Journal of Heterocyclic Chemistry / Volume 57, Issue 10 / p. 3544-3557

ARTICLE

Synthesis of isoniazid-1,2,3-triazole conjugates: Antitubercular, antimicrobial evaluation and molecular docking study

Adinath D. Badar, Shubham M. Sulakhe, Mahesh B. Muluk, Naziya N. M. A. Rehman, Prashant P. Dixit, Prafulla B. Choudhari, Estharla Madhu Rekha, Dharmarajan Sriram, Kishan P. Haval

First published: 25 June 2020
https://doi.org/10.1002/jhet.4072
Citations: 15

Abstract

In the present study, a series of new isoniazid-1,2,3-triazole conjugates (**5a-k**) was synthesized *via* click chemistry approach. The newly synthesized compounds were assessed for their *in vitro* antitubercular and antimicrobial activities. The compound **5g** has displayed potent antitubercular activity against *Mycobacterium tuberculosis* H37Rv (*Mtb*) with MIC value 1.56 μg/mL. The active compounds were screened for their cytotoxicity profile by MTT assay against RAW 264.7 cell line. The four compounds have shown good *in vitro* antimicrobial activities against both antibacterial and antifungal pathogens. A molecular docking study was accomplished to identify the probable mode of action of synthesized derivatives. These compounds have shown excellent binding affinity toward *Enoyl-acp reductase* (INHA) and *DNA gyrase*.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

Supporting Information

Filename	Description
jhet4072-sup-0001-supinfo.docx Word 2007 document , 3.4 MB	**Appendix S1**: Supporting Information

Please note: The publisher is not responsible for the content or functionality of any supporting information supplied by the authors. Any queries (other than missing content) should be directed to the corresponding author for the article.

REFERENCES

1 M. L. T. Ang, S. Z. Zainul Rahim, P. F. de Sessions, W. Lin, V. Koh, K. Pethe, M. L. Hibberd, S. Alonso, *Front. Microbiol.* 2017, **8**, 710.

PubMed | Web of Science® | Google Scholar

2 World Health Organization (WHO), *Global Tuberculosis Report 2019*, WHO, Geneve, Switzerland 2019. http://www.who.int/tb/publications/global_report/en/.

Google Scholar

3 A. Bahuguna, D. S. Rawat, *Med. Res. Rev.* 2020, **40**, 693.

Google Scholar

4 J. A. Garrido-Cardenas, C. de Lamo-Sevilla, M. T. Cabezas-Fernández, F. Manzano-Agugliaro, M. Martínez-Lirola, *Tuberculosis* 2020, **121**, 101917.

CAS | PubMed | Web of Science® | Google Scholar

5 A. Koul, E. Arnoult, N. Lounis, J. Guillemont, K. Andries, *Nature* 2011, **469**, 483.

CAS | PubMed | Web of Science® | Google Scholar

6 V. Singh, V. Mizrahi, *Drug Discov. Today* 2016, **22**, 503.

PubMed | Web of Science® | Google Scholar

7 M. Ashok, B. S. Holla, *J. Pharmacol. Toxicol.* 2007, **2**, 256.

CAS | Google Scholar

8 M. H. Shaikh, D. D. Subhedar, M. Arkile, V. M. Khedkar, N. Jadhav, D. Sarkar, B. B. Shingate, *Bioorg. Med. Chem. Lett.* 2016, **26**, 561.

CAS | PubMed | Web of Science® | Google Scholar

9 R. Bollu, J. D. Palem, R. Bantu, V. Guguloth, L. Nagarapu, S. Polepalli, N. Jain, *Eur. J. Med. Chem.* 2015, **89**, 138.

CAS | PubMed | Web of Science® | Google Scholar

10 H. B. Lazrek, M. Taourirte, T. Oulih, J. L. Barascut, J. L. Imbach, C. Pannecouque, M. Witrouw, E. De Clercq,

Nucleosides Nucleotides Nucleic Acids 2001, **12**, 1949.

Web of Science® | Google Scholar

11 G. Wang, Z. Peng, J. Wang, J. Li, X. Li, *Bioorg. Med. Chem. Lett.* 2016, **26**, 5719.

CAS | PubMed | Web of Science® | Google Scholar

12 M. S. Costa, N. Boechat, E. A. Rangel, F. C. Da Silva, A. M. T. De Souza, C. R. Rodrigues, H. C. Castro, I. N. Junior, M. C. S. Lourenco, S. M. S. V. Wardell, V. F. Ferreira, *Bioorg. Med. Chem.* 2006, **14**, 8644.

CAS | PubMed | Web of Science® | Google Scholar

13 A. Krajczyk, K. Kulinska, T. Kulinski, B. L. Hurst, C. W. Day, D. F. Smee, T. Ostrowski, P. Januszczyk, J. Zeidler, *Antivir. Chem. Chemother.* 2014, **23**, 161.

PubMed | Google Scholar

14 J. Nalawade, A. Shinde, A. Chavan, S. Patil, M. Suryavanshi, M. Modak, P. B. Choudhari, V. D. Bobade, P. C. Mhaske, *Eur. J. Med. Chem.* 2019, **179**, 649.

CAS | PubMed | Web of Science® | Google Scholar

15 D. Kumar, B. Negi, D. S. Rawat, *Future Med. Chem.* 2015, **14**, 1981.

Web of Science® | Google Scholar

16 S. T. Dhumal, A. R. Deshmukh, K. R. Kharat, B. R. Sathe, S. S. Chavan, R. A. Mane, *New J. Chem.* 2019, **43**, 7663.

CAS | Web of Science® | Google Scholar

17 N. Kumar, R. K. Tittal, P. Yadav, K. Lal, G. V. Dasharath, A. Kumar, *New J. Chem.* 2019, **43**, 8052.

Web of Science® | Google Scholar

18 (a) Beena, D. S. Rawat, *Med. Res. Rev.* 2013, **33**, 693.

CAS | PubMed | Web of Science® | Google Scholar

(b) V. Nalla, A. Shaikh, S. Bapat, R. Vyas, M. Karthikeyan, P. Yogeeswari, D. Sriram, M. Muthukrishnan, *R. Soc. Open Sci.* 2018, **5**, 171750.

PubMed | Web of Science® | Google Scholar

(c) Y. Sajja, S. Vanguru, H. R. Vulupala, R. Bantu, P. Yogeswari, D. Sriram, L. Nagarapu, *Bioorg. Med. Chem. Lett.* 2017, **27**, 5119.

CAS | PubMed | Web of Science® | Google Scholar

19 (a) M. H. Shaikh, D. D. Subhedar, L. Nawale, D. Sarkar, F. A. K. Khan, J. A. Sangshetti, B. B. Shingate, *Med. Chem. Commun.* 2015, **6**, 1104.

CAS | Web of Science® | Google Scholar

(b) M. H. Shaikh, D. D. Subhedar, F. A. K. Khan, J. N. Sangshetti, L. Nawale, M. Arkile, D. Sarkar, B. B. Shingate, *J. Heterocycl. Chem.* 2017, **54**, 413.

CAS | Web of Science® | Google Scholar

20 W. M. Eldehna, M. Fares, M. M. Abdel-Aziz, H. A. Abdel-Aziz, *Molecules* 2015, **20**, 8800.

CAS | PubMed | Web of Science® | Google Scholar

21 J. T. Denholm, E. S. McBryde, D. P. Eisen, J. S. Penington, C. Chen, A. C. Street, *Drug Healthc. Patient Saf.* 2014, **6**, 145.

CAS | PubMed | Google Scholar

22 (a) S. Zhang, Z. Xu, C. Gao, Q. -C. Ren, L. Chang, Z. -S. Lv, L. -S. Feng, *Eur. J. Med. Chem.* 2017, **138**, 501.

CAS | PubMed | Web of Science® | Google Scholar

(b) Y. -Q. Hu, S. Zhang, F. Zhao, C. Gao, L. -S. Feng, Z. -S. Lv, Z. Xu, X. Wu, *Eur. J. Med. Chem.* 2017, **133**, 255.

CAS | PubMed | Web of Science® | Google Scholar

23 D. Kumar, G. Khare, Beena, S. Kidwai, A. K. Tyagi, R. Singh, D. S. Rawat, *Med. Chem. Commun.* 2015, **6**, 131.

CAS | Web of Science® | Google Scholar

24 D. Kumar, Beena, G. Khare, S. Kidwai, A. K. Tyagi, R. Singh, D. S. Rawat, *Eur. J. Med. Chem.* 2014, **81**, 301.

CAS | PubMed | Web of Science® | Google Scholar

25 H. S. Sutherland, A. Blaser, I. Kmentova, S. G. Franzblau, B. Wan, Y. Wang, Z. Ma, B. D. Palmer, W. A. Denny, A. M. Thompson, *J. Med. Chem.* 2010, **53**, 855.

CAS | PubMed | Web of Science® | Google Scholar

26 N. Boechat, V. F. Ferreira, S. B. Ferreira, M. L. G. Ferreira, F. C. da Silva, M. M. Bastos, S. C. M. Dos, M. C. Lourenço, A. C. Pinto, A. U. Krettli, A. C. Aguiar, B. M. Teixeira, N. V. da Silva, P. R. Martins, F. A. Bezerra, A. L. Camilo, G. P. da Silva, C. C. Costa, *J. Med. Chem.* 2011, **54**, 5988.

CAS | PubMed | Web of Science® | Google Scholar

27 (a) X. Xia, Q. Zhang, L. Zhao, Y. Hu, *Eur. J. Med. Chem.* 2017, **138**, 66.

PubMed | Web of Science® | Google Scholar

(b) F. J. Smit, R. Seldon, J. Aucamp, A. Jordaan, D. F. Warner, D. D. N'Da, *Med. Chem. Res.* 2019, **28**, 2279.

CAS | Web of Science® | Google Scholar

(c) F. Rizvi, M. Khan, A. Jabeen, H. Siddiqui, M. I. Choudhary, *Sci. Rep.* 2019, **9**, 6738.

PubMed | Web of Science® | Google Scholar

(d) S. P. Khare, T. R. Deshmukh, J. N. Sangshetti, V. S. Krishna, D. Sriram, V. M. Khedkar, B. B. Shingate, *ChemistrySelect* 2018, **3**, 13113.

CAS | Web of Science® | Google Scholar

(e) V. Makarov, B. Lechartier, M. Zhang, J. Neres, A. M. van der Sar, S. A. Raadsen, R. C. Hartkoorn, O. B. Ryabova, A. Vocat, L. A. Decosterd, N. Widmer, T. Buclin, W. Bitter, K. Andries, F. Pojer, P. J. Dyson, S. T. Cole, *EMBO Mol. Med.* 2014, **6**, 372.

CAS | PubMed | Web of Science® | Google Scholar

(f) P. F. M. Oliveira, B. Guidetti, A. Chamayou, C. André-Barrès, J. Madacki, J. Korduláková, G. Mori, B. S. Orena, L. R. Chiarelli, M. R. Pasca, C. Lherbet, C. Carayon, S. Massou, M. Baron, M. Baltas, *Molecules* 2017, **22**, 1457.

Web of Science® | Google Scholar

(g) P. Shanmugavelan, S. Nagarajan, M. Sathishkumar, A. Ponnuswamy, P. Yogeeswari, D. Sriram, *Bioorg. Med. Chem. Lett.* 2011, **21**, 7273.

CAS | PubMed | Web of Science® | Google Scholar

28 P. S. Phatak, R. D. Bakale, S. T. Dhumal, L. K. Dahiwade, P. B. Choudhari, V. S. Krishna, D. Sriram, K. P. Haval, *Synth. Commun.* 2019, **49**, 2017.

CAS | Web of Science® | Google Scholar

29 P. S. Phatak, B. P. Sathe, S. T. Dhumal, N. N. M. A. Rehman, P. P. Dixit, V. M. Khedkar, K. P. Haval, *J. Heterocycl. Chem.* 2019, **56**, 1928.

CAS | Web of Science® | Google Scholar

30 M. B. Muluk, P. S. Phatak, S. B. Pawar, S. T. Dhumal, N. N. M. A. Rehman, P. P. Dixit, P. B. Choudhari, K. P. Haval, *J. Chin. Chem. Soc.* 2019, **66**, 1507.

CAS | Web of Science® | Google Scholar

31 (a) L. A. Collins, S. G. Franzblau, *Antimicrob. Agents Chemother.* 1997, **41**, 1004.

CAS | PubMed | Web of Science® | Google Scholar

(b) V. S. Krishna, S. Zheng, E. M. Rekha, L. W. Guddat, D. Sriram, *J. Comput. Aided Mol. Des.* 2019, **33**, 357.

CAS | PubMed | Web of Science® | Google Scholar

32 J. Van Meerloo, G. J. Kaspers, J. Cloos, *Methods Mol. Biol.* 2011, **731**, 237.

CAS | PubMed | Web of Science® | Google Scholar

33 M. B. Muluk, S. T. Dhumal, N. N. M. A. Rehman, P. P. Dixit, K. R. Kharat, K. P. Haval, *ChemistrySelect* 2019, **4**, 8993.

CAS | Web of Science® | Google Scholar

34 (a) M. B. Muluk, S. T. Dhumal, P. S. Phatak, N. N. M. A. Rehman, P. P. Dixit, P. B. Choudhari, R. A. Mane, K. P. Haval, *J. Heterocycl. Chem.* 2019, **56**, 2411.

CAS | Web of Science® | Google Scholar

(b)R. K. Thalji, K. Raha, D. Andreotti, A. Checchia, H. Cui, G. Meneghelli, R. Profeta, F. Tonelli, S. Tommasi, T. Bakshi, B. T. Donovan, A. Howells, S. Jain, C. Nixon, G. Quinque, L. McCloskey, B. D. Bax, M. Neu, P. F. Chan, R. A. Stavenger, *Bioorg. Med. Chem. Lett.* 2019, **29**, 1407.

CAS | PubMed | Web of Science® | Google Scholar

35 D. A. Rozwarski, G. A. Grant, D. H. Barton, W. R. Jacobs Jr., J. C. Sacchettini, *Science* 1998, **279**, 98.

CAS | PubMed | Web of Science® | Google Scholar

Citing Literature

Download PDF