



BENZOTHAIAZOLE ANALOGS SYNTHESIS BY USING DIFFERENT TYPES OF REACTION.

Ajit K. Nangare², Amit N. Chavan^{1*}, Ujwala R. Avhad¹, Gaurav S. Lodha¹, Nikhil S. Kolate¹, Balu J. Ransing¹, Abhishek Bura¹

¹Dr. Vithalrao Viikhepatil Foundations College of Pharmacy, Viladghat, Ahmednagar (MS), INDIA- 414111.

²Department of Pharmaceutical Chemistry, Dr. Vithalrao Vikhe Patil Foundation's College of Pharmacy, Vilad Ghat, Ahmednagar, (MS), India, 414111.

*Corresponding Author: Dr. Amit N. Chavan

Dr. Vithalrao Viikhepatil Foundations College of Pharmacy, Viladghat, Ahmednagar (MS), INDIA- 414111.

Article Received on 21/03/2017

Article Revised on 11/04/2017

Article Accepted on 01/05/2017

ABSTRACT

Heterocyclic compounds class has important because of substituted of different group on the heterocyclic ring. In past years the heterocyclic compound or molecule are become more attractive because of their different activity on different disease. The benzothiazole compound having different biological activity like, antimicrobial agent, antidiabetic agent, anti-inflammatory agent, anticonvulsant agent, antimalarial agent, anthelmintic agent, analgesic, antitubercular agent etc. The present review focuses on the different types of synthesis method and different derivative with their different use.

KEYWORDS: Heterocyclic compounds derivative with their different use.

INTRODUCTION

In the organic compound class the heterocyclic compound benzothiazole has taken the important place by showing the different biological activity. In developing the novel pharmaceutical active pharmaceutical ingredient it has been taken the great part. The benzothiazole compound contains one nitrogen and sulfur molecule. The different methods have been found to synthesize the derivatives of benzothiazole. Attachment or substitution of different compound on the on any part can change the activity of the compound. The benzothiazole compound and its derivatives are now used for their different biological activity like, antimicrobial agent^[6,11,8,18,10], antidiabetic agent^[16], anti-inflammatory agent, anticancer^[3,14,13,15], anticonvulsant agent, antioxidants^[4], antimalarial agent, anthelmintic agent, analgesic, antitubercular agent etc.

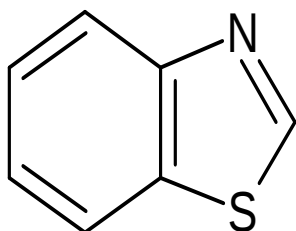


Fig. 1: Skeletal formula of Benzothiazole Molecule.

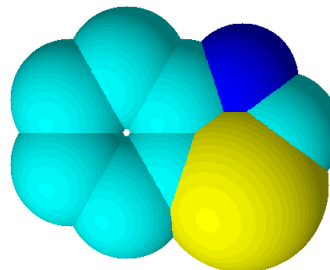


Fig. 2: Spacing Model of the Benzothiazole Molecule.

Library syntheses of benzothiazole^[17]

Benzothiazole might be synthesized through the action of acid anhydrides (Otherwise) chlorides on o-aminophenols as well as formic acid in the occurrence of acetic anhydride.

Synthesis of Benzothiazole

Method 1: Solvent free synthesis

By condensation of 2-aminothiophenol with various fatty acids under the microwave in free solvent condition we use to synthesize 2-substituted benzothiazole (way-A). By using the catalyst P4S10 in (way-B). This can be completed successfully within 3-4 min.^[12]

Method 2: Using acetic anhydride to synthesize 101

1. Benzothiazole can be synthesized by using formic acid, chlorides on o-aminophenols or acid anhydrides and in the presence of acetic anhydride.

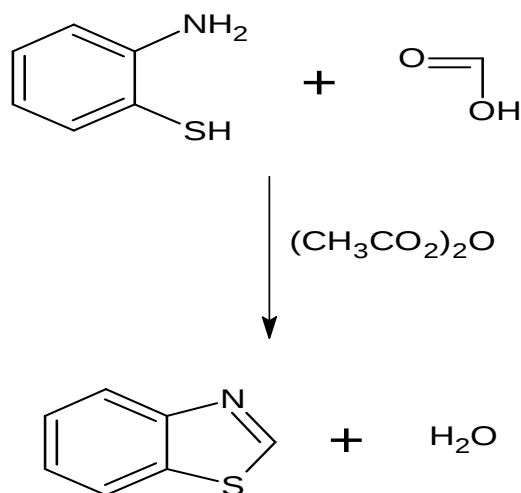


Fig. 3: Synthesis of Benzothiazole by using acetic anhydride (A)

2. 2-mercaptobenzothiazole can be use as starting material for sysnthesis andvulkanisation is use to accelerator it.^[17,18]

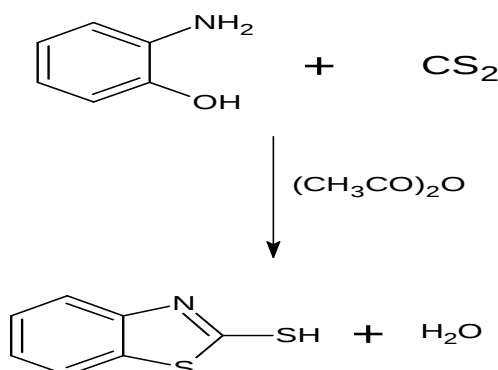


Fig. 4: Synthesis of Benzothiazole by using acetic anhydride (A)

Method 3: Using Phosphorus pentasulfideto synthesis.

By acting on the o-acylaminopenoles the phousphoruspentasulfide gives Benzothiazole derivative.^[1,19]

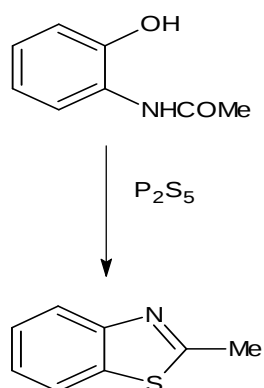


Fig. 5: Synthesis of Benzothiazole by using phosphorus pentasulfide.

Method 4: Using condensation method of o-aminothiophenolfor synthesized.

By just applying condensation on o-aminothiophenol it can easily use for synthesis of benzothiazole.

1. In presence of aldehydes the Condensation of o-aminothiophenol take place for synthesis^[7]

Different types of Catalysts use for the synthesis (i-vi):

- AcOH /Air, Microwave/ Thermal Heating
- Baker's yeast, Dichloro methane
- H₂O₂ /HCl system in ethanol
- Cerium (IV) ammonium nitrate
- Montmorillonite, SiO₂/Graphite; Microwave, p-TsOH
- Diethyl bromophosphonate/tert-Butyl hypochlorite, acetonitrile

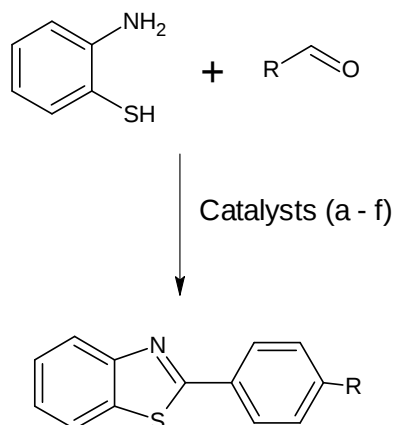


Fig. 6: Synthesis of Benzothiazole by using acetic anhydride (A)

Method 5. By using the cyclization method 2-substituted Benzothiazole is synthesized^[7]

- Thioformanilides converting using different catalysts in to the 2-aminobenzothiazoles:-

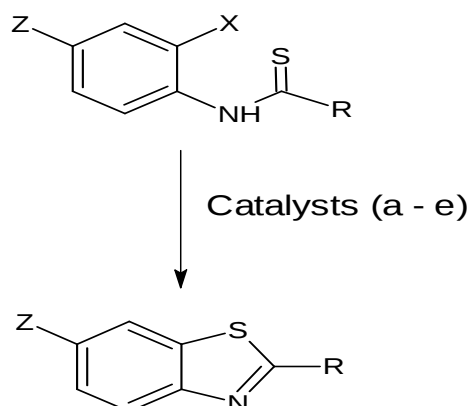


Fig. 7: Synthesis of Benzothiazole by using cyclization method

Different types of Catalysts use for the synthesis (i-v)

- CS₂CO₃, Dioxane
- Pd (PPh₃)₄/MnO₂ system under an oxygen
- CuI; 1, 10-Phenanthroline, CS₂CO₃, reflux
- chloranil atmosphere Manganese triacetate
- Photochemical cyclization induced by

Method 6: By coupling synthesized method^[7]**1. Thiophenols and aromatic nitriles are attached by Coupling method**

Ceric ammonium nitrate is used as the mediator in the reaction of thiophenols when they are treated with the aromatic nitriles to give 2-arylbenzothiazoles with good yield.

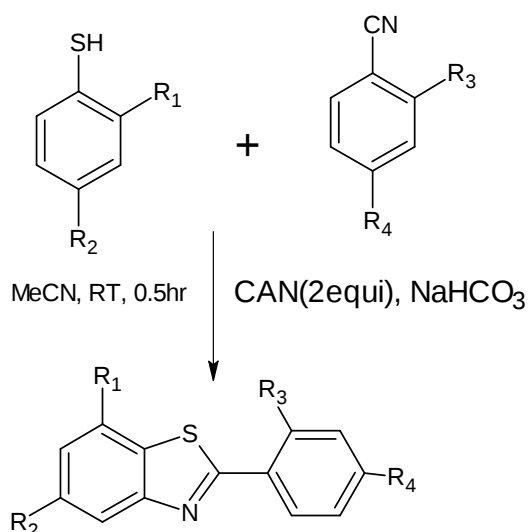


Fig. 8: Synthesis of Benzothiazole by using coupling between aromatic nitriles and thiophenols.

Method 7: By using substituted anilines for synthesis^[7]

1. Substituted anilines in different position in the ring and treating with KSCN in existence of glacial acetic acid to synthesize Benzothiazole.

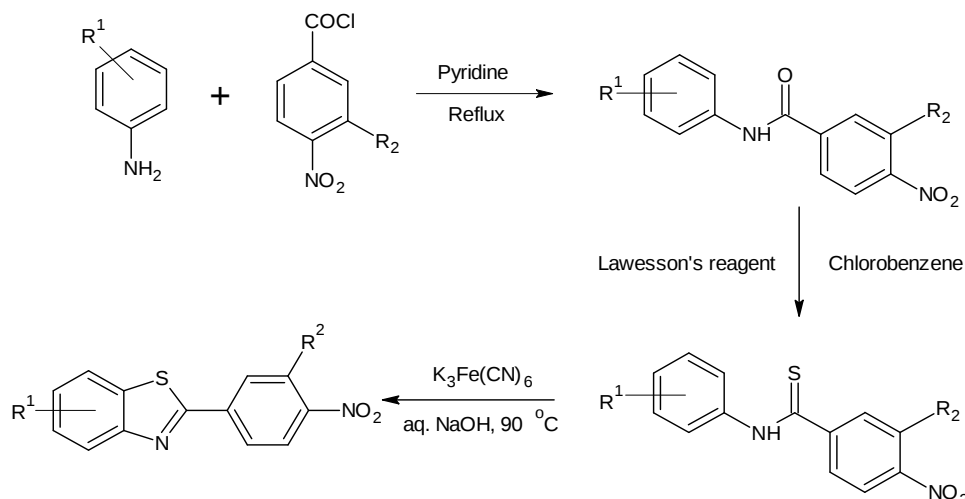


Fig. 10: Synthesis of Benzothiazole by using substituted anilines (B).

Method 8: Using of different type of catalysts for synthesis^[7,12]**(A) Using bromine as the catalyst**

Recently some methods are reported which mostly use bromine as catalyst for the synthesis.

1. Hagerschoff found this Reaction in early 1900s.

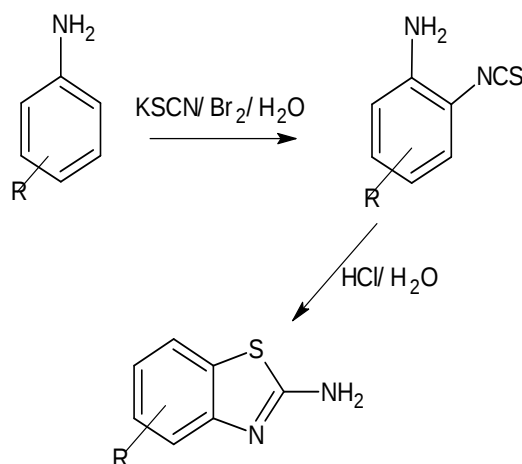


Fig. 9: Synthesis of Benzothiazole by using substituted anilines (A).

2. Substituted anilines with nitrobenzoyl chloride into the pyridine under reflux and additional treatment through Lawesson's reagent as well as after that cyclization of intermediate with Potassium ferricyanide.

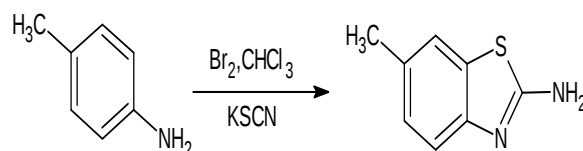


Fig. 11: Synthesis of Benzothiazole by using bromine as catalyst (a).

2. Johanson and Hamillton found this Reaction and prepared new method to synthesis the compound.

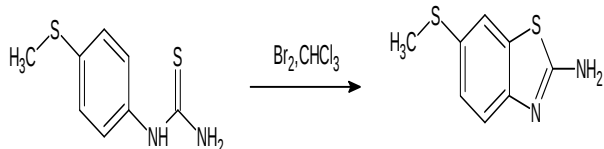


Fig. 12: Synthesis of Benzothiazole by using bromine as catalyst (b).

3. Stuckwisch found this Reaction, used potassium thiocyanate to cyclize p-substituted aniline into 2-amino-6-substituted benzothiazole in the presence of bromine as a catalyst.

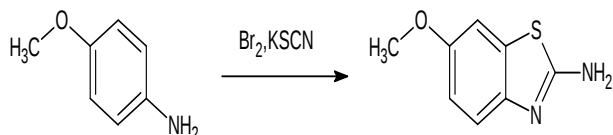


Fig. 13: Synthesis of Benzothiazole by using bromine as catalyst (c).

4. Alaimo and his coworkers has prepared 2-amino-5,6-dichloro and 2-amino-6,7-dichlorobenzothiazole.

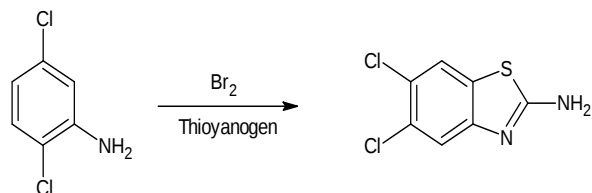
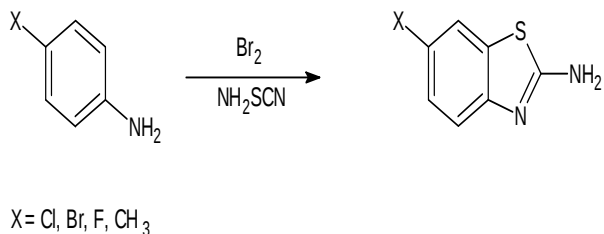


Fig. 14: Synthesis of Benzothiazole by using bromine as catalyst (d).

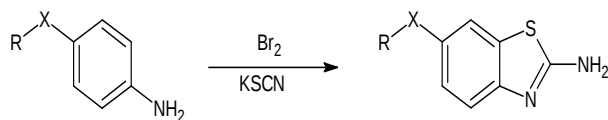
5. Jeng Li found this Reaction which prepared 6-substituted-2-aminobenzothiazole by cyclizations method of p-substituted anilines in presence of ammonium thiocyanate with bromine.



X = Cl, Br, F, CH_3

Fig. 15: Synthesis of Benzothiazole by using bromine as catalyst (e).

6. Naim found this Reaction which is used to synthesize 2-amino-6-substituted-carbonyl benzothiazole and 2-aminobenzothiazole-6-carboxylic acid.

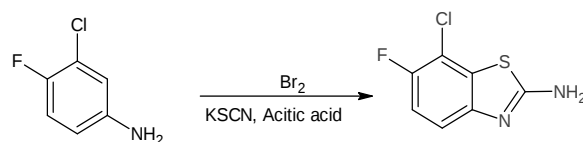


X = CO

R = OH, O, alkyls

Fig. 16: Synthesis of Benzothiazole by using bromine as catalyst (f).

7. D. S. Dogruer and coworkers found this Reaction which by cyclization method of potassium thiocyanate and 3-chloro-4-fluoroaniline and give 2-amino-6-fluoro-7-chlorobenzothiazole its done in presence bromine as catalyst.



X = CO

R = OH, O, alkyls

Fig. 17: Synthesis of Benzothiazole by using bromine as catalyst (g).

8. Agrawal and Patel were synthesized various substituted-2-aminobenzothiazoles molecules.

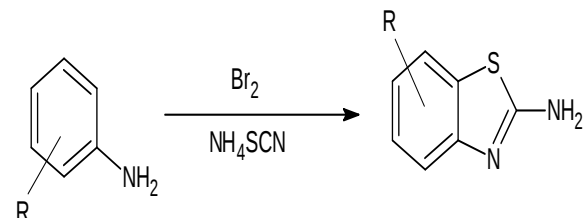


Fig. 18: Synthesis of Benzothiazole by using bromine as catalyst (h).

(B) Using sulfuric acid as catalyst

Allen establishes this Reaction by using cyclize p-substituted aniline with sodium thiocyanate in the occurrence of sulfuric acid as a catalyst and convert to into 2-amino-6-substituted Benzothiazole which act.

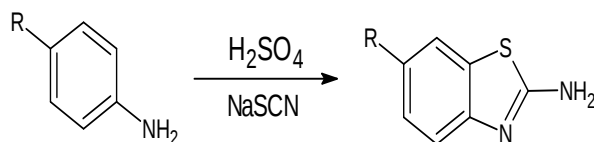


Fig. 19: Synthesis of Benzothiazole by using sulfuric acid as catalyst (i).

(C) Using benzene as catalyst

Tweit establishes this Reaction by using cyclizations method with isothiocyanate toward 2-aminobenzothiazole in occurrence of benzene as catalyst.

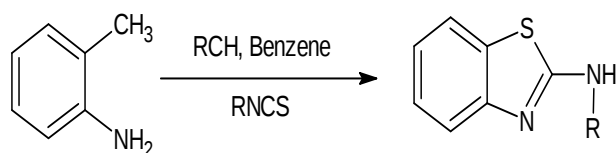


Fig. 19: Synthesis of Benzothiazole by using benzene as catalyst (j).

(D) Using benzyltrimethylammonium tribromide as catalyst

Jordan establishes this Reaction by using $\text{PhCH}_2\text{NMe}_3\text{Br}_3$ (Benzyltrimethylammonium tribromide), is an good electrophilic bromine source for the alteration of replacement of arylthioureas to 2-aminobenzothiazoles less than mild conditions with giving good yields.

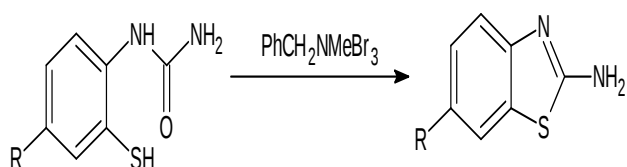


Fig. 20: Synthesis of Benzothiazole by using benzyltrimethylammonium tribromide as catalyst (k).

REFERENCES

- Shivaraj H, Gazi S, Patil S, Surwas S. Asian J Research Chem 2010; 3(2): 421-427.
- Rauf A, Gangal S, Sharma S. Solvent-free synthesis of 2-alkyl and 2-alkenylbenzoles from fatty acids. Kini S, Swain S, Gandhi A. I J Pharm Sci 2007; Jan-Feb: 46-50.
- Sreenivasa M, Jaychand E, Shivakumar B, Jayraj Kumar K, Vijaykumar J. Arch Pharm Sci and Res 2009; 1(2): 150-157.
- Heo Y, Song Y, Kim B, Heo J. Tetrahedron Letters 2006; 47: 3091-3094.
- Gupta S, Ajmera N, Gautam N, Sharma R, Gautam D. I J Chem 2009; 48B: 853-858.
- Khokra Sukhbir L, Arora Kanika, Mehta Heena, Aggarwal Ajay, Yadav Manish. Int J Pharm Sci and Res 2011; 2(6): 1356-1377.
- Murthi Y, Pathak D. J Pharm Res 2008; 7(3): 153-155.
- Reddy P, Lin Y, Chang H. Arcivoc 2007; xvi: 113-122.
- Maharan M, William S, Ramzy F, Sembel A. Molecules 2007; 12: 622-633.
- Kumbhare RM, Ingle VN. I J Chem 2009; 48B: 996-1000.
- Gupta Akhilesh, Rawat Swati. J Curr Pharm Res 2010; 3(1): 13-23.
- Wang M, Gao M, Mock B, Miller K, Sledge G, Hutchins G, Zheng Q. Bioorg Med Chem 2006; (14): 8599-8607.
- Stanton HLK, R Gambhari, Chung HC, Johny COT, Filly C, Albert SCC. Bioorg Med Chem 2008; 16: 3626-3631.
- Hutchinson I, Chua MS, Browne HL, Trapani V, Bradshaw TD, Westwell AD. J Med Chem 2001; 44: 1446-1449.
- Pattan S, Suresh C, Pujar V, Reddy V, Rasal V, Koti B. I J Chem 2005; 44B: 2404-2408.
- Shivaraj H, Gazi S, Patil S, Surwas S. Synthesis and biological evaluation of some benzothiazole derivatives. Asian J Research Chem. 2010; 3(2): 421-427.
- Rajeeva B, Srinivasulu N, Shantakumar S. E-Journal of Chemistry 2009; 6(3): 775-779.
- Yadav PS, Devprakash, GP Senthilkumar. Int J Pharm Sci and Drug Res 2011; 3(1): 01-07.