ASEC 2024 Conference

The 5th International Electronic Conference on Applied Sciences

04–06 December 2024 | Online

Study of the antimicrobial activity of new 1,3,5-triazine derivatives

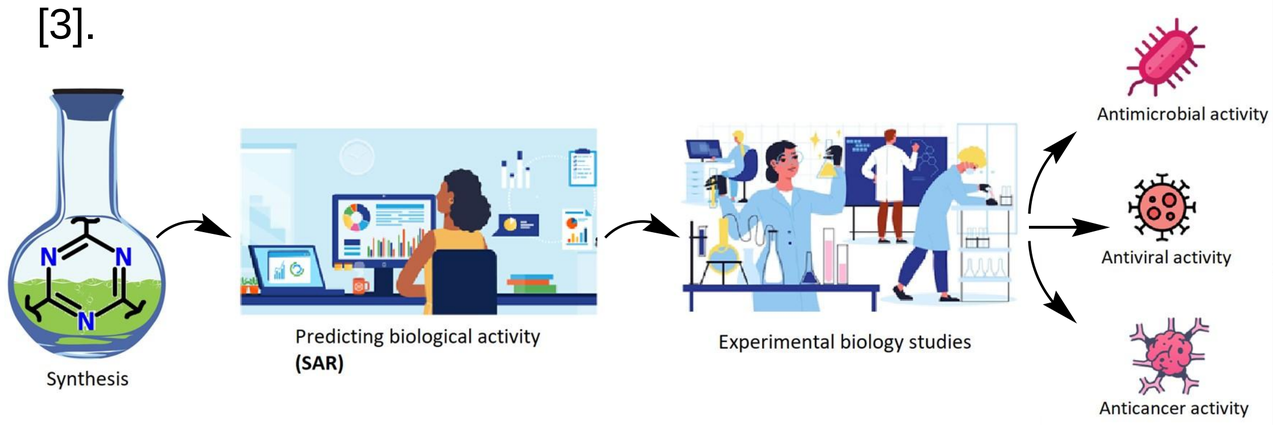
Polina Olegovna Levshukova[1], Denis Andreevich Kolesnik[1], Igor Pavlovich Yakovlev[1], Gleb Valentinovich Kondratiev[2], Elena Vladimirovna Kuvaeva[1], Egor Vyacheslavovich Morozov[1]

1 Federal-Funded Educational Institution of Higher Education «Saint Petersburg State Chemical and Pharmaceutical University of the Ministry of Healthcare of the Russian Federation», Department of Organic Chemistry

2 Federal State Budgetary Educational Institution of Higher Education St. Petersburg State Pediatric Medical University of the Ministry of Health of Russia, Department of Oncology, Pediatric Oncology and Radiation Therapy

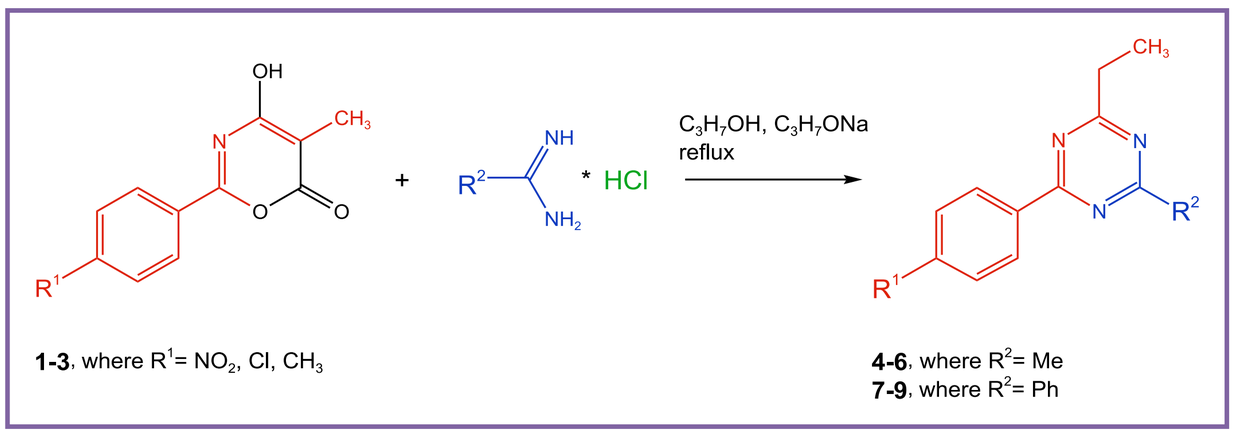
INTRODUCTION & AIM

1,3,5-triazine derivatives are an important class of heterocyclic compounds that have a wide range of biological activities, including exhibiting strong antimicrobial activity [1,2]. Thus, the preparation of new compounds based on a triazine core, as well as the study of their antimicrobial activity, is an urgent task [3].



METHOD

- The target compounds were obtained by recyclization of 2-aryl-4-hydroxy-5-methyl-6H-1,3-oxazin-6-ones (**1-3**) with ethanimidamide and benzenecarboximidamide, which are 1,3-binucleophilic reagents (scheme 1). The reaction was carried out in the presence of an amount of sodium propoxide equimolar to the nucleophile in boiling n-propanol for 2-5 hours.
- The structure of the obtained compounds (**4-9**) was proven using modern physico-chemical methods of analysis. The antimicrobial activity potential of the synthesized compounds was determined by computer analysis using the AntiBac Pred online service. Experimentally, the antimicrobial activity of the compounds was studied by the method of serial dilutions against Gram-positive (Staphylococcus aureus, Bacillus subtilis) and Gram-negative (Escherichia coli, Pseudomonas aeruginosa) test cultures of microorganisms.



Scheme 1.

RESULTS & DISCUSSION

The target compounds were obtained in 58-88% yield. As a result of in silico computer screening using the AntiBac Pred online service, data on the potential antimicrobial effect of the target compounds were obtained. Using experimental microbiological studies, it was shown that the studied compounds have moderate antimicrobial activity against the test cultures studied (fig. 1). Analyzing the structure-activity relationship, it was found that compounds that have a methyl group in position 2 of the triazine ring have the strongest inhibitory effect (fig. 2). The inhibitory activity against Gram-negative strains (Escherichia coli, Pseudomonas aeruginosa) is strongest for triazines that have a methyl group in position 2 and electron-donating substituents in the benzene ring.

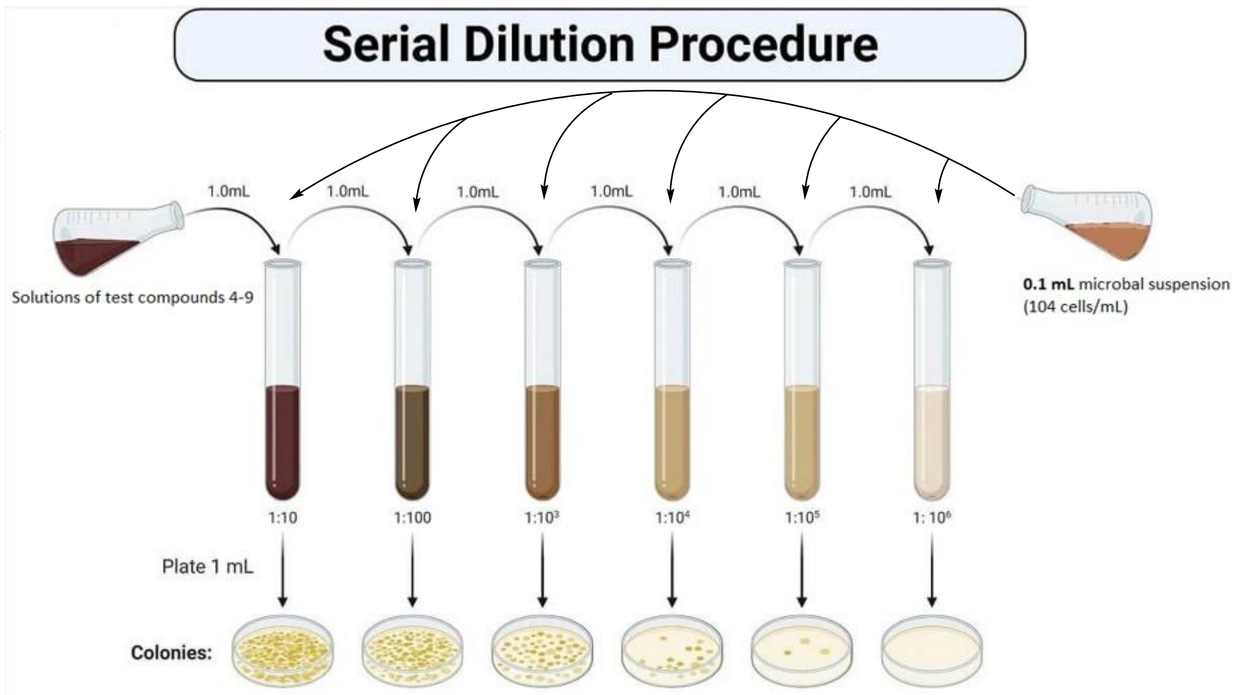


Figure 1. Serial dilution method.

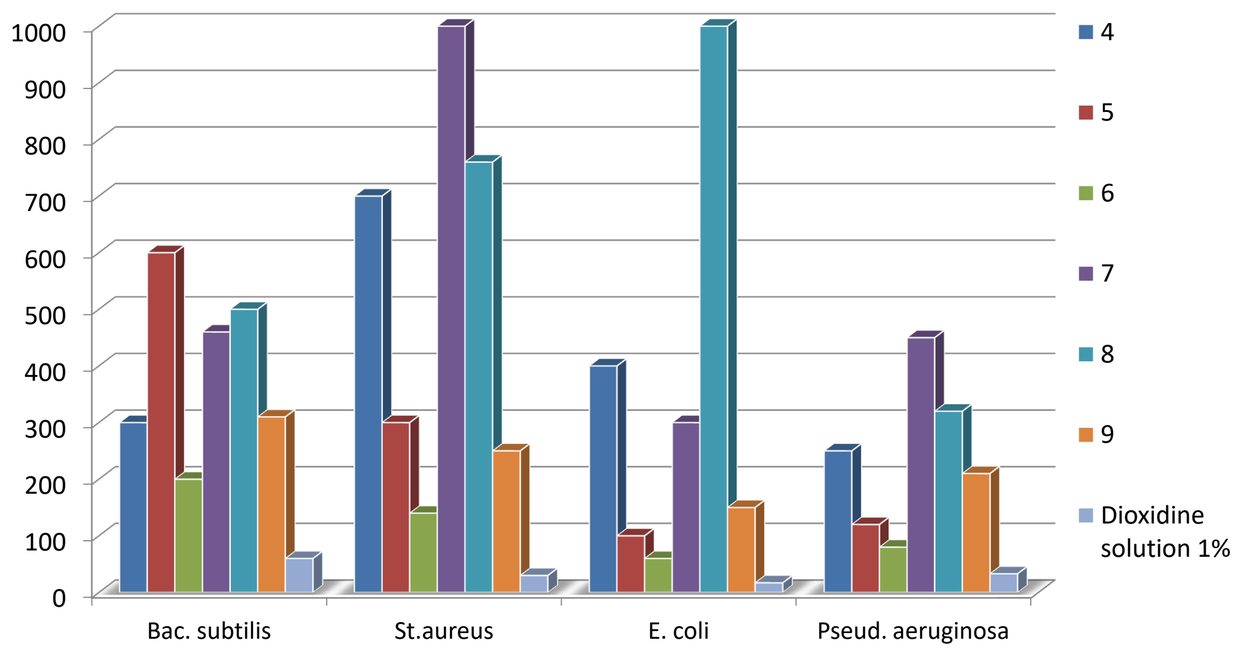


Figure 2. Antimicrobial activity of synthesized compounds

CONCLUSION

1,3,5-triazine derivatives were obtained, the structure of which was proven using physicochemical methods of analysis. The potential antimicrobial activity of the resulting compounds was determined in two ways:

- by computer analysis using the AntiBac Pred online service;
- by the method of serial dilutions in relation to Gram-positive and Gram-negative test cultures of microorganisms.

FUTURE WORK / REFERENCES

1. Kuvaeva E.V., Levshukova P.O., Kolesnik D.A., Kirillova E.N., Yakovlev I.P., Ladutko Yu.M. Synthesis and evaluation of antimicrobial activity of new 1,3,5-triazine derivatives. Questions of biological, medical and pharmaceutical chemistry. 2022;25(7):39−43. https://doi.org/10.29296/25877313-2022-07-06
2. Design, synthesis, anticancer, antibacterial, and antifungal evaluation of 4-aminoquinoline-1,3,5-triazine derivatives / H. Bhat [et al.] // J. Heterocyclic Chem. 2019. Vol 57. N 1. P. 390-399. DOI: 10.1002/jhet.3791
3. Structure-activity relationships (SAR) of triazine derivatives: Promising antimicrobial agents / H. Liu [et al.] // Eur. J. Med. Chem. 2020. Vol 185. P. 111804. DOI: 10.1016/j.ejmech.2019.111804