JCHR (2019) 9(1), 69-74

Journal of Chemical Health Risks

www.jchr.org

ORIGINAL ARTICLE

Evaluation of In-vitro Antimicrobial Activity of some Newly Synthe-sized2-amino-3-phenylsulfonyl-4-aryl-4H-benzo[h]chromens Derivatives

Farzaneh Manouchehri[1], Bahareh Sadeghi[*1], Farhood Najafi[2], Mohammad Hossein Mosslemin[1]

[1] *Department of Chemistry, Yazd Branch, Islamic Azad University, Yazd, Iran*

[2] *Department of Resin and Additives, Institute for Color Science and Technology, P.O. BOX: 16765-654, Tehran, Iran*

(Received: 5 October 2018 Accepted: 1 January 2019)

KEYWORDS

Antibacterial activity; 4H-Chromens derivatives; Microdilutionbroth; Disk Diffusion Agar test

ABSTRACT: In this study, some chromens derivatives were synthesized as mentioned in our previous report.The synthesized compounds were evaluated for their antibacterial effect against three different bacterial species, using Disk Diffusion Agar test and microdilution broth (MIC) method against the *S. aureus, E. coli, P. aeruginosa*bacterias according to the National Committee for Clinical Laboratory Standards (NCCLS) recommendations. The results indicated that 4-nitro compound has considerable antibacterial activity against *S. aureus*bacteria .Moreover, compound 3-chloro has antibacterial properties against*E. coli* standard strain and none of 4H-Chromens derivatives have antibacterial effect on *P. aeruginosa* strains.

INTRODUCTION

In recent decades, there has been ever increasing interest in investigating and developing new compounds with antibacterial activity as a part of human health care studies. At the present time, some bacterias become resistance against current antimicrobial agents [1]. The overuse of antibiotic as well as uncompleted courses of prescribed antibiotics by patients will result in antibiotics resistance in human body; furthermore, increased antibiotic consumption in livestock and poultry is considered as another factor causing antibiotic resistance [2].Therefore, there is a necessity to evaluate antibacterial properties of new compounds which could be used as antibiotic[3-5]. Heterocyclic compounds are considered as an important class of organic compounds because of their unique application, including bioactivity and pharmaceutical properties.Chromenes are particular classes of oxygen-containing heterocyclic scaffolds. These are biologically interesting and attractive compounds with antimicrobial, antiviral and antitumor agents [6-10] .These compounds work in different ways such as inhibiting the influenza virus [11], DNA mutagenicity [12], sex pheromone [13] and also in central nervous system (CNS) activity [14] .

In previous works, there have been reports based on this fact that, some Pyran and Chromenederivates have significant activity against some bacteria [15,16]. Accordingly, in the present study, it is reported for the first time that some Chromenederivatives showed significant antibacterial activities towards various bacteriasandthederivativeswere

*Corresponding author: sadeghi@iauyazd.ac.ir (B.Sadeghi)
DOI: 10.22034/jchr.2019.545977

prepared as mentioned in our previous study[17]. Antimicrobial activities were determined as MIC values, using the microdilution broth method and Disk diffusion agar test against the *S. aureusE. Coli, P. aeruginosa, S. aureus, E. coli, P. aeruginosa*bacterias.

MATERIALS AND METHODS

The cultures were grown on Mueller-Hinton Agar (MHA) (Merck,Germany) for all bacteria after 18-24 h of incubation at 37ºCand antibacterial activity were investigated for *Staphylococcus aureus ATCC* 653, *Escherichia coli* ATCC 25922 , *Pseudomonas aeruginosa*P7.

Disk diffusion agar test

First, colonies of clinical and standard strains of *Staphylococcus aureus, Pseu - domonasaeruginosa and Escherichia coli* were suspended in 0.9% NaCl solution to prepare 0.5 McFarland standard (1-1.5 × 10^8 CFU/mL) by spectrophotometric assay. A sterile swab was immersed in a bacterial suspension and used to inoculate Mueller-Hinton agar plates. Serial dilutions of compounds were prepared in 20% DMSO from 512 to 32 µg/mL. Then 10 µL of each prepared compound solution was loaded on blanket disk. The disks were applied to the MHA plate. Following the incubation at 37° C for 24h, inhibition zone diameter was measured. A disk containing gentamycin (GM) was used as positive control and a disk containing DMSO was used as negative control. All experiments were done in duplicate.

Minimum inhibitory concentration method (Microdilution broth)

Minimum inhibitory concentration (MIC) has been measured for each compound and also for the standard antibiotic, gentamicin, and they were all compared with each other. MIC is the lowest compound concentration that visibly inhibits microbial growth. At first, 50 µL of the Mueller Hinton broth medium was added to each well of the 96 microtiter plates (SPL, Korea). Then 50 µL of compound solution in 20% DMSO at 2048 µg/mL concentration was added to first series of wells and after pipetting, 50 µL of it was added to next series of wells and this was done to last series of wells. 50 µL of content of last wells was removed. Microbial suspension in 0.9% NaCl solution with final 5×10^5 CFU/ml concentration inoculated in each well. The plates were incubated at 37°C for 24 h. Gentamicin was used as the standard antimicrobial agent. Wells containing broth medium with bacterial inoculum were used as positive control and negative control was contained DMSO (20%) with broth medium. All tests were done in triplicate.

RESULTS AND DISCUSSION

The structures of experimental compounds are given in Table 1.

Antibacterial activity results

Evaluation of the antibacterial activity in this study was performed using MIC (minimum inhibitory concentration) and the inhibition zone diameter measurement against the *S. aureus, E. coli, P. aeruginosa*bacterias[18]. The assessment of minimal inhibitory concentrations provides a method for measuring the amount of microbial activity of 2-amino-3-phenylsulfonyl-4-aryl-4H-benzo[h]chromensderivatives. Furthermore, their MIC values against these organisms were determined by serial dilution method using DMF as a solvent and were compared with Gentamycin as a standard antibiotic. The results obtained are given in Tables 2 and 3 and also Figures 1, 2 and 3 show Effect of compounds 4H-Chromens derivatives on Standard strains and Clinical strains.

Table 1. The structures of compounds

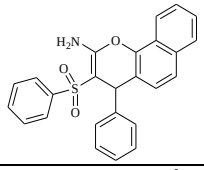
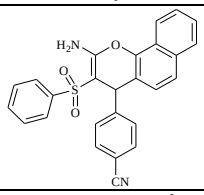
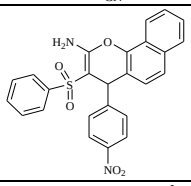
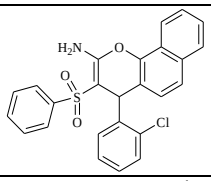
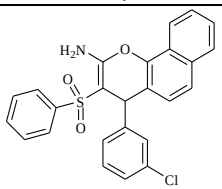
Entry	Name	Product
1	Benz aldehyde	
2	4-cyanid	
3	4-nitro	
4	2-chloro	
5	3-chloro	

Table 2. Inhibition zone diameter(mm) of chromens derivatives against clinical and standard isolates

Inhibition zone diameter of compounds against *strains* (mm)						
	Standard strains			**Clinical isolates**		
Compound	***S. aureus***	***E. coli***	***P. aeruginosa***	***S. aureus***	***E. coli***	***P. aeruginosa***
4-nitro (128 µg/mL)	10	0	0	11	0	0
4-nitro (256 µg/mL)	15			11		
2-chloro	0	0	0	0	0	0
3-chloro (256 µg/mL)	0	10	0	0	0	0
3-chloro (512 µg/mL)		14				
4-cyanid	0	0	0	0	0	0
Benz aldehyde	0	0	0	0	0	0
DMSO (control)	0	0	0	0	0	0
Gentamycin	21	16	17	20	16	15

Table 3. ChromensderivativesMIC (µg/mL) against clinical and standard isolates by microbroth dilution.

	MIC (µg/mL)					
	Standard strains			Clinical isolates		
Compound	***S. aureus***	***E. coli***	***P. aeruginosa***	***S. aureus***	***E. coli***	***P. aeruginosa***
4-nitro	128	512≤	512≤	128	512≤	512≤
2-chloro	512≤	512≤	512≤	512≤	512≤	512≤
3-choloro	512≤	256	512≤	512≤	512≤	512≤
4-cyanid	512≤	512≤	512≤	512≤	512≤	512≤
Benz aldehyde	512≤	512≤	512≤	512≤	512≤	512≤
DMSO (control)	512≤	512≤	512≤	512≤	512≤	512≤
Gentamycin	4	16	16	4	32	16

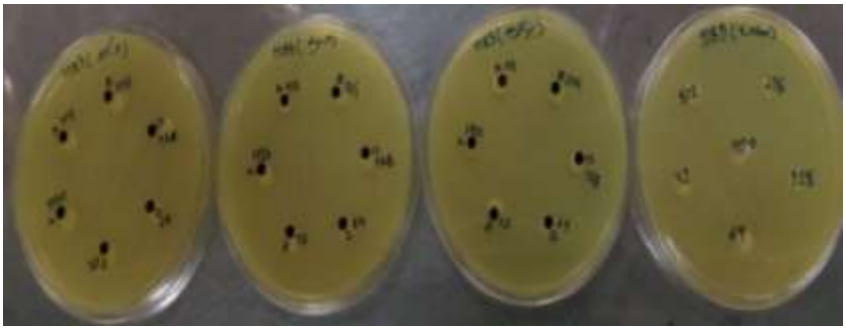


Figure 1. Effect of compounds on clinical strain of *P. aeruginosa*.

Figure 2. Effect of 4-nitro on S. aureus standard and clinical strain.

Figure 3. Effect of 3-choloro on E. coli standard strain.

As displayed in the results, compound 4-nitro was the most effective, presenting inhibition zones measured 10 mm against*S. aureus*strains at 128 µg/mL concentration. 3-chloro compound inhibited the growth of *E. coli* standard strain at 256 µg/mL, However, other compounds showed even no activity at a higher concentration of 512µg/mL.None of the compounds have antibacterial effect on *P. aeruginosa* strains. These results show an effective in vitro activity of 4-nitro and 3-chloro. Therefore, this compounds has promising applications in a wide range of antibiotic therapy.

CONCLUSIONS

In summary, synthesized compounds were evaluated in terms of their antibacterial properties, using MIC (minimum inhibitory concentration) and the inhibition zone diameter measurement against some gram positive andgramnegativebacteria. The results indicated that compound4-nitro has significant antibacterial activity against *S. aureus*bacteria and also compound 3-chloro has considerable antibacterial properties against*E. coli* standard strain.

ACKNOWLEDGEMENTS

The Research Council of the Islamic Azad University of Yazd is gratefully acknowledged for their financial support of this work.

REFERENCES

1. Andrews J.M., 2001. Determination of minimum inhibitory concentrations. JAntimicrobChemother. 48(suppl-1), 5-16.

2. Sabir R., Danish Alvi S.F., Fawwad A., 2013. Antimicrobial susceptibility pattern of aerobic microbial isolates in a clinical laboratory in Karachi-Pakistan. Pak J Med Sci. 29(3), 851–855.

3. Kirilmis C., Ahmedzade M., Servi S., Koca M., Kizirgil A., Kazaz C., 2008. Synthesis and antimicrobial activity of some novel derivatives of benzofuran: Part 2. The synthesis and antimicrobial activity of some novel 1-(1-benzofuran-2-yl)-2-mesitylethanone derivatives.Eur J Med Chem. 43(2), 300-308

4. Talas Z.S., Gok Y., Ozdemir I., Ates B., Gunal S., Yilmaz I., 2015.Synthesis, antioxidant and anti-microbial properties of two organoselenium compounds. Pak J Pharm Sci. 28 (2), 611-616.

5. Selamoglu Z., Duran A., Gulhan M., Erdemli M., 2015. Effects of propolis on biochemical and microbiological parameters in carp (*Cyprinuscarpio*) fillets exposed to arsenic. Iran J Fish Sci. 14(4), 896-907.

6. Mohr S.J., Chirigos M.A., Fuhrman F.S., Pryor J.W., 1975. Pyran copolymer as an effective adjuvant to chemotherapy against a murine leukemia and solid tumor. Cancer Res. 35(12), 3750-3754.

7. El-Agrody A.M., Abd El-Latif M.S., El-Hady N.A., Fakery A.H., Bedair A.H., 2001. Heteroaromatization with 4-Hydroxycoumarin Part II: Synthesis of Some New Pyrano [2, 3-d] pyrimidines,[1, 2, 4] triazolo [1, 5-c] pyrimidines and Pyrimido [1, 6-b]-[1, 2, 4] triazine Derivatives. Molecules.(6), 519-527.

8. Bedair A.H., El-Hady N.A., El-Latif M.A., Fakery A.H., El-Agrody A.M., 2000. 4-Hydroxycoumarin in heterocyclic synthesis: Part III. Synthesis of some new pyrano [2, 3-d] pyrimidine, 2-substituted [1, 2, 4] triazolo [1, 5-c] pyrimidine and pyrimido [1, 6-b][1, 2, 4] triazine derivatives. IlFarmaco. 55(11-12), 708-714.

9. El-AgrodyA.M., El-Hakim M.H., El-Latif M.A., Fakeri A.H., El-Sayed E.S., El-Ghareab K.A., 2000. Synthesis of pyrano [2, 3-d] pyrimidine and pyrano [3, 2-e][1, 2, 4] triazolo [2, 3-c] pyrimidine derivatives with promising antibacterial activities. Acta Pharm. 50(2), 111-120.

10. Martínez-Grau A., Marco J., 1997. Friedländer reaction on 2-amino-3-cyano-4H-pyrans: Synthesis of derivatives of 4H-pyran [2, 3-b] quinoline, new tacrine analogues. J Bioorg Med ChemLett. 7(24), 3165-3170.

11. Smith P.W., Sollis S.L., Howes P.D., Cherry P.C., Starkey I.D., Cobley K.N., Weston H., Scicinski J., Merritt A., Whittington A., Wyatt P., 1998. Dihydropyrancarboxamides related to zanamivir: A new series of inhibitors of influenza virus sialidases. 1. Discovery, synthesis, biological activity, and structure− activity relationships of 4-

guanidino-and 4-amino-4 H-pyran-6-carboxamides. JMed Chem. 41(6), 787-797.

12. Hiramoto K., Nasuhara A., Michikoshi K., Kato T., Kikugawa K., 1997. DNA strand-breaking activity and mutagenicity of 2, 3-dihydro-3, 5-dihydroxy-6-methyl-4H-pyran-4-one (DDMP), a Maillard reaction product of glucose and glycine.Mutat Res Genet Toxicol Environ Mutagen. 395(1), 47-56.

13. Bianchi G.,Tava A., 1987. Synthesis of (2 R)-(+)-2, 3-dihydro-2, 6-dimethyl-4 H-pyran-4-one, a homologue of pheromones of a species in the hepialidaefamily.AgricBiol Chem. 51(7), 2001-2002.

14. Eiden F., Denk F., 1991. Synthesis of CNS-activity of pyran derivatives: 6, 8-dioxabicyclo (3, 2, 1) octane. Arch Pharm. 324(6), 353-354.

15. Fairlamb I.J., Marrison L.R., Dickinson J.M., Lu F.J., SchmidtJ.P., 2004. 2-Pyrones possessing antimicrobial and cytotoxic activities.Bioorg Med Chem. 12(15), 4285-4299.

16. Aytemir M.D., Calis U., OzalpM., 2004. Synthesis and evaluation of anticonvulsant and antimicrobial activities of 3-hydroxy-6-methyl-2-substitute 4h-pyran – 4-one derivatives.Arch Pharm (Weinheim). 337(5), 281-288.

17. Manouchehri F., Sadeghi B., Najafi F., Mosslemin M.H., 2018. Preparation and characterization of $SbCl_5$ supported on coconut shell as nanocatalyst for the synthesis of novel 2-amino-3-phenylsulfonyl-4-aryl-4H-benzo [h] chromens. J Iran Chem Soc. 15(8), 1673-1683.

18. Ashafa A.,Olajuyigbe O.,2014. Chemical Composition and Antibacterial Activity of Essential Oil of Cosmos bipinnatus Cav. Leaves from South Africa. Iran J Pharm Res. 13,1417–1423.