Available online at www.derpharmachemica.com

Scholars Research Library

Der Pharma Chemica, 2015, 7(4):225-227
(http://derpharmachemica.com/archive.html)

ISSN 0975-413X
CODEN (USA): PCHHAX

Synthesis of ethyl [(1, 3-benzothiazol-2-yl) sulfanyl] acetate derivatives by greener techniques

Ashish L. Asrondkar, Vrushali N. Patil, Anil S. Bobade and Abhay S. Chowdhary

Department of Chemotherapy, Haffkine Institute For Training, Research and Testing, Parel, Mumbai, India

---

ABSTRACT

A series of various benzothiazole derivatives were synthesized by the reaction of chloroethylacetate with substituted benzothiazole under conventional, Ultrasound irradiation and microwave irradiation conditions, purified by recrystallisation and the structure of all the compounds have been confirmed by IR, NMR and Mass spectral data.

Keywords: Benzothiazole, microwave irradiation, conventional, ultrasound irradiation

---

INTRODUCTION

Green chemistry involves design and re-design of chemical synthesis[1] and chemical products to prevents pollution and thereby solve environmental problems. Among the challenges for chemists include discovery and development of novel and simple environmentally safe chemical processes for selective synthesis by identifying alternative reaction conditions and solvents for much improved selectivity, energy conservation and less or no toxic waste generation and inherently safer chemical products. Therefore, to address depletion of natural resources and preservation of ecosystem it is just urgent to adopt so called “greener technologies” to make chemical agents for well being of human health.

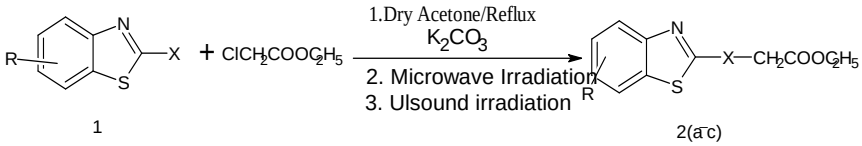
Being a heterocyclic compound, benzothiazole finds use in research as a starting material for the synthesis of larger compounds, usually bioactive structures. Its aromaticity makes it relatively stable; although, as a heterocycle, it has reactive sites, which allow for functionalization. [2,3]
A large number of therapeutic agents are synthesized with the help of benzothiazole nucleus[4]. During recent years there have been some interesting developments in the biological activities of benzothiazole derivatives.These compounds have special significance in the field of medicinal chemistry due to their remarkable pharmacological potentialities[5,6]. Considering above fact, it was decided to use different method to synthesis benzothiazole derivative as an effective scaffold.

MATERIALS AND METHODS

All raw materials used in the synthesis have been obtained from M/S Fluka AG (Bachs, Switzerland) and M/S Sigma-Aldrich chemicals and Co. Inc. (Milwoukee, WI, USA). Microwave Synthesis Reactor (Monowave 300 Anton Parr), ultrasound irradiation was carried out in Ultrasonic Bath model number XUBA3 having maximum power output of 200W and 50-60 Hertz Melting points were recorded on a Thermonik Melting point Apparatus (Campbell Electronics, Mumbai, India) and are uncorrected. IR spectra were recorded on an IR-Affinity, Shimadzu

using DRS system. ^{1}H-NMR spectra have been recorded on a JEOL AL-400 FT-NMR spectrometer (400 MHz, JEOL Ltd., Tokyo, Japan), using TMS as internal standard in solvent DMSO. Mass data have been recorded on Agilent GC-MS Elemental analysis has been carried out on a C, H, and N Elemental Analyzer (Thermo-Finnigan Flash EA 1112, Italy) Mass spectroscopy is done by using GC-MS of Agilent.

3.0 Reaction Scheme



MATERIALS AND METHODS

4.0 Experimental

Method 1: Conventional

4.1 Synthesis of ethyl [(1, 3-benzothiazol-2-yl) sulfanyl] acetate

2-aminobenzothiazole / 2-mercaptobenzothiazole (0.01 M) was dissolved in acetone stirred for 30 mins and K_2CO_3 (0.005M) was added and reflux the reaction mixture, ethyl chloroacetate (0.01M) was added over the period of 15 mins. Reflux the reaction mixture till completion of reaction. Reaction was monitored by TLC. The acetone was removed from the filtrate by distillation the remaining filtrate was poured into well stirred, ice-cold water. Clear solution was extracted with diethyl ether to extract product from aqueous layer. Recrystallized the product from acetone.The characterization data is given on table 1.

Method 2: Microwave Irradiation

4.2 Synthesis of ethyl [(1, 3-benzothiazol-2-yl) sulfanyl] acetate

2-aminobenzothiazole/2-mercaptobenzothiazole (0.01 M), K_2CO_3 (0.005M) and ethyl chloroacetate (0.01M) was mixed thoroughly and taken in 10ml vial, content of the vial was irradiated under microwave irradiation for 4 minutes at 180^0 C. Reaction was monitored by TLC. Solid product thus formed was purified by recrystallisation.The characterization data is given on table 1.

Method 3: Ultrasound Irradiation

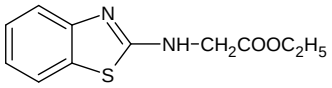
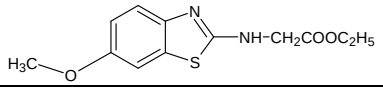
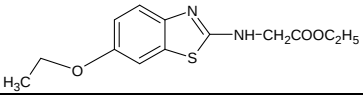
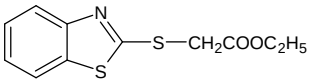
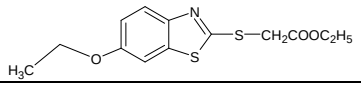
4.3 Synthesis of ethyl [(1, 3-benzothiazol-2-yl) sulfanyl] acetate

2-amino Benzothiazole /2-mercaptobenzothiazole (0.01M), K_2CO_3 (0.005M) and ethyl chloroacetate (0.01M) were taken in 100ml round bottom flask, Content of the flask was subjected to ultrasound irradiation for 15 minutes. After completion of reaction the content was poured into crushed ice, resulting solid thus obtained was separated through filtration, formation of product was confirmed by physical data .The characterization data is given on table 1.

Table 1: Comparative data of synthesizeed compounds

Comps	X	R	MP (^{0}C)	Conventional Method		Microwave Irradiation		Ultrasound Irradiation	
				Time(min)	Yield (%)	Time (min)	Yield (%)	Time (min)	Yield (%)
2a	NH_2	H	166	122	62	4	92	15	79
2b	NH_2	OCH_3	145	136	39	5	90	15	75
2c	NH_2	OC_2H_5	158	148	70	4	82	15	82
2d	SH	H	172	120	55	9	79	15	77
2e	SH	OC_2H_5	178	150	58	15	76	15	76

Table 2: Characterisation data

Compounds		^{1}H NMR (δ ppm)	IR(cm^{-1})	MS
2a		2.28(t, 3H), 3.15(q,2H), 4.87(s,2H), 7.01-8.02 (m, 4H, Ar-H), 5.22 (s, 1H)	1732(CO), 3320(NH)	236[M^+] ($C_{11}H_{12}N_2O_2S^+$), 192($C_8H_7NS_2$), 135(C_7H_5NS).
2b		2.30(t, 3H), 2.45(s,3H), 3.20(q,2H) 4.27(s,2H), 7.04-8.09 (m, 3H, Ar-H), 5.12 (s, 1H)	1728(CO), 3319(NH)	266[M^+] ($C_{12}H_{14}N_2O_3S^+$), 180 ($C_8H_8N_2OS_2$).
2c		2.30(t, 3H), 2.68(t, 3H), 3.22 (q,2H) 4.62(s, 2H) 3.87(q,2H), 7.01-8.02 (m, 3H, Ar-H), 5.22 (s, 1H)	1730(CO), 3350(NH)	280[M^+] ($C_{13}H_{16}N_2O_3S^+$), 194($C_9H_{10}N_2OS_2$)
2d		2.48(t, 3H), 3.89 (q,2H) 4.77(s,2H), 7.09-8.09 (m, 4H, Ar-H)	1740(CO), 690 (C-S)	253[M^+] ($C_{11}H_{11}S_2O_2N^+$), 167($C_7H_5NS_2$),
2e		2.10(t, 3H), 2.44(t, 3H), 3.09(q,2H), 3.59 (q,2H) 4.87(s,2H), 7.21-8.92 (m, 3H, Ar-H),	1743(CO), 699 (C-S)	297[M^+] ($C_{13}H_{15}NO_3S_2^+$), 211($C_9H_9NOS_2$)

RESULTS AND DISCUSSION

In microwave assisted synthesis, the product from 2(a-e) was formed within the range of 2-15 minutes also the yield range of desired products 2(a-e) depicted in Table 1. Optimal reaction time for the synthesis was 2-15 min at 180^0 C. Similarly the synthesis of compounds 2(a-e) was also attempted under the ultrasound irradiation conditions and it was found that at content 15 minutes of duration the desired product was formed with comparatively moderate yield between conventional and microwave method. Whereas the traditional method has consumed more amount of time to form the desired product but with the less yield of the compounds which clearly indicated the loss of product as well as time consuming also this requires constant monitoring.

CONCLUSION

The study clearly showed that, safe chemical processes are very much important for environment. To developed greener techniques for synthesis is very important for the fututre scope of all chemists.

Acknowledgement
The authors are thankful to SAIF, Patiala University, Punjab for recording the NMR spectra.

REFERENCES

[1] W. F. Hoelderic, *J Appl Cat A*, **2000**, 487, 194-195
[2] R.Ali, N.Siddiqui, *Journal of Chemistry*, (**2013**), 12.
[3] A.Martin ,R.Martin, *Journal of Chemistry*,(**2014**), 3(1),323-329.
[4] S. Banerjee, S.Ganguly, K.K. Sen, A Review on 1, 2, 4 – Triazoles, J. Adv. Pharm. Edu. & Res, (**2013**), 3 (3), 102-115.
[5] J.Boström, A.Hogner , A.Llinàs , E.Wellner ,A.T.Plowright , *J Med Chem.*, (**2012**), 8;55(5),1817-30.
[6] K. Kinoshita, A. Mitani, J. D. Hearse, V. M. Braimbridge, S. H. Manning, *J. Surg.Res.* **1989,** 97,166.