Thomas Baker Chemicals Pvt. Ltd., New Delhi, SD Fine chemicals Pvt. Ltd., Mumbai and Sigma Aldrich Chemicals Ltd., Bangalore. All the reagents were of commercial grade reagent. Melting points were determined in an open capillary method. UV spectra were recorded on double beam Spectrometer Schimatzu, 1800 model, Infrared spectra were recorded on Bruker FTIR 550 spectrometer lab India Pvt. Ltd. Hyderabad. ^{1}HNMR and ^{13}CNMR spectra were recorded in DMSO-d_6 and $CDCl_3$ using Bruker Avance-II, 400MHz, Panjab University Chandigarh, using TMS as internal standard. Mass Spectra were taken as Bruker at Panjab University Chandigarh. All the targeted compounds were synthesised on microwave monomode reactor, IFB. Column chromatography was carried out on 60-120 mesh size silica gel .

Typical procedure for $NaHSO_4$–SiO_2 supported synthesis of 3,4,5-trisubstituted imidazoles using Radiszewski method under microwave irradiations (4)

Recently, $NaHSO_4$–SiO_2 as an inexpensive catalyst, was effectively utilised in target compound synthesis as an acid ca talyst, which is easily separable from the reaction products. (Scheme 1)Synthesis of target compounds (4a-4l) involves impregnating the mixture of solid support, NaHSO4–SiO2and ammonium acetate (ammonia source) with CH2Cl2 solution of benzil (1), formaldehyde (2) and amine (3a-3l), evaporating the solvent and heating the solid residue in a microwave oven for 12 min (classical heating takes 2h)

A mixture of NaHSO4–SiO2 (9.3 g) and ammonium acetate (4.4 g) were mixed and ground in a mortar until a fine powder was formed. A solution of benzil (0.5 mol), aldehyde (0.5 mmol) and amine (0.5 mmol) in 2 ml of methylene chloride, was added to 0.3 g of the $NaHSO_4$–SiO_2 mixture in a 50 ml beaker. The excess solvent was allowed to evaporate and the dry residue was irradiated in microwave oven at 600 W for 10-15 min. The mixture was cooled to room temperature and mixed thoroughly with 30 mL of acetone. After separation of solid, the remaining solvent was evaporated in rota evaporator under reduced pressure. The resulting solid residue was purified by recrystallisation from acetone–water. Physical characterisation was done by TLC. Outcome of our investigations is described in Table 1 in terms of effect of substitution on time of reaction and % yield.

Experimental procedure for synthesis of diazonium chloride salt (6)

Synthesis of diazonium chloride salt (6) was carried out by taking 4*g* of aniline (5) in a 50 *ml* Erlenmeyer flask then Add 1.2*g* of anhydrous sodium carbonate and 45 *ml* distilled water. Warm this mixture gently on the hot plate. Then, cool the solution to room temperature. Add 1.7*g* of sodium nitrite. Stir to dissolve. Place in an ice-water bath to cool. While this solution is cooling, mix about 40*g* of ice with 120 drops of concentrated hydrochloric acid. Stir thoroughly. The diazonium salt (6) should begin to form within 2-5 minutes (Scheme 2) For further separation and purification of products, the residue was purified either by preparative TLC. After chromatographic separation, melting points were determined.

Experimental procedure for synthesis of diazo Coupling Reaction (7a-7l)

2-Diazo-1-phenyl-(1,4,5-triphenyl-1*H*-imidazole derivatives (7a-7l) were synthesised by taking 0.824 *mmol* of 3,4,5-triphenyl-1*H*-imidazole (4a-4l) and 2.2*g* of glacial acetic acid. The mixture was poured into the Erlenmeyer flask containing the suspended diazonium salt (6) (1.23g, 0.01 mol). The contents were stirred for several minutes. A pasty mass separated. Add 40 *ml* of 10% NaOH and mix. NaOH was added to make the solution alkaline. Heated the mixture in microwave oven at 120-130℃ at 400W for 3-5 min. (Scheme 3) Diazo compound was separated as solid. Effect of substitution on time of reaction and % yield has shown in Table 2.

Experimental procedure for synthesis of 2-amino imidazole derivatives by reduction (8a-8l)

For the synthesis of 2-amino-3,4,5-triphenyl-1*H*-imidazole (8a-8l), took suspension of the diazo compound, 2-diazo-1-phenyl-(3,4,5-triphenyl-1*H*-imidazole (7a-7l) (2g) and zinc dust (1g) in methanol or in any other suitable solvent (10 mL or the requisite amount) and ammonium acetate (1g) was were blended together at room temperature. (Scheme 4) After the completion of the reaction the reaction mixture was filtered through a Buchner funnel and washings are concentrated under vacuum. Effect of substitution on time of reaction and % yield has shown in Table 3.

Pharmacological activity

Evaluation of antioxidant activity of newly synthesised compounds (8a-8l) was done by reducing power method and DPPH radical scavenging assay method.

a) Reducing power method

In vitro antioxidant activity for some synthesised compounds was evaluated by reducing power method and absorbance was recorded on UV spectrophotometer at 700 nm. Different concentrations (10 ug/ ml, 20 ug/ ml, 30ug/ ml, 40ug/ ml, 50ug/ ml) of each compound were taken in different test tubes. The reducing power of the compounds increased with increase in concentration. Among the other derivatives screened, the observations were taken and compared with ascorbic acid, which was used as standard antioxidant are shown in Table 4.

b) DPPH free radical scavenging assay

DPPH radical scavenging activity evaluation is a standard assay for the determination of antioxidant activity Internal standard Ascorbic acid and the synthesised compounds of different concentrations (10 ug/ml, 20 ug/ml, 30ug/ml, 40ug/ml, 50ug/ml) were prepared of each compound. A freshly prepared DPPH solution exhibits a dark purple color with maximum absorption at 517 nm. Among the other derivatives screened, the observations were made and compared with ascorbic acid, are shown in Table 5.

RESULTS AND DISCUSSION

The above methods are good in terms of reactivity; this method of synthesis not only affords the products in excellent yields but also avoids the problems associated with catalyst cost, handling, safety and pollution.

Physical and spectral data

2-Amino-3,4,5-triphenyl-1*H*-imidazole (8a)

M.pt. (℃) 155-157; IR (KBr, cm^{-1}): 3365.58 (NH_2), 3060.82, (Ar-C-H), 1653.59(C=N), 1505.33(Ar-C=C), 1205.93(C-N); ^{1}H-NMR (δ, 400MHz, DMSO-d_6,ppm): 7.21-7.48 (m, Ar-15H), 4.2 (s, NH_2); ^{13}CNMR δC (ppm): 133.10, 129.50, 128.80, 151.30, 156 .40,160.22, (C_1-C_6), 137.40, 122.40, 129.70, 126.12 (C_1-C_6, N-Ar), 137.30, 132.30, 124.78 (C_1-C_3); MS (m/z, M^+): 311.4, $C_{21}H_{17}N_3$.

2-Amino-1-(4-methoxyphenyl)-4,5-triphenyl-1*H*-imidazole (8b)

M.pt. (℃)184-187;IR (KBr, *cm^{-1}*): 3300.60 (NH_2), 3095.80 (Ar-C-H, sp^2), 2880 (C-H sp^3), 1640.30 (C=N), 1560.30 (Ar-C=C), 1234.93(C-N), 1727 (C=O), 1034 (C-O), 800 (*p*-disubstituted); ^{1}H-NMR (δ, 400MHz, DMSO-d_6,*ppm*): 7.21-7.48 (m, Ar-10H), 4.2 (s, NH_2)), 7.6 (d, Ar-2H), 7.4 (Ar-2H),3.5 (s,3H-OCH_3); ^{13}CNMR δC (*ppm*): 140.10,135.40, 132.80, 150.30, 150.40, 162.30, (C_1-C_6), 144.20, 125.40, 130.70, 129.12 (C_1-C_6, N-Ar), 137.30, 132.30, 124.78 (C_1-C_3), 45.30 (OCH_3); MS (*m/z*, M^+): 341.4, $C_{22}H_{19}N_3O$

2-Amino-1-(4-nitrophenyl)-4,5-diphenyl-1*H*-imidazole (8c)

M.pt. (℃)219-220;IR (KBr, *cm^{-1}*): 3290.60 (NH_2), 3160.70 (Ar-C-H), 1648.24 (C=N), 1517.33 (Ar-C=C), 1205.93(C-N), 1725 (C=O), 1450 (N=O), 1320 (N-O), 820(*p*-disubstituted); ^{1}H-NMR (δ, 400MHz, DMSO-d_6, ppm): 6.50-7.80 (m, Ar-10H), 8.61 & 8.82 (d, Ar-4H); ^{13}CNMR δC (ppm): 140.10, 137.30, 133.20, 152.30, 153.40, 160.30, (C_1-C_6), 140.20, 130.40, 125.70, 129.12 (C_1-C_6, N-Ar), 137.30, 132.30, 124.78 (C_1-C_3);MS (*m/z*, M^+): 355.4, $C_{21}H_{15}N_4O_2$

2-Amino-1-(4-ethylphenyl)-4,5-diphenyl-1*H*-imidazole (8d)

M.pt. (℃) 191-193; IR (KBr, cm^{-1}): 3365.60 (NH_2), 3055.73 (Ar-C-H), 2850 (C-H sp^3), 1648.24 (C=N), 1517.33(Ar-C=C), 1205.93(C-N), 1725 (C=O); ^{1}H-NMR (δ, 400MHz, DMSO-d_6, *ppm*): 6.50-7.80 (m, Ar-10H), 7.91 & 8.0 (d, Ar-4H), 7.5 (m, Ar-5H), 1.6 (q, 2H, C-CH_3), 1.2(t, 3H, C-CH_2); ^{13}CNMR δC (*ppm*): 140.10, 127.30, 123.20, 142.30, 143.40, 162.30,(C_1-C_6), 138.20, 135.40, 120.70, 122.12 (C_1-C_6, N-Ar), 134.30, 130.30, 122.78 (C_1-C_3); MS (*m/z*, M^+: 339.4, $C_{23}H_{21}N_3$

2-Amino-1-(2-chloro-4-nitrophenyl)-4,5-diphenyl-1*H*-imidazole (8e)

M.pt. (℃)249-251;IR (KBr, cm^{-1}): 3355.58 (NH_2), 3125.73(Ar-C-H), 1648.24 (C=N), 1517.33(Ar-C=C), 1205.93(C-N), 1725 (C=O), 1450 (N=O), 1320(N-O), 780 & 850 (1,2,4-trisub. phenyl), 740(C-Cl); ^{1}H-NMR (δ, 400MHz, DMSO-d_6, *ppm*): 4.3 (s NH_2), 7.1-7.4 (m, Ar-10H), 8.5 (s, Ar-1H), 8.4 (d, Ar-1H), 8.3 (d, Ar-1H), 1.9 (s, 1H),2.10 (s, 3H, COMe, 1.3 (d, 3H, C-CH); ^{13}CNMR δC (*ppm*): 140.10, 132.30, 130.20, 133.30, 137.40(C_1-C_6), 138.20, 145.40, 140.70, 135.12 (C_1-C_6, N-Ar), 128.30, 131.30, 123.78 (C_1-C_3);MS (*m/z*, M^+): 390.8, $C_{21}H_{15}N4O_2Cl$

2-Amino-1-(4- chlorophenyl)-4,5-diphenyl-1*H*-imidazole (8f)

M.pt. (℃)201-203;IR (KBr, cm^{-1}): 3270-30(NH_2), 3040.73 (Ar-C-H), 1648.24 (C=N), 1517.33 (Ar-C=C), 1205.93 (C-N), 1725 (C=O), 750 (C-Cl) 820 (*p*-disubstituted). ^{1}H-NMR (δ, 400MHz, DMSO-d_6, *ppm*): 4.8 (s, NH_2), 6.50-7.80 (m, Ar-10H), 8.61 & 8.82 (d, Ar-4H).^{13}CNMR δC (*ppm*): 140.10, 127.30, 123.20, 132.30, 133.40, 138.30, (C_1-C_6), 138.20, 135.40, 120.70, 122.12 (C_1-C_6, N-Ar), 134.30, 130.30, 122.78 (C_1-C_3);MS (*m/z*, M^+): 345.8, $C_{21}H_{16}N_3Cl$.

2-Amino-1-(2-methoxyphenyl)-4,5-diphenyl-1*H*-imidazole (8g)

M.pt. (℃)192-195;IR (KBr, cm^{-1}): 3190.70 (NH_2), 3020.82(Ar-C-H), 1599.59(C=N), 1560.33(Ar-C=C), 1240.93(C-N), 1730(C=O),1050(C-O), 760 (*o*-disubstituted);^{1}H-NMR (δ, 400MHz, DMSO-d_6, *ppm*): 6.40-7.60 (m, Ar-10H), 8.62 (d, Ar-2H), 7.80(dd, Ar-2H), 3.7 (s, 3H, C-OCH_3); ^{13}CNMR δC (*ppm*): 35.30 (OCH_3), 135.50, 115.30, 118.40, 155.00, 110.80(C_1-C_6), 138.20, 135.40, 120.70, 122.12 (C_1-C_6, N-Ar), 124.30, 120.30, 132.78 (C_1-C_3); MS (*m/z*, M^+): 341.4 ,$C_{22}H_{19}N_3O$

2-Amino-1-(4-fluorophenyl)-4,5-diphenyl-1*H*-imidazole (8h)

M.pt. (℃) 146-148;IR (KBr, cm^{-1}): 3275.80 (NH_2), 3150.50(Ar-C-H), 1648.24(C=N), 1517.33(Ar-C=C), 1212.30(C-N), 1725.20 (C=O), 1220(C-F), 820(*p*-disubstituted); ^{1}H-NMR (δ, 400MHz, DMSO-d_6, *ppm*): 6.50-7.80 (m, Ar-10H), 8.78& 8.90(d, Ar-4H), 7.5 (m, Ar-5H), 1.9 (s, 1H),2.10 (s, 3H, COMe), 1.3 (d, 3H, C-CH), 1.8 (q, 1H, CH_3-C), 1.7 ; ^{13}CNMR δC (*ppm*): 115.30, 118.40, 125.00, 135.30, 130.20, 145.30, 130.80, 133.40, 135.30; MS (*m/z*, M^+): 329.4, $C_{21}H_{16}N_3F$

2-Amino-1-(4-bromophenyl)-4,5-diphenyl-1*H*-imidazole (8i)

M.pt. (℃)188-190;IR (KBr, cm^{-1}): 3150.80(NH_2), 3095.45 (Ar-C-H), 1648.24 (C=N), 1525.33 (Ar-C=C), 1205.93 (C-N), 1725 (C=O), 800(C-Br) 820 (*p*-disubstituted); ^{1}H-NMR (δ, 400MHz, DMSO-d_6 *ppm)*: 6.50-7.20 (m, Ar-10H), 8.65& 8.80 (d, Ar-4H); ^{13}CNMR δC (ppm): 135.50, 115.30, 118.40, 125.00, 130.30, 122.20, 185.30, 110.80, 160.40, 165.30,; MS (*m/z*, M^+): 390.3, $C_{21}H_{16}N_3Br$

2-Amino-1-(2-ethylphenyl)-4,5-diphenyl-1*H*-imidazole (8j)

M.pt. (℃)165-167;IR (KBr, cm^{-1}): 3290 (NH_2), 3100.73 (Ar-C-H), 2900 (C-H sp3) 1650.30 (C=N), 1525.33(Ar-C=C), 1205.93(C-N), 1725 (C=O), 760 (*o*-disubstituted); ^{1}H-NMR (δ, 400MHz, DMSO-d_6*ppm*): 4.3 (s, NH_2), 7.20-7.50 (m, Ar-10H), 8.62 (d, Ar-2H), 7.80(dd, Ar-2H), 1.6 (q, 2H), 1.2(t, 3H); ^{13}CNMR δC (*ppm*): 112.40, 116.40, 123.30, 132.70 133.80, 28.60, 35.60; MS (*m/z*, M^+): 339.4, $C_{23}H_{21}N_3$.

2-Amino-1-(3-nitrophenyl)-4,5-diphenyl-1*H*-imidazole (8k)

M.pt. (℃)186-188;IR (KBr, cm^{-1}): 3230.30 (NH_2), 3090.40 (Ar-C-H), 1650.24 (C=N), 1535.33(Ar-C=C), 1228.93(C-N), 1733 (C=O), 1500 (N=O), 1360 (N-O), 900,800,700 (*m*-substituted); ^{1}H-NMR (δ, 400MHz, DMSO-d_6*ppm*): 4.4 (N-H), 6.50-7.80 (m, Ar-10H), 8.62 (d, Ar-H), 7.80(t, Ar-1H), 9.2 (d, Ar-1H), 9.5 (s, Ar-1H), 1.9 (s, 1H),7.5 (m, Ar-5H), 2.10 (s, 3H, COMe), 1.3 (d, 3H, C-CH), 1.8 (q, 1H, CH3-C), 1.7 (t, 0H, CO-C-(CH), 1.2 (d, 0H, C-CH); ^{13}CNMR δC (*ppm*): 65.30, 195.50, 25.40, 80.40, 115.30, 118.40, 155.00, 175.30, 180.20, 185.30, 110.80, 160.40, 165.30, 70.50, 45.30, 55.40, 50.40; MS (*m/z*, M^+):356.4, $C_{21}H_{16}N_4O_2$

2-Amino-1-(3-chlorophenyl)-4,5-diphenyl-1*H*-imidazole (8l)

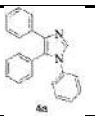
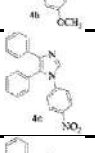
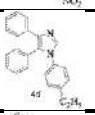
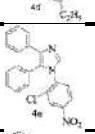
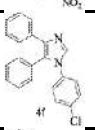
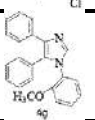
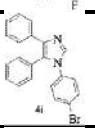
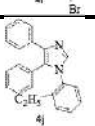
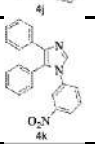
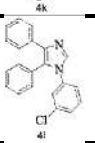
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Pharmacological Evaluation

Antioxidant activity

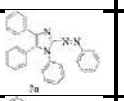
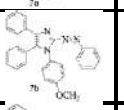
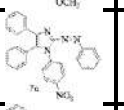
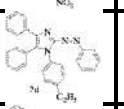
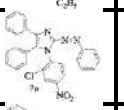
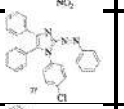
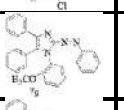
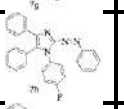
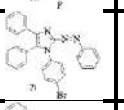
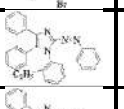
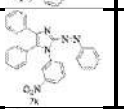
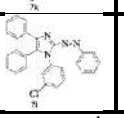
Reducing power method and DPPH radical showed enhanced antioxidant activity for the groups like; -CH_3, -Cl, -OH. In both of the methods, compounds*8c,* 8e, 8f, 8k, 8l were found to be having significant antioxidant activity. However rest of compounds exhibited mild to moderate antioxidant activity when compared to ascorbic acid. Moreover, there is a concentration dependant increase in absorbance also seen.

Table 1: Synthesis of 3,4,5-trisubstituted imidazoles under microwave irradiations (600W) using $NaHSO_4$/silica gel support(4a-4l)

S. No.	Entry	R_1	R_2	R_3	Structure	Time (min)	Yield (%)[a]	M.Pt (°C)
1	**4a**	H	H	H		15	94	155-157
2	**4b**	H	H	OCH_3		12	90	184-187
3	**4c**	H	H	NO_2		14	93	219-220
4	**4d**	H	H	C_2H_5		11	92	188-191
5	**4e**	Cl	H	NO_2		10	93	149-151
6	**4f**	H	H	Cl		13	92	186-189
7	**4g**	OCH_3	H	H		13	84	208-211
8	**4h**	H	H	F		14	86	196-198
9	**4i**	H	H	Br		13	89	188-190
10	**4j**	C_2H_5	H	H		12	76	165-167
11	**4k**	H	NO_2	H		11	88	176-178
12	**4l**	H	Cl	H		11	87	175-176

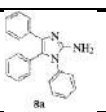
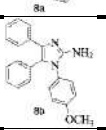
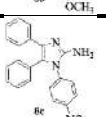
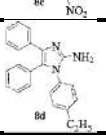
[a]Isolated % yield after column chromatography

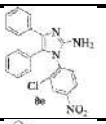
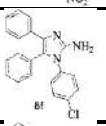
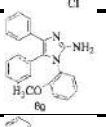
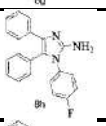
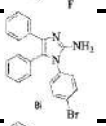
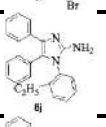
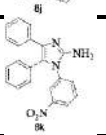
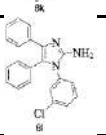
Table 2: Synthesis of 2-diazophenyl-3,4,5-triphenyl-1*H*-imidazole derivatives using microwaves at 400 W(7a-7l)

S. No.	Entry	R_1	R_2	R_3	Structure	Time (min)	Yield (%)	M.Pt. (℃)
1	7a	H	H	H		3	72	170-172
2	7b	H	H	OCH_3		4	75	174-76
3	7c	H	H	NO_2		5	85	181-83
4	7d	H	H	C_2H_5		3	81	186-88
5	7e	Cl	H	NO_2		5	69	192-94
6	7f	H	H	Cl		5	75	182-84
7	7g	OCH_3	H	H		3	70	166-68
8	7h	H	H	F		5	65	168-70
9	7i	H	H	Br		3	78	178-80
10	7j	C_2H_5	H	H		5	68	171-73
11	7k	H	NO_2	H		3	82	175-77
12	7l	H	Cl	H		3	85	168-170

[a]Isolated % yield after column chromatography

Table 3: Synthesis of 2-amino-3,4,5-triphenyl-1*H*-imidazole (8a-8l)

S. No.	Entry	R_1	R_2	R_3	Structure	Time (min)	R_f	Yield (%)	M.Pt.( )
1	8a	H	H	H		2.2	0.52	67.2	248-50
2	8b	H	H	OCH_3		0.8	0.67	72.8	250-52
3	8c	H	H	NO_2		1.5	0.63	68.7	246-48
4	8d	H	H	C_2H_5		1.2	0.55	65.5	254-56

5	8e	Cl	H	NO_2		2	0.69	78.2	260-62
6	8f	H	H	Cl		1.8	0.56	89.7	268-70
7	8g	OCH_3	H	H		1.5	0.58	92.6	262-62
8	8h	H	H	F		2	0.72	70.8	258-60
9	8i	H	H	Br		3	0.67	69.4	274-76
10	8j	C_2H_5	H	H		3.5	0.56	62.5	280-82
11	8k	H	NO_2	H		3.5	0.58	67.4	278-80
12	8l	H	Cl	H		3.2	0.62	68.0	282-84

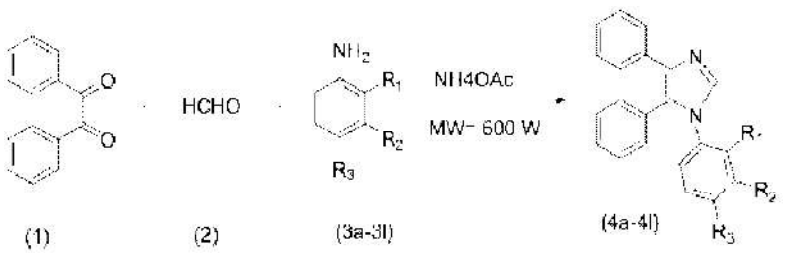
[a]Isolated % yield after column chromatography

Table 4: Mean value, SD and SEM of absorbance at various concentrations of reducing power method

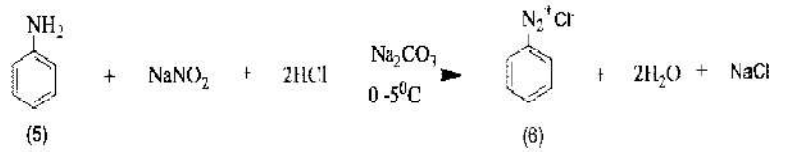
S. No.	Entry	Absorbance at different concentrations											
		10µg/ml			25µg/ml			50µg/ml			100µg/ml		
		Mean	SD	SEM	Mean	SD	SEM	Mean	SD	SEM	Mean	SD	SEM
1.	**8a**	0.166	0.173	0.169	0.258	0.265	0.272	0.363	0.356	0.360	0.517	0.505	0.498
2.	**8b**	0.107	0.093	0.102	0.196	0.201	0.183	0.296	0.312	0.307	0.439	0.446	0.425
3.	**8c**	0.093	0.090	0.085	0.190	0.193	0.207	0.283	0.296	0.306	0.422	0.410	0.402
4.	**8d**	0.124	0.132	0.140	0.223	0.215	0.219	0.318	0.315	0.308	0.465	0.479	0.475
5.	**8e**	0.149	0.158	0.152	0.236	0.247	0.252	0.321	0.328	0.324	0.478	0.489	0.497
6.	**8f**	0.156	0.164	0.172	0.249	0.252	0.259	0.357	0.367	0.386	0.492	0.508	0.516
7.	**8g**	0.111	0.099	0.105	0.202	0.193	0.185	0.304	0.301	0.295	0.443	0.439	0.440
8.	**8h**	0.098	0.103	0.114	0.192	0.204	0.189	0.287	0.293	0.302	0.428	0.416	0.409
9.	**8i**	0.102	0.110	0.099	0.194	0.210	0.193	0.290	0.318	0.312	0.432	0.456	0.444
10.	**8j**	0.105	0.096	0.115	0.195	0.198	0.209	0.296	0.282	0.308	0.436	0.442	0.459
11.	**8k**	0.088	0.096	0.092	0.186	0.194	0.184	0.279	0.285	0.296	0.415	0.418	0.424
12.	**8l**	0.102	0.110	0.099	0.102	0.407	0.099		0.210	0.193	0.290	0.318	0.312
13	Ascor-bic acid	0.139			0.286			0.605			0.862		

Table 5: Mean value, SD and SEM of absorbance at various concentrations of DPPH method

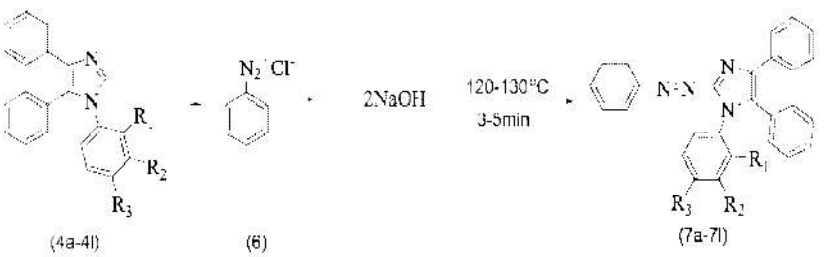
S. No.	Entry	Absorbance at different concentrations											
		10µg/ml			25µg/ml			50µg/ml			100µg/ml		
		Mean	SD	SEM	Mean	SD	SEM	Mean	SD	SEM	Mean	SD	SEM
1.	**8a**	0.169	0.003	0.001	0.265	0.007	0.004	0.359	0.003	0.001	0.506	0.009	0.005
2.	**8b**	0.100	0.007	0.004	0.193	0.013	0.007	0.305	0.008	0.004	0.436	0.010	0.005
3.	**8c**	0.089	0.004	0.002	0.196	0.009	0.005	0.295	0.011	0.006	0.411	0.010	0.005
4.	**8d**	0.132	0.008	0.004	0.219	0.004	0.002	0.313	0.005	0.002	0.473	0.007	0.004
5.	**8e**	0.153	0.004	0.002	0.245	0.008	0.004	0.324	0.003	0.001	0.488	0.009	0.005
6.	**8f**	0.164	0.008	0.004	0.253	0.005	0.002	0.370	0.014	0.008	0.488	0.012	0.006
7.	**8g**	0.105	0.006	0.003	0.193	0.008	0.004	0.300	0.004	0.002	0.440	0.002	0.011
8.	**8h**	0.105	0.008	0.004	0.198	0.007	0.004	0.294	0.007	0.004	0.417	0.009	0.005
9.	**8i**	0.103	0.005	0.002	0.199	0.009	0.005	0.306	0.014	0.008	0.444	0.012	0.006
10.	**8j**	0.097	0.009	0.005	0.200	0.007	0.004	0.295	0.013	0.007	0.445	0.011	0.006
11.	**8k**	0.092	0.004	0.002	0.188	0.005	0.002	0.286	0.008	0.004	0.419	0.004	0.002
12.	**8l**	0.132	0.008	0.004	0.132	0.008	0.004	0.132	0.008	0.004	0.132	0.008	0.004
13	**Ascor-bic acid**	0.139			0.286			0.605			0.862		



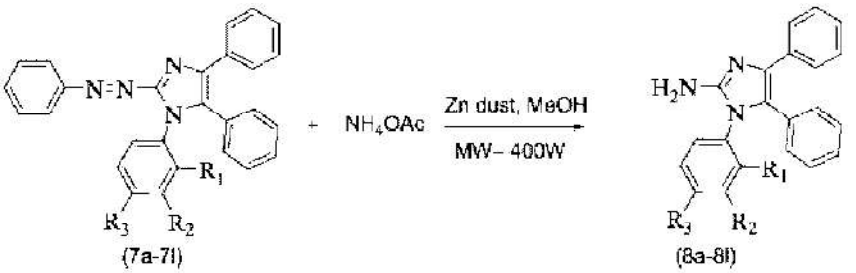
Scheme 1 Synthesis of 3,4,5-*tris*ubstituted imidazoles (4a-4l)



Scheme 2 Synthesis of diazonium chloride salt (6)



Scheme 3 Synthesis of 2-diazophenyl-3,4,5-triphenyl-1*H*-imidazole (7a-7l)



Scheme 4 Synthesis of 2-amine-3,4,5-triphenyl-1*H*-imidazole (8a-8l)

CONCLUSION

This molecular hybrid will provide potential lead for further studies and development of biologically active molecules. These chemical entities may serve as lead for further modification to render them clinically useful drug agents having least side effects as compared to drugs presently available in the market.

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