April 2013, Vol-4, Issue -2

Available online at www.ijppronline.in

International Journal of Pharma Professional Research

ISSN NO:0976-6723

Review Article

TRIAZOLE DERIVATIVES: AS POTENTIAL PHAMACOLOGICAL AGENTS

Priyanka Dhiman[1*], Anurag Khatkar[2], Neelam Malik[2] , Neelam Redhu[2]

1. Department of Phamaceutical Sciences, M.D.University, Rohtak, HARYANA

2. Department of Microbiology, Punjab Agricultural University, Ludhiana, PUNJAB

Abstract

Triazoles and its derivatives possess a great importance in medicinal chemistry and can be used for the synthesis of numerous heterocyclic compounds with different biological activities. In present article various pharmacological activites of triazole have been described in brief, such as, antiviral, antibacterial, antifungal and antitubercular. Thus triazole acts as an important medicinal agent for the scientists working over this field. This review can be helpful to develop various more new compounds having triazoles moiety that could be better in terms of potency and reduced toxicity.

Keywords: Triazole derivatives, pharmacological activities

Introduction

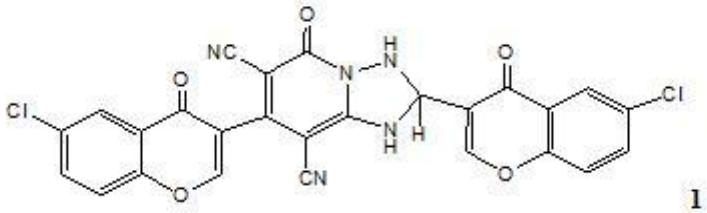
Nitrogen containing heterocyclic ring such as triazole is a promising structural moiety for drug design. Triazole and triazoles fused with six-membered ring systems are found to possess diverse applications in the fields of medicine, agriculture and industry. Triazole derivatives form a component in a number of useful drugs and are associated with many biological and therapeutical activities. Triazole exihibit interesting pharmacological properties such as anti-carcinogenic (Rollas *et al.*, 2007), antihelmentic (Shrivastava *et al.*, 2010), antibacterial (Padmaja *et al.*, 2009), antioxidant (Valentina *et al*., 2009), hypoglycemic (Deliwala *et al.*, 1971), and anti-inflammatory (Palaska *et al*., 2007) etc. The numerous modifications upon triazole ring and its relative importance in nature have made it an interesting area for researchers.

2. Biological activities of triazole derivatives:

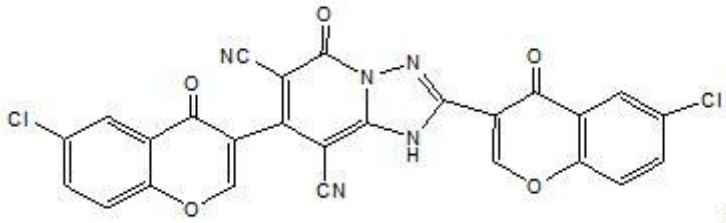
2.1 Antimicrobial activity:

Ibrahim *et al.*, (2010) synthesized three series of novel fused nitrogen heterocyclic systems such as 1,2,4-triazolo[1,5-*a*] pyridines (5-7 and 9),pyrido[1,2-*b*][1,2,4]triazines (10, 11, 13 and 15), and pyrido[1,2-*b*][1,2,4]triazepines (17, 18, 20 and 22) linked with a chromone moiety from the key intermediate 1,6-diamino-(6-chloro-4-oxo-4*H*-chromen-3-yl)-2-oxo-1,2-dihydropyridine-3,5-dicarbonitrile.

Antimicrobial activity was determined by the standardized disc agar diffusion method against the sensitive organisms *Staphylococcus aureus* (ATCC 25923) and *Streptococcus pyogenes* (ATCC 19615) as Gram positive bacteria, *Pseudomonas fluorescens* (S 97) and *Pseudomonas phaseolicola* (GSPB 2828) as Gram negative bacteria and two species of fungi, namely *Fusarium oxysporum* and *Aspergillus fumigatus*. Where antibiotic chloramphenicol was used as reference in the case of Gram negative bacteria, while cephalothin was used in the case of Gram positive bacteria and cycloheximide was used as antifungal reference. Compounds **1** and **2** showed the significant activities when compared with the reference drugs.

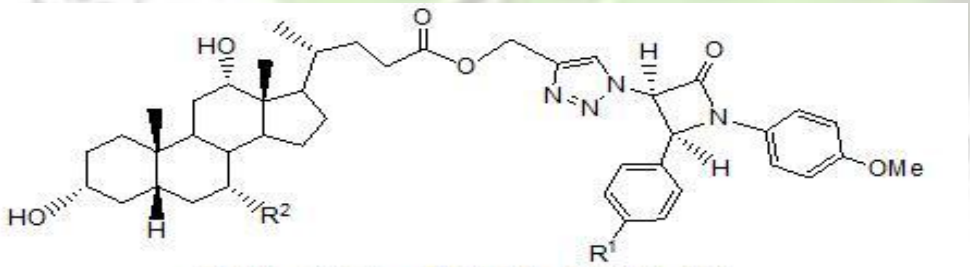


1

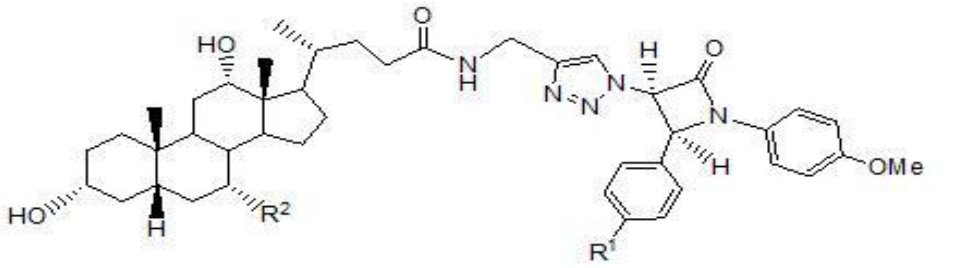


2

Namdev *et al.*, (2008) synthesized novel 1,2,3-triazole-linked b-lactam–bile acid conjugates 17–24 using 1,3-dipolar cycloaddition reaction of azido b-lactam and terminal alkyne of bile acids in the presence of Cu(I) catalyst. All the synthesized molecules were further evaluated *in vitro* for their antifungal and antibacterial activities. Most of the compounds exhibited significant antifungal and moderate antibacterial activity against all the tested strains. Compounds **3-10** demonstrated potent antimicrobial activity against all the strains tested. The compound **10** showed very good antifungal activity with MIC value of 16 lg/mL against *C. albicans* and 8 lg/mL against *B. poitrasii*. In particular, compound **4** exhibited the maximum activity with MIC values of 4 lg/mL against *Y. lipolytica*. Additionally, only the compounds **3**, **5**, **7** and **9** derived from cholic acid were found moderately active against *S. aureus*.



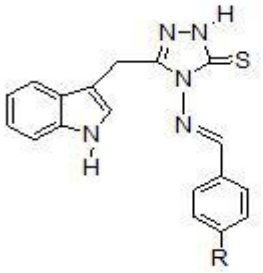
3, R1 = H, R2 = OH **5**, R1 = Cl, R2 = OH
4, R1 = H, R2 = H **6**, R1 = Cl, R2 = H



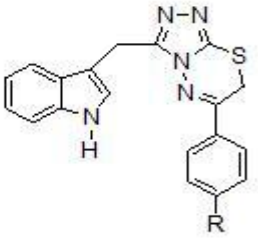
7, R1 = H, R2 = OH **9**, R1 = Cl, R2 = OH

8, R1 = H, R2 = H **10**, R1 = Cl, R2 = H

Revial *et al.*, (2008) synthesized series of novel 4-arylideneamino-3-mercapto-5-[(1H-indol-3-yl)methyl]-4H-1,2,4-triazoles **11(a-e)** and 3-[(1H-indol-3-yl)methyl]-6-aryl-7H-1,2,4-triazolo[3,4-b][1,3,4] thiadiazines **12(a-e)**, then all the synthesized compounds were evaluated for their antimicrobial activities against *Micrococcus luteus* (NRLL B-4375), *Bacillus cereus* (NRRL B-3711), *Proteus vulgaris* (NRRL B-123), *Salmonella typhimurium* (NRRL B-4420), *Staphylococcus aureus* (NRRL B-767), *Escherichia coli* (NRRL B-3704). Among these series compound **12c** including the methyl on phenyl showed significant antifungal activitiy. On the other hand compounds **11c**, **12a**, **12c**, and **12e** also showed significant antibacterial activities.

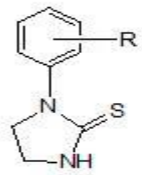


11

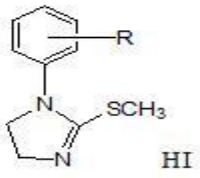


12

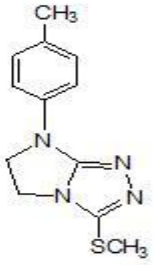
Pasternak *et al.*, (2006) synthesized 1-Arylimidazolidine-2-thiones **13(a–g)** by the condensation reaction of N-arylethylenediamines with carbon disulfide in xylene medium. Their further alkylation with methyl iodide led to the formation of some biologically active 1-aryl-2-methylthio-imidazolines **14(a–g)**. The 7-(4-methylphenyl)-3-methylthio-5H-6,7-dihydro imidazo[2,1-c][1,2,4]triazole **15(b)** was obtained by the alkylation of the respective 7-(4-methylphenyl)-2,5,6,7-tetrahydroimidazo[2,1-c][1,2,4]triazol-3(H)-thione **16(b)** with methyliodide. Antimicrobial activities of 1-aryl-2-methylthio-imidazolines **14(a–g)** and the 7-(4-methylphenyl)-3-methylthio-5H-6,7-dihydroimidazo[2,1-c][1,2,4]triazole **15(b)** are presented. All tested compounds showed MIC in the range of 11.0–89.2 lM. Compounds **14a, e** were found to be equipotent to chloramphenicol *in vitro*, whereas **14a,c,e-g** and **15b** showed superior activity (MIC) to ampicillin.



13(a–g)



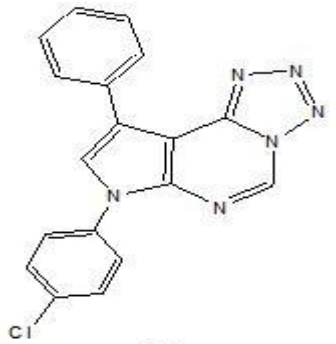
14(a–g)



15(b)

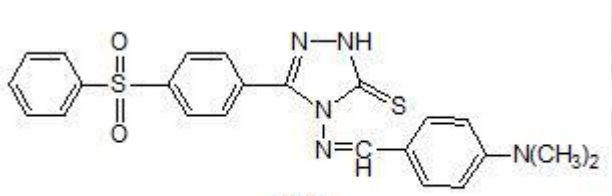
a : R = H; **b** : R = 4-CH_3; **c** : R = 2-CH_3O; **d** : R = 4-CH_3O; **e** : R = 3-Cl; **f** : R= 2,6-Cl_2
g : R = 3,4-Cl_2.

Shah *et al.*, (2002) synthesized a series of novel tetrazolo[1,5-*c*]pyrrolo[3,2-e]pyrimidines **16(a-f)** and triazolo[1,5-*c*]pyrrolo[3,2-*e*]-pyrimidines **17(a-e)** by two different routes. The potential antimicrobial effects of the synthesized compounds were investigated using *E. coli*, *E. entericus*, *P. aeruginosa*, *S. aureous* and *B. subtilis*. Antimicrobial assays were carried out by the agar plate diffusion method. Compound **16c** was found to be most potent than ampicillin against all the tested cultures except *S. aureous*.



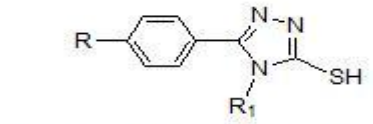
16c

Almajan *et al.*,(2009) synthesized series of Mannich bases of 4-substituted 5-[4-(4-X-phenylsulfonyl) phenyl]-2,4-dihydro-3H-1,2,4-triazole-3-thiones, X ¼ H, Cl, Br. All the synthesized compounds were evaluated for antimicrobial activity against different bacterial cultures comprising *Acinetobacter baumanii* ATCC 19606; *Citrobacter freundii* ATCC 8090; *Pseudomonas aeruginosa* ATCC 9027; *Enterococcus faecalis* ATCC 19433; *Staphylococcus aureus* ATCC 12600; *Staphylococcus epidermidis* ATCC 14990; *Bacillus subtilis* ATCC 6633 strains. Some of them exhibited promising activities against *A. baumanii* and *B. subtilis*. Results of antimicrobial activity shown that **18d** showed excellent activity against B. subtilis (MIC ¼64 mg/mL) and **18e** showed good activity against A. baumanii and P. aeruginosa (MIC¼ 128 and 256 mg/mL respectively), comparative with chloramphenicol.



18d

Baluja *et al.*, (2007) synthesized some 4-aryltriazoles and all thesynthesized compounds were evaluated for the antibacterial activity against *Bacillus cereus*, *Pseudomonas testosteroni*, *Klebsiella pneumonia*, *Micrococcus flavus*, and *Citrobacter freundii*. The 4-aryltriazole derivatives were obtained by cyclization of potassium salt of the appropriately substituted dithiocarbazinic acid wit aromatic amines. In antimicrobial study against *P. testosteroni*, **19f** had shown the maximum activity. However **19j** and **19a** contain the *o*-methoxyphenyl and *p*-methylphenyl group, respectively, which were found to be effective against *P. testosteroni*. Compound **19f** also had shown the maximum activity against *K. pneumoniae*. Whereas, compounds **19c** and **19i** showed no activity at all against this bacterium, while the other compounds showed some activity. Against *M. flavus*, **19a** showed the maximum activity. Antibacterial activity against *C. freundii* was observed only with **19f** and **19d**.



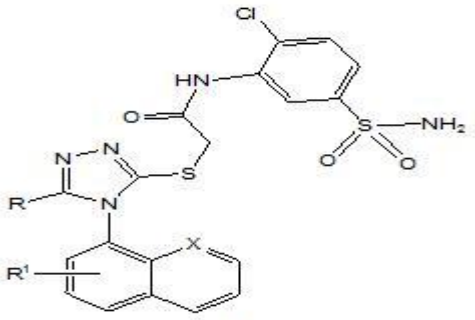
19f R=OCH_3, R_1= 2,4-$(CH_3)_2$–C_6H_3

2.2 Anti HIV activity

Cheng *et al.*, (2007) synthesized a series of 5-alkylthio **20(a-d)**, 4-arylideneamino **21(a-d)** and 4-arylideneamino-5-alkylthio derivatives **22(a-f)** of 4-amino-3-(2-furyl)-5-mercapto-1,2,4-triazole (**1**) by alkylation of the parent compound with alkyl halides and condensation with aldehydes, respectively. Sulfanyl 961immers **23(a-d)** and 4-iminomethyl dimer **6** were correspondingly prepared by reaction with alkane dibromides and 1,4-diformylbenzene. The newly designed and synthesized substituted s-triazole derivatives were assayed for anti-HIV-1 activity by examination of their inhibition of HIV-1-induced cytopathogenicity in MT-4 cells and by determination of their inhibitory effect on HIV-1 reverse transcriptase. Compound **22e** was found to be the most active inhibitor against HIV-1 replication in cell culture (EC_{50} = 12 μM) and against HIV-1 reverse transcriptase (IC50 =43.5 μ M).

22e

Kim *et al.*, (2006) synthesized a new series of 1,2,4-triazoles and tested against several NNRTI-resistant HIV-1 isolates. Several compounds exhibited potent antiviral activities against efavirenz- and nevirapine-resistant viruses,



25

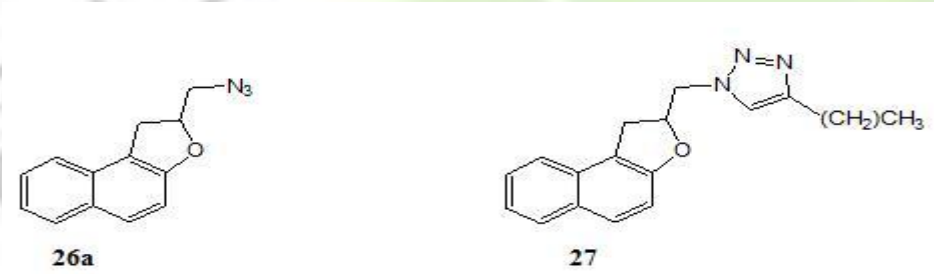
where 25b R=Me, R^1=H, X=CH and

25f R=Me, R^1=2,4-DiMe, X=CH

containing K103N and/or Y181C mutations or Y188L mutation. Except for compounds **24b** and **25f**, the presence of the 5-trifluoromethyl replacing the 5-methyl-substitution on the triazole improved the antiviral activity against the Y188L mutant.

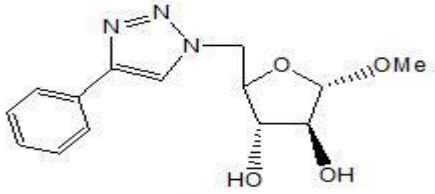
2.3 Antitubercular activity

Tripathi *et al.*, (2010) synthesized series of 1,4-Disubstituted-1,2,3-triazoles by [3b2] cycloaddition of different 2-(azidomethyl) dihydronaptho(benzo)furans with different alkynes. All the compounds were screened for antitubercular activity against *Mycobacterium tuberculosis* H37Rv. Compounds **26a**, and **27** exhibited antitubercular activities with MIC ranging from 12.5 to 3.12 mg/ml.



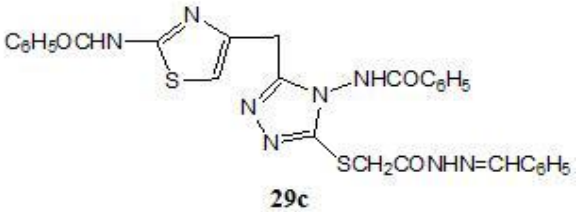
26a **27**

Kumar *et al.*, (2008) synthesized series of 5-Azido-5-deoxy-xylo-, ribo-, and arabinofuranoses by nucleophilic substitution reaction of the respective 5-O-(methanesulfonyl) or p-toluenesulfonyl derivatives with NaN_3 in DMF. The intermediate 5-azido-5-deoxy glycofuranoses on 1,3-cycloaddition with different alkynes in the presence of CuSO4 and sodium ascorbate gave the corresponding sugar triazoles in very good yields. The synthesized sugar triazoles were screened for their antitubercular activity against *Mycobacterium tuberculosis* H37Rv, where one of the compounds displayed mild antitubercular activity *in vitro* with MIC 12.5 lg/mL.



28

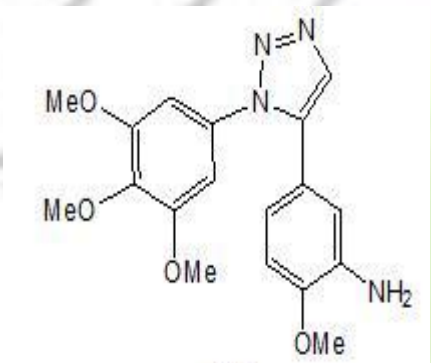
Shiradkar *et al.*, (2007) synthesized of thiazolyl triazole derivatives, starting from ethyl acetoacetate, by microwave organic reaction enhancement method (MORE) and results of investigations of their antimycobacterial and antimicrobial activities. Many compounds had shown promising activity while others were found to be inactive. Specifically compounds **29(a-c)**, i.e. Schiff bases probably because of their ability to increase the penetration in the bacterial cell had shown the best of all. Due to the better activity against the mycobacteria, compounds **29(a-c)** were the best choice for the preparations of new derivatives in order to improve its effectiveness on intracellular mycobacteria (macrophage) or in infected animal.



29c

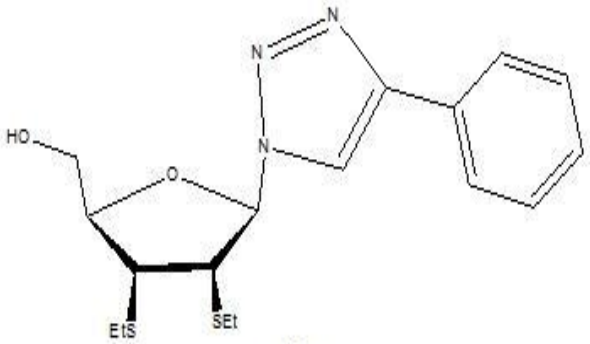
2.4 Anticancer activity

Hentzen *et al.*, (2008) synthesized a series of cis-restricted 1,5-disubstituted 1,2,3-triazole analogues of combretastatin. The triazole12f, 2-methoxy-5-(1-(3,4,5-trimethoxyphenyl)-1H-1,2,3-triazol-5-yl)aniline, resulted potent cytotoxic activity against several cancer cell lines with IC_{50} values in the nanomolar range. The ability of triazoles to inhibit tubulin polymerization was evaluated, and **30f** inhibited tubulin polymerization with IC_{50} = 4.8 lM. Molecular modeling experiments involving **30f** and the colchicines binding site of a,b-tubulin shown that the triazole moiety interacts with b-tubulin via hydrogen bonding with several amino acids.



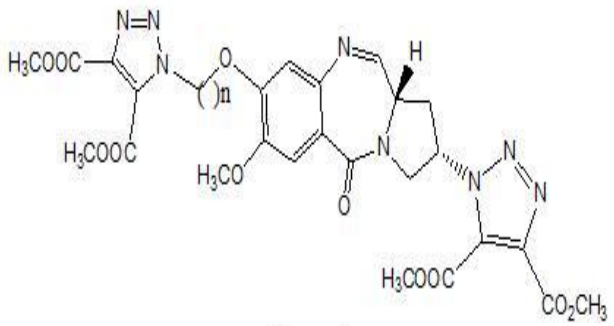
30f

Zhang *et al.*, (2010) synthesized a series of novel 20,30-dideoxy-20,30 diethanethioribonucleosides and those modified with a triazole ring. All the synthesized compounds were evaluated for their antitumor activity. Nucleosides with a triazole ring, **31(a-c)**, have shown significantly improved activity towards a broad range of tumor cell lines.



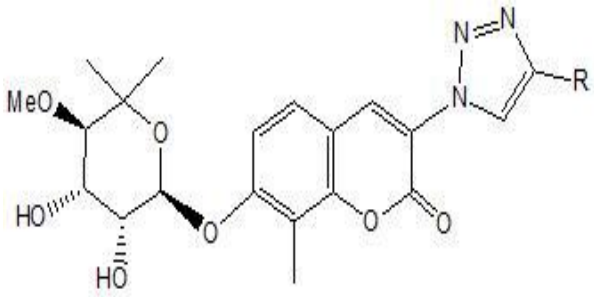
31a

Kamal *et al.*, (2008) synthesized a series of A/C8, C/C2 and A/C8-C/C2-linked 1,2,3-triazole-PBD conjugates by employing 'click' chemistry. These molecules have exhibited promising DNA-binding affinity and anticancer activity in to selected human cancer cell lines.



32a: n = 3
32b: n = 4
33c: n = 5

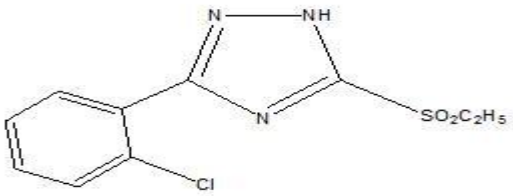
Peterson *et al.*, (2010) synthesized a series of triazole-containing novobiocin analogues. The anti-proliferative activity of these compounds was evaluated against two breast cancer cell lines (SKBr-3 and MCF-7), and manifested activities similar to their amide-containing counterparts. Additionally, Hsp90-dependent client protein degradation was observed via Western blot analyses, supporting a common mode of Hsp90 inhibition for both structural classes. The results indicated that the amide moiety can be replaced by the triazole functionality, though, in some cases the loss of the hydrogen bond donor appears detrimental, but this effect can be overcome by the inclusion of steric bulk in the triazole substituent.



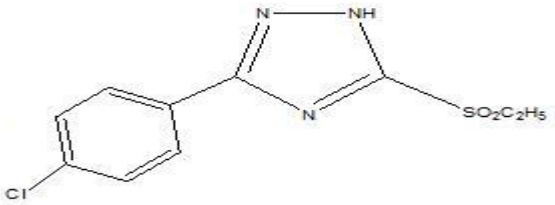
33 where R=Biaryl

2.5 Anti-inflammatory activity

Tozkoparan *et al.*, synthesized a series of 5-aryl-3-alkylthio-1,2,4-triazoles andcorresponding sulfones. The synthesized compounds were assayed per os in mice for their antiinflammatory and analgesic activity as well as the ulcerogenic risk and acute toxicity. Alkylsulfone derivatives were found to be more potent analgesic-antiinflammatory agents than the corresponding alkylthio analogs. Compounds **34** and **35** were found to be most active of the series in both analgesic and antiinflammatory activity tests.

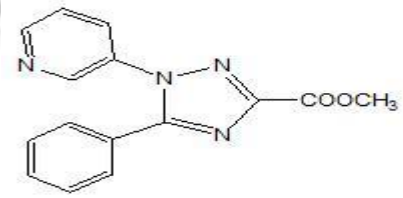


34

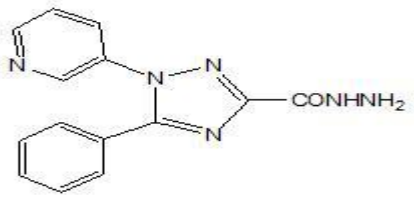


35

Rabea *et al.*, (2006) synthesized a series of 5-phenyl-1-(3-pyridyl)-1H-1,2,4-triazole-3-carboxylic acid derivatives. The results of the anti-inflammatory activity of the synthesized derivatives showed that most of the tested compounds exhibited significant inhibition against carrageenan-induced rat paw edema in albino rats. Derivatives **36** and **37** has shown promising results and were found equipotent or more potent than Indomethacin and Celecoxib as reference drugs at two dose levels, 5 and 10 mg/kg, and they has no ulcerogenic activity.

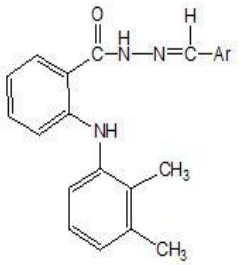


36



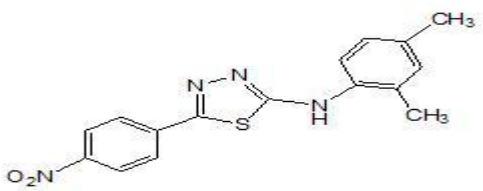
37

Tajik *et al.*, (2005) synthesized a series of N-Arylhydrazone derivatives of mefenamic acid (a known nonsteroidal anti-inflammatory drug). All the synthesized compounds were evaluated for their analgesic and anti-inflammatory activities by abdominal constriction test (writhing test) and carrageenaninduced rat paw edema test respectively. Among them, compounds **38,39, 40, 41, 42, 43,** and **44** were significantly greater than mefenamic acid in the writhing test, but they are not potent anti-inflammatory agents



Where 38 Ar=4-tolyl, **39** Ar=4-fluorophenyl, **40** Ar=4-hydroxyphenyl, **41** Ar=4-nitrophenyl, **42** Ar=4-pyridyl, **43** Ar=3-pyridyl, **44** Ar=2-pyridyl

Khan *et al.*, (2010) synthesized a new series of 4,5-disubstituted-2,4-dihydro-3H-1,2,4-triazole-3-thiones (8aej) and 2,5-disubstituted-1,3,4-thiadiazoles (9aeh) were synthesized by dehydrative cyclization of hydrazine carbothioamide derivatives by refluxing in 4 N aqueous sodium hydroxide and by overnight stirring with polyphosphoric acid, respectively. All the synthesized compounds were screened for their antioxidant and urease inhibition activities. N-(2,4-Dimethylphenyl)-5-(4-nitrophenyl)-1,3,4-thiadiazol-2-amine **45** showed excellent antioxidant activity more than the standard drug.



3. Conclusion

Triazole moiety and its various derivatives studied frequently in the past time and found potent in various pharmacological and pathological conditions, which are discussed in brief in this article. This article mainly focused on the various derivatives of triazole showed various important pharmacological activities like antimicrobial, anti-inflammatory, antitubercular, anti-HIV, etc. Thus by studying all the derivatives showing variety of activities can say that triazole ring have been explored in past years and is still be used for future development of new drugs against many more pathological conditions.

4. References

1.Almajan GL, Barbuceanu SF, Almajan E, Draghici C, Saramet G (2009) Synthesis, characterization and antibacterial activity of some triazole Mannich bases carrying diphenylsulfone moieties. Eur. J. Med. Chem, 44:3083-3089.

2.Almasirad A, Tajik M, Bakhtiari D, Shafiee A (2005) Synthesis and analgesic activity of N-arylhydrazone derivatives of mefenamic acid. J Pharm Pharmaceut Sci. 8(3):419-425.

3.Baluja S, Chanda S, Chabhadiya R, Kachhadia N, Nair R, Solanki A (2007) A facile synthesis and the antimicrobial activity of some 4-aryltriazoles. J. Serb. Chem. Soc. 72(6):539-544.

4.Cikla P, Rollas S (2007) Synthesis of Some New Triazene and Diazene Derivatives and *In vitro* Evaluation of Preliminary Antitumor Activities. J. Pharm. Sci, 32:33-40.

5.Dave CG and Shah RD (2002) Annellation of triazole and tetrazole systems onto pyrrolo[2,3-*d*]pyrimidines: synthesis of tetrazolo[1,5-*c*]-pyrrolo[3,2-e]-pyrimidines and triazolo[1,5 *c*]pyrrolo-[3,2-*e*]pyrimidines as potential antibacterial agents. Molecules, 7:554-565.

6.Deliwala CV , Mhasalkar MY , Shah MH, Nikam ST, Anantanarayanan KG (1971) Further studies in substituted 4H-1,2,4-triazoles for possible hypoglycemic activity. J. Med. Chem. 14(3):260-262.

7.Ibrahim MA, Ali TS (2010) Synthesis and antimicrobial activity of chromone-linked 2-pyridone fused with 1,2,4-triazoles, 1,2,4-triazines and 1,2,4-triazepines ring systems. J Braz Chem Soc, 21 (16):1007-16.

8.Kamal A, Shankaraiah N, Devaiah V, Reddy KL, Juvekar A, Sen S *et al*, (2008) Synthesis of 1,2,3-triazole-linked pyrrolobenzodiazepine conjugates employing 'click' chemistry: DNA-binding affinity and anticancer activity. Bioorg. Med. Chem. Lett, 18:1468-73.

9.Khan I, Ali S, Hameed S, Rama NH, Hussain MT, Wadood A, *et al*, (2010) Synthesis, antioxidant activities and urease inhibition of some new 1,2,4-triazole and 1,3,4-thiadiazole derivatives. Eur. J. Med. Chem, 1-8.

10.Kim HW, Gunic E, Jenket C, Boyle U, Korboukh I, Allan M, *et al*, (2006) Tri-substituted triazoles as potent non-nucleoside inhibitors of the HIV-1 reverse transcriptase. Bioorg. Med. Chem. Lett, 16:4444-49.

11.Odlo K, Hentzen J, Ducki S, Sylte I, Skrede M, Florenes AV, Hansen TV *et al*, (2008) 1,5-Disubstituted 1,2,3-triazoles as cis-restricted analogues of combretastatin A-4: Synthesis, molecular modeling and evaluation as cytotoxic agents and inhibitors of tubulin. Bioorg. Med. Chem. Lett, 16:4829-4838.

12.Padmavathi V, Reddy GS, Padmaja A, Kondaiah P, Shazia A (2009) Synthesis, antimicrobial and cytotoxic activities of 1,3,4-oxadiazoles,1,3,4-thiadiazoles and 1,2,4-triazoles. Eur. J. Med. Chem, 44:2106-2112.

13.Palaska E, Sahin G, Kelicen P, Durlu NT, Altinok G (2007) Synthesis and anti-inflammatory activity of 1-acylthiosemicarbazides, 1,3,4-oxadiazoles, 1,3,4-thiadiazoles and 1,2,4-triazole-3-thiones. Il Farmaco. 57:101-107.

14.Peterson LB, Blagg BSJ (2010) Click chemistry to probe Hsp90: Synthesis and evaluation of a series of triazole-containing novobiocin analogues. Bioorg. Med. Chem. Lett, 1-4.

15.Peterson LB, Blagg BSJ (2010) Click chemistry to probe Hsp90: Synthesis and evaluation of a series of triazole-containing novobiocin analogues. Bioorg. Med. Chem. Lett, 1-4.

16.Rabea SM, El-Koussi NA, Hassan HY, Aboul-Fadl T (2006) Synthesis of 5-Phenyl-1-(3-pyridyl)-1H-1,2,4-triazole-3-carboxylic Acid derivatives of potential anti-inflammatory activity. Arch. Pharm. Chem. Life Sci, 339:32-40.

17.Revial G, Kaplancıklı ZA, Turan-Zitouni G, Ozdemir A, (2008) New triazole and triazolothiadiazine derivatives as possible antimicrobial agents. Eur. J. Med. Chem, 43:155-159.

18.Sharma RK, Shrivastava K, Daniel V, Panwar MS, Goyal S (2010) synthesis and antihelmentic activity of some azole derivative of hippuric acid. Int.J.Ph.Sci, 2(2):502-507.

19.Shiradkar M, Kumar GVS, Dasari V, Tatikonda S, Akula KC, Shah R (2007) Clubbed triazoles: a novel approach to antitubercular drugs. Eur. J. Med. Chem, 42: 807-816.

20.Singh BK, Yadav AK, Kumar B, Gaikwad A, Sinha SK, Chaturvedic V, Tripathi RP (2008) Preparation and reactions of sugar azides with alkynes: synthesis of sugar triazoles as antitubercular agents. Carbohydrate Res, 343:1153-1162.

21.Sztanke K, Pasternak K, Sidor-Wojtowicz A, Truchlinskac J, Jozwiak K (2006) Synthesis of imidazoline and imidazo[2,1-c][1,2,4] triazole aryl derivatives containing the methylthio group as possible antibacterial agents. Bioorg. Med. Chem. Lett, 14:3635-3642.

22.Tozkoparan B, Kupeli E, Yesilada E, Ertan M (2007) Preparation of 5-aryl-3-alkylthio-l,2,4-triazoles and corresponding sulfones with anti-inflammatory, analgesic activity. Bioorg. Med. Chem. Lett, 15:1808-1814.

23.Tripathi RP, Yadav AK, Ajay A, Bisht SS, Chaturvedi V, Sinha SK (2010) Application of Huisgen (3 þ 2) cycloaddition reaction: Synthesis of 1-(2,3-dihydrobenzofuran-2-yl-methyl [1,2,3]-triazoles, and their antitubercular evaluations. Eur. J. Med. Chem, 45:142-148.

24.Valentina P, Ilango K, Deepthi M, Harusha P, Pavani G, Sindhura KL, Keerthanan CG (2009) Antioxidant activity of some substituted 1, 2, 4 - Triazo-5-thione Schiff base. J. Pharm. Sci. & Res. 1(2):74-77.

25.Vatmurge SN, Hazra BG, Pore VS, Shirazi F, Chavan PS, Deshpande MV (2008) Synthesis and antimicrobial activity of b-lactam–bile acid conjugates linked via triazole. Bioorg. Med. Chem. Lett, 18:2043-2047.

26.Wu J, Liu X, Cheng X, Cao Y, Wang D, Li Z, Xu W, Pannecouque C, Witvrouw M, Clercq ED (2007) Synthesis of novel derivatives of 4-amino-3-(2-furyl)-5-mercapto-1,2,4-triazole as potential hiv-1 nnrtis. molecules, 12:2003-2016.

27.Yu J, Wua Q, Zhang Q, Liu Y, Li Y, Zhou Z (2010) Synthesis and antitumor activity of novel 20,30-dideoxy-20,30-diethane thionucleosides bearing 1,2,3-triazole residues. Bioorg. Med. Chem. Lett, 20:240-243.

Corresponding Author:

Priyanka Dhiman

Department of Phamaceutical Sciences, M.D.University, Rohtak, HARYANA

E-mail- principlania812@gmail.com