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Der Pharmacia Lettre, 2013, 5 (5):164-167
(http://scholarsresearchlibrary.com/archive.html)

ISSN 0975-5071
USA CODEN: DPLEB4

Novel Synthetic Approaches of 1, 2, 3 benzotriazole Derivatives under Solvent Free Conditions

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ABSTRACT

The present study some new 1, 2, 3 benzotriazole derivatives were synthesized under conventional, microwave, ultrasonication according to scheme. All the products were tested for purity by tlc and characterized by elemental analysis (for carbon, hydrogen and nitrogen), IR, ^{1}H-NMR, ^{13}C-NMR and mass spectral studies.

Keywords: Benzotriazole, Conventional synthesis, Microwave irradiation, Ultrasonication solvent free conditions.

INTRODUCTION

Although number of drugs is available in the market, but the need of discovering the new antimicrobial drugs with better pharmacokinetic profile and lesser toxicity has become the main objective in the field of chemistry, it is also due to the fast microbial resistance to the existing molecules.

A large number of compounds containing benzotriazole system have been investigated through different synthetic approaches. Considerable biological applications, benzotriazoles are important intermediates, protecting groups and final products in organic synthesis.

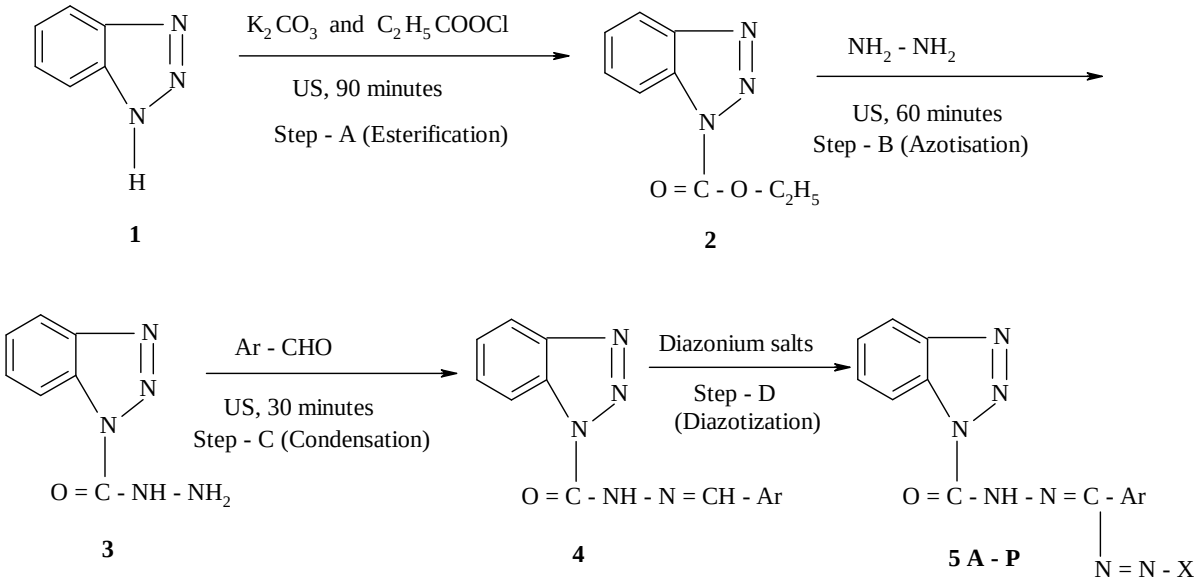
The conventional synthetic techniques have several drawbacks including strong reagents, longer reaction times, low yields of products, use of toxic solvents etc. These are inefficient and harmful to environment. Environmental scientists supposed green techniques are Microwave irradiation, Ultrasonication, Phase transfer catalysis, solvent free reactions.

In the present study newer benzotriazole derivatives are compared with Conventional, Microwave irradiation under solvent free conditions and their spectral data also included.

MATERIALS AND METHODS

All organic solvents and chemicals were purchased from SD Fine Chemicals Ltd., Mumbai and were of analytical grade.

Scheme for the synthesis of the compounds: By suitable modifications to the classical synthesis carried out by other workers viz., Asati *et al* [3], Chitre *et al*[30], Sukla and Srivatsava[31], six new compounds were synthesized under ultrasonication and solvent free conditions in four steps (Step A – Esterification, Step B –Azotisation, Step C – Condensation, Step D - Diazotization) as shown in Figure 1.



1 **2** **3** **4** **5 A - P**

5A – D: Ar = C_6H_5 ; 5E – H: Ar = C_4H_3O ; 5 I – L: Ar = $C_6H_4NO_2$ and 5M – P: Ar = C_6H_4Cl

5A, E, I, M: X = C_6H_5 ; 5B, F, J, N: X = $C_6H_4NO_2$; 5C, G, K, O: X = C_6H_4Cl and 5D, H, L, P: X = C_6H_4Br

Note : US = Ultrasonication

Figure 1. Scheme of Synthesis

Table-1 Data of Time taken for synthesis of 1, 2, 3-benztriazoles by three different synthetic methods

• Step	Conventional	Microwave	Ultrasonication
• Preparation of Ester	8hrs evaporation with solvents.	15min evaporation with solvents.	1.5hrs without solvents.
• Preparation of Hydrogide	6hrs evaporation with solvents.	12min evaporation with solvents.	1hr without solvents.
• Preparation of Sciffbases	3hrs evaporation with solvents.	6min evaporation with solvents.	0.5hrs without solvents.
• Diazotization of Schiff bases	The formed diazonium chloride is added to above formed Schiff base in pyridine at 0-5°C with stirring. The derivatives are formed when the reaction was left over night at ambient temperature.		

Table-2Physical characterization data for synthesized 1, 2, 3 – benzotriazole derivatives are given below

S. No.	Compound Code	Molecular Formula	Molecular Weight	Melting Point (^{0}C)	Yield (%)		
					Conventional	Microwave	Ultrasonic
1.	5 A	$C_{20}H_{15}N_7O$	369.4	99	66	72	82
2.	5 B	$C_{20}H_{14}N_8O_3$	414.4	96	62	69	79
3	5C	$C_{18}H_{12}ClN_7O_2$	393.8	95	57	64	73
4.	5D	$C_{18}H_{12}BrN_7O_2$	438.2	97	59	65	72
5.	5 E	$C_{20}H_{14}ClN_7O$	403.8	80	59	65	72
6.	5 F	$C_{20}H_{13}Cl_2N_7O$	438.3	100	66	72	82

Spectral data for prepared compounds are given below:

❖ **1-(1H-benzo[d][1,2,3]triazole-1-carbonyl)-3,5-diphenylformazan (5A):**

IR (KBr, cm^{-1}): 1696.66 (Ar C = C, stretch); 1603.37 (N = N, stretch), 1542.28 (N – H, stretch), 1256.37 (Aryl C – N, stretch), 1007.57 (Aniline C – N, stretch) and 737.28 (CHO – deformation); ^{1}H NMR (400 MHz) (MeOD) δ (ppm): 7.0 (1H, s, N-H), 7.06 (1H, d, C-H), 7.33 (2H, d, C-H), 7.40 (2H, d, C-H), 7.45 – 7.48 (2H, m, C-H), 7.56 – 7.59 (3H, m, C-H), 7.83 (2H, d, C-H) and 7.96 (2H, d, C-H).

❖ **1-(1H-benzo[d][1,2,3]triazole-1-carbonyl)-5-(4-nitrophenyl)-3-phenylformazan 5B):**

IR (KBr, cm^{-1}):1698.47 (Ar C = C, stretch); 1593.99 (N = N, stretch), 1495.50 (Ar – NO_2, stretch), 1301.09 (Aryl C – N, stretch), 1206.78 (Aniline C – N, stretch), 843.07 (p – disubstitution, stretch) and 739.50 (CHO – deformation); ^{1}H NMR (400 MHz) (MeOD) δ (ppm): 7.0 (1H, s, N-H), 7.18 (2H, d, C-H), 7.40 (2H, d, C-H), 7.52 – 7.59 (3H, m, C-H), 7.83 (2H, d, C-H), 7.96 (2H, d, C-H) and 8.10 (2H, d, C-H).

❖ **1-(1H-benzo[d][1,2,3]triazole-1-carbonyl)-5-(4-chlorophenyl)-3-(furan-2-yl) formazan (5C):**
IR (KBr, cm^{-1}): 3649.31 (Amide – CONH, stretch), 1594.63 (N = N, stretch), 1485.68 (Furan Ring, C = C, stretch), 1206.43 (Aniline C – N, stretch), 1007.96 (C – O – C, stretch), 820.27 (p – disubstitution, stretch), 740.62 (CHO deformation, stretch) and 539.68 (C – Cl); ^{1}H NMR (400 MHz) (MeOD) δ (ppm): 6.52 (1H, m, Furan C-H), 6.54 (1H, d, Furan C-H), 7.0 (1H, s, N-H), 7.27 (2H, d, C-H), 7.40 (2H, d, C-H), 7.49 (2H, d, C-H), 7.75 (1H, d, Furan C-H) and 7.96 (2H, d, C-H).

❖ **1-(1H-benzo[d][1,2,3]triazole-1-carbonyl)-5-(4-bromophenyl)-3-(furan-2-yl) formazan (5D):**
IR (KBr, cm^{-1}): 3652.10 (Amide – CONH, stretch), 1722.17 (Furan Ring, stretch), 1622.31 (N = N, stretch), 1511.18 (Ar C = C, stretch), 1457.07 (Furan Ring C = C, stretch), 1202.93 (Aniline C – N, stretch), 1005.36 (C – O – C, stretch), 875.16 (p – disubstitution, stretch), 773.52 (CHO deformation, stretch) and 515.35 (C – Br, stretch); ^{1}H NMR (400 MHz) (MeOD) δ (ppm): 6.52 (1H, m, Furan C-H), 6.54 (1H, d, Furan C-H), 7.0 (1H, s, N-H), 7.22 (2H, d, C-H), 7.40 (2H, d, C-H), 7.75 (1H, d, Furan C-H), 7.76 (2H, d, C-H) and 7.96 (2H, d, C-H).

❖ **1-(1H-benzo[d][1,2,3]triazole-1-carbonyl)-3-(4-chlorophenyl)-5-phenyl formazan (5E):**
IR (KBr, cm^{-1}):3650.62 (Amide – CONH), 1706.94 (Ar, C = C, stretch), 1593.76 (N = N, stretch), 1513.71 (N – H, stretch), 1264.35 (Aryl C – N, stretch), 1204.85 (Aniline C – N, stretch), 820.56 (p – disubstitution, stretch), 772.75 (CHO – deformation, stretch) and 605.30 (C – Cl, stretch); ^{1}H NMR (400 MHz) (MeOD) δ (ppm): 7.0 (1H, s, N-H), 7.06 (1H, d, C-H), 7.33 (2H, d, C-H), 7.40 (2H, d, C-H), 7.45 (2H, d, C-H), 7.52 (2H, d, C-H), 7.77 (2H, d, C-H) and 7.96 (2H, d, C-H).

❖ **1-(1H-benzo[d][1,2,3]triazole-1-carbonyl)-3,5-bis(4-chloro- phenyl) formazan (5F):**
IR(KBr, cm^{-1}): 1710.45 (Ar, C = C, stretch), 1593.50 (N = N, stretch), 1486.45 (N – H, stretch), 1256.86 (Aryl C – N, stretch), 1143.95 (Aniline C – N, stretch), 827.70 (p – disubstitution, stretch), 773.01 (CHO – deformation, stretch) and 620.81 (C – Cl, stretch); ^{1}H NMR (400 MHz) (MeOD) δ (ppm): 7.0 (1H, s, N-H), 7.27 (2H, d, C-H), 7.40 (2H, d, C-H), 7.49 (2H, d, C-H), 7.52 (2H, d, C-H), 7.77 (2H, d, C-H) and 7.96 (2H, d, C-H).

RESULTS AND DISCUSSION

Comparing with Conventional synthesis and Microwave irradiation Ultrasonicated synthesis, a considerable increase in the reaction rate has been observed and that too, with better yields. is more beneficial because it has following features:

- Solid- solid interactions
- Pollution free and environmentally acceptable.
- High degree of stereo selectivity in products.
- Shorter reaction time with simple work up.

CONCLUSION

Finally in conclusion, 1,2,3 – benzotriazole derivatives synthesized under solvent-free and ultrasound irradiation with noteworthy advantages viz., shorter reaction times, operational simplicity, simple work-up, and eco-friendly nature, have shown antifungal activities against selected pathogenic strains.

Acknowledgement
The authors are grateful to Chalapathi Institute of Pharmaceutical Sciences, Chalapathinagar, Lam, Guntur, Andhra Pradesh, India for providing the necessary research facilities.

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