IJPSR (2024), Volume 15, Issue 3 **(Research Article)**

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 16 July 2023; received in revised form, 10 October 2023; accepted, 23 November 2023; published 01 March 2024

SYNTHESIS, CHARACTERIZATIONS AND ANTIMICROBIAL ACTIVITY OF NEW AURONE DERIVATIVES

Madhav M. Kendre * and Ravi R. Vidule

Department of Chemistry, Shri Sant Gadge Maharaj Mahavidyalaya, Loha, Tq. Loha, Nanded - 431708, Maharashtra, India.

Keywords:

2-hydroxychalcone, Aurones, Antibacterial and antifungal activities

Correspondence to Author:
Dr. Kendre Madhav Marotirao

Assistant Professor,
Department of Chemistry,
Shri Sant Gadge Maharaj Mahavidyalaya, Loha, Tq. Loha,
Nanded - 431708, Maharashtra, India.

E-mail: madhavkendre72@gmail.com

ABSTRACT: Aurones constitute a less studied sub-class of flavonoides which occur rarely in nature. Aurones are responsible for the golden yellow colour of some flowers. Substituted 2-benzylidene-1-benzofuran-3 (2*H*)-ones are commonly known as aurones that belong to the naturally occurring flavonoids. In the present investigation, a series of some novel substituted 2-benzylidene-1-benzofuran-3 (2*H*)-ones (2a-j) have been synthesized by cyclization of 1-(substituted-2-hydroxy-phenyl)-3-(4'-dimethylamino-phenyl)-prop-2-en-1-one (2-hydroxychalcone) (1a-j) with mercuric acetate in DMSO. The products were tested for purity by TLC and structures of newly synthesized compounds were confirmed by physical data, IR, ^{1}H NMR and Mass spectral analysis. All these newly synthesized compounds were evaluated for their antibacterial activity against four different pathogens such as *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus* and *Bacillus subtilis* and antifungal activity against *Aspergillus niger*, *Penicillium chrysogenum*, *Fusarium moneliforme* and *Aspergillus flavus*, using Peniciline and Greseofulvin as standard drugs by agar cup method and Poison plate method, respectively.

INTRODUCTION: Substituted 2-benzylidene-1-benzofuran-3(2*H*)-ones are commonly known as aurones that belong to the naturally occurring flavonoids [1-2] and are structurally isomeric to flavones. They play significant role in the pigmentation of flowers in which they are found. It also has reported antibacterial, antifungal and antiviral activities [3-4]. The chalcones, flavones, flavanols, flavanones and isoflavones have been well studied for preventing various diseases from past several years but the biological activity of aurones has not been extensively studied.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.15(3).733-38

This article can be accessed online on www.ijpsr.com

DOI link: https://doi.org/10.13040/IJPSR.0975-8232.15(3).733-38

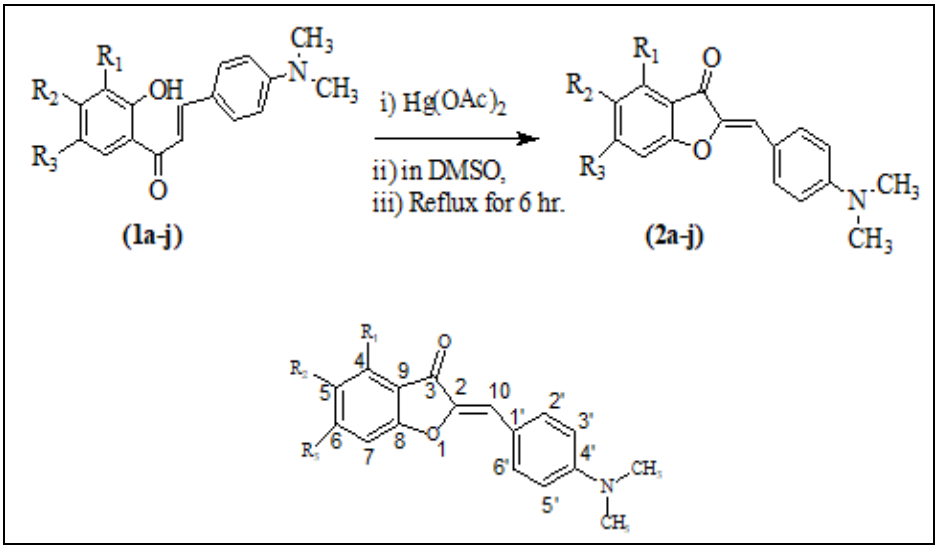
Aurones are mainly found in the use of anti-cancer [5-6], antihyperglycemic activity [7] and antioxidant activities [8-9]. Chalcone is the main source for the synthesis of aurone by oxidation, cyclization and rearrangement. Aurones exhibit a wide variety of biological activities such as antibacterial, antifungal [10-11], potential anti-influenza agents [12], *in-vitro* neuraminidase [13], anti-inflammatory [14] and antimalarial [15-16].

Therefore, aurone is an important class of potentially Useful pharmacologically active compounds, their synthesis has wide spread applications in organic chemistry [17-18]. Because of these exciting biological activities, number of aurone compounds have been synthesized and studied their biological activities [19-20]. In view of these observations, we report in the present investigation, the synthesis of some novel substituted 2-benzylidene-1-benzofuran-3 (2*H*)-

ones (2a-j), having halogen and dimethylamino groups with an aim to find new, significantly most active antimicrobial agents.

MATERIALS AND METHODS: All the solvents and reagents were obtained from commercial sources and were used without further purification. The melting points were determined by Open Capillary method and are uncorrected. The mass spectra were obtained with a Shimadzu GC-MS spectrophotometer. The IR spectra in KBr were recorded on Shimadzu Spectrophotometer and ^{1}H NMR spectra were recorded in DMSO on Avance 300 MHz Spectrometer using TMS as internal standard. The chemical shift values are expressed in part per million (ppm) downfield from the internal standard and signals are quoted as *s* (singlet), *d* (doublet), *t* (triplet) and *m* (multiplet). Thin-layer chromatography (TLC) was used to monitor the progress of all reactions and to check the purity of the compounds by using ethyl acetate and petroleum ether as an eluent in the ratio of (3:7 v/v). All the newly synthesized substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one compounds were tested for their antimicrobial activities by agar cup method and Poison plate method, respectively.

General Method for the Synthesis of Substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one (Aurones) Derivatives: The substituted 1-(substituted - 2 - hydroxy-phenyl) – 3 - (4'-dimethylamino-phenyl) – prop - 2 – en - 1 - one (2-hydroxy-chalcone) (0.002mol) was dissolved in dimethyl sulfoxide (DMSO) (20 ml) and after adding mercuric acetate (0.003mol); the reaction mixture was refluxed for 6 hours. The progress of the reaction was monitored by using TLC [eluent: ethyl acetate; petroleum ether (3:7)]. After completion of the reaction, the product was poured on crushed, ice-cold water. The solid crude product obtained was filtered, washed with cold water, dried and recrystallized by using ethanol to get corresponding substituted 2-benzylidene-1-benzofuran-3 (2*H*)-ones.



SCHEME 1: SYNTHESIS OF SUBSTITUTED 2-BENZYLIDENE-1-BENZOFURAN-3 (2*H*)-ONE (AURONES) DERIVATIVES (2A-J)

TABLE 1: PHYSICAL DATA OF SYNTHESIZED SUBSTITUTED 2-BENZYLIDENE-1-BENZOFURAN-3 (2*H*)-ONE (AURONES) DERIVATIVES (2A-J)

Sr. no.	Entry	R_1	R_2	R_3	Molecular formula	Molecular weight	Yield in (%)	Melting Point ^{0}C
1	2a	Cl	H	Cl	$C_{17}H_{13}Cl_2O_2N$	336	55	115-117
2	2b	I	H	Cl	$C_{17}H_{13}ICIO_2N$	426	50	108-110
3	2c	Br	H	Cl	$C_{17}H_{13}BrClO_2N$	379	55	105-107
4	2d	Br	H	Br	$C_{17}H_{13}Br_2O_2N$	423	50	116-118
5	2e	H	H	Br	$C_{17}H_{14}BrO_2N$	344	56	137-139
6	2f	H	H	Cl	$C_{17}H_{14}ClO_2N$	300	60	127-129
7	2g	Br	CH_3	Cl	$C_{18}H_{15}BrClO_2N$	393	56	142-144
8	2h	I	CH_3	Cl	$C_{18}H_{15}ICIO_2N$	440	50	170-172
9	2i	Cl	H	CH_3	$C_{18}H_{16}ClO_2N$	314	60	139-141
10	2j	Cl	H	Br	$C_{17}H_{13}BrClO_2N$	379	58	111-113

Antimicrobial Activities:

Antibacterial Activity: All the newly synthesized substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one derivatives (2a-j) were assessed for their antibacterial and antifungal activities against four different strains of bacteria such as *E. coli*, *S typhi*, *S. aureus* and *B. subtilis* and four fungi like *Aspergillus niger, Penicillium chrysogenum, Fusarium moneliforme and Aspergillus flavus*. The test for antibacterial activity was carried out by agar cup method [21] (cup size 8 mm) with nutrient agar as a medium where as antifungal activity was carried out by using potato-dextrose agar (PDA) medium by same agar cup plate method. All newly synthesized compounds were dissolved in DMSO and used as controlled concentration for each test compound which was 100 µg/ml. The experiments were performed in triplicate, in order to minimize the errors. Zone of inhibition was recorded after incubation at 37 ^{0}C for 24 hrs, zone of inhibition produced by each compound was measured in mm. After incubation plates were observed for the zone of inhibition of bacterial growth around the agar cup, results were recorded by measuring the zone of inhibition in millimeter (mm) by using the zone reader. All the newly synthesized substituted 2-benzylidene - 1 - benzofuran - 3 (2*H*) - one (2a-j) compounds were evaluated for their antibacterial activity against the selected four different pathogens such as *E. coli, S. typhi, S. aureus* and *B. subtilis. The compounds 2a, 2c and 2i show* good activity and 2b, 2e, 2g and 2h compounds does not show activity against *E. coli*. The compounds 2b, 2h, and 2j showed weak activity against *S. typhi*, while 2a, 2c, 2f and 2g showed stronger activity in comparison with standard (Penicilin) drug. All the synthesized compounds of aurone except 2b, 2e, 2h and 2i showed moderate activity against *S. aureus*. The bromine substituted compound **2c** showed significant activity against *B. subtilis* as compared to standard drug.

TABLE 2: ANTIBACTERIAL ACTIVITY DATA OF SUBSTITUTED 2-BENZYLIDENE-1-BENZOFURAN-3 (2*H*)-ONE (AURONES) DERIVATIVES (2A-J)

Sr. no.	Entry	molecular formula	Antibacterial activity (Zone of Inhibition in mm)			
			Escherichia coli	***Salmonella typhi***	***Staphylococcus aureus***	***Bacillus subtilis***
1	2a	$C_{17}H_{13}Cl_2O_2N$	13	17	23	12
2	2b	$C_{17}H_{13}IClO_2N$	--	13	--	11
3	2c	$C_{17}H_{13}BrClO_2N$	13	15	21	17
4	2d	$C_{17}H_{13}Br_2O_2N$	10	--	18	--
5	2e	$C_{17}H_{14}BrO_2N$	--	--	--	--
6	2f	$C_{17}H_{14}ClO_2N$	11	16	17	12
7	2g	$C_{18}H_{15}BrClO_2N$	--	17	21	13
8	2h	$C_{18}H_{15}IClO_2N$	--	12	--	--
9	2i	$C_{18}H_{16}ClO_2N$	12	--	--	--
10	2j	$C_{17}H_{13}BrClO_2N$	10	13	22	14
+ve Control DMSO			-ve	-ve	-ve	-ve
Penicilline			12	20	34	22

Antifungal Activity: The antifungal activity of synthesized substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one (aurones) derivatives (2a-j) were screened against four plant pathogenic and mold fungi, such as *Aspergillus niger, penicillium chrysogenum, Fusarium moneliforme and Aspergillus flavus.* The antifungal activities of the synthesized substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one (2a-J) compounds were assessed by poisoned plate method [22]. Griseofulvin (100 µg/disc) was used as a standard drug for the antifungal test. Potato Dextrose Agar (PDA) was used as a basal medium to test fungi. The compounds of 100 µg were mixed with sterilized potato dextrose agar (PDA) medium at 40 °C at the rate of 100 mg/mL PDA. The medium was poured in sterilized Petri-plates and allowed solidified PDA media and then incubated at 30 °C for 72 hours. The growth of fungal area was measured in mm after 4 days of incubation at 30 °C. The control set was maintained using only PDA with DMSO as a growth medium. Results were measured as the growth of fungi (does not show antifungal activity), reduced growth of fungi (to observed moderate antifungal activity), and no growth of fungi (antifungal activity observed in the area). All the newly synthesized compounds were evaluated for their antifungal activity against the four different

pathogens *Aspergillus niger, Penicillium chrysogenum, Fusarium moneliforme and Aspergillus flavus*. The antifungal activity of some aurone compounds showed good activity against four pathogens. The presence of more electronegative substituted halogen atoms and dimethylamino groups were found to responsible for increasing antimicrobial activity.

TABLE 3: ANTIFUNGAL ACTIVITY DATA OF SUBSTITUTED 2-BENZYLIDENE-1-BENZOFURAN-3 (2*H*)-ONE (AURONES) DERIVATIVES (2A-J)

Sr. no.	Entry	molecular formula	Antifungal activity (Zone of Inhibition in mm)			
			Aspergillus niger	***Penicillium chrysogenum***	***Fusarium moneliforme***	***Aspergillus flavus***
1	2a	$C_{17}H_{13}Cl_2O_2N$	-ve	-ve	-ve	-ve
2	2b	$C_{17}H_{13}ICl O_2N$	RG	-ve	RG	-ve
3	2c	$C_{17}H_{13}BrClO_2N$	-ve	RG	-ve	RG
4	2d	$C_{17}H_{13}Br_2O_2N$	-ve	-ve	RG	-ve
5	2e	$C_{17}H_{14}BrO_2N$	RG	-ve	-ve	-ve
6	2f	$C_{17}H_{14}ClO_2N$	-ve	RG	-ve	RG
7	2g	$C_{18}H_{15}BrClO_2N$	-ve	-ve	RG	-ve
8	2h	$C_{18}H_{15}ICl O_2N$	-ve	RG	-ve	RG
9	2i	$C_{18}H_{16}ClO_2N$	RG	RG	RG	-ve
10	2j	$C_{17}H_{13}BrClO_2N$	-ve	-ve	RG	-ve
+ve Control DMSO			+ve	+ve	+ve	+ve
-ve Control (Griseofulvin)			-ve	-ve	-ve	-ve

[+ve = No growth (Antifungal activity absent), RG = Reduced Growth (more than 50 % but less than 90 % i. e. Moderate Activity), -ve = No Growth (Antifungal Activity Observed 90 %)]

RESULTS AND DISCUSSION: In recent years, one of the most important conventional methods used for the synthesis of substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one compounds has been the reaction of α, β-unsaturated carbonyl compounds, such as substituted 2′-hydroxychalcone with mercuric acetate [23-24] in dimethyl sulfoxide (DMSO) was refluxed for 6 hour. The reaction mixture was distilled to remove the excess solvent and the reaction mixture was poured on Crushed, ice-cold water and recrystallized by using absolute ethanol to get substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one compounds (2a-j) in 50-60 % yield. The newly synthesized compounds have been confirmed first by TLC and physical data of Products was different from that of corresponding reactants. The structures of newly synthesized substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one (2a-j) derivatives were confirmed on the basis of IR, ^{1}HNMR and Mass spectral data. The IR spectrum of compound 2a exhibited peaks due to group -C=O at 1690-1697 cm^{-1} and absorption peaks around 780-788 cm^{-1} due to stretching –C-O-C- and also shows -C=CH- at 1652 cm^{-1} which indicated formation of aurone ring. The mass spectra of all the compounds of aurones showed mass ion peaks which are also the base peaks of the compound by indicating the stability of the molecule. The structures of the substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one (aurones) (2a-j) derivatives were confirmed on the basis ^{1}HNMR spectra which shows δ 6.57-6.68 due to benzylidene proton. These observations are in agreement with the spectral data reported [25-26]. All the newly synthesized aurones were evaluated for their antibacterial activity against the selected four different pathogens, such as *E. coli, S. typhi, S. aureus* and *B. subtilis*. The compounds 2a, 2c and 2i show good activity and 2b, 2e, 2g and 2h compounds does not show activity against *E. coli*. The compounds 2b, 2h, and 2j showed weak activity against *S. typhi*, while 2a, 2c, 2f and 2g showed stronger activity in comparison with standard (Penicilin) drug. All the synthesized compounds of aurone except 2b, 2e, 2h and 2i showed moderate activity against *S. aureus*. The bromine substituted compound 2c showed significant activity against *B. subtilis* as compared with standard drug. All the newly synthesized compounds were evaluated for their antifungal activity against the four different pathogens *Aspergillus niger, Penicillium chrysogenum, Fusarium moneliforme and Aspergillus flavus*. The antifungal activity of some aurone compounds showed good activity against four pathogens. The presence of more electronegative substituted halogen atoms and dimethylamino groups were

found responsible for increasing antimicrobial activity.

Spectroscopic Data of Synthesized Compounds:
4,6-Dichloro-2-(4'-dimethylamino-benzylidene)-benzofuran-3-one (Aurone)2a: Yield 55 % and M. P**.** 115-117 ^{0}C, IR (KBr): 1696 cm-$^{-1}$ (-C=O), 1652 cm^{-1} (-C=CH), 784 cm^{-1} (-C-O-C-); 782 cm^{-1}C-Cl); ^{1}HNMR ($CDCl_3$): δ 3.0 (s, 6H, -N(CH_3)$_2$), δ 6.97 (s, 1H,=CH-Ar, H-10), δ 6.74 (s, 1H, H-7), δ 6.86 (d, 1H, H-5), δ 6.66 (d, 2H, H-3', H-5') δ 7.24 (d, 2H, H-2', H-6'),), M.S. (m/z): = 336, Molecular formula: $C_{17}H_{13}Cl_2O_2N$.

4 – Bromo – 6 – Chloro – 2 - (4'-dimethylamino-benzylidene)-benzofuran-3-one (aurone) 2c: Yield 55 % and M. P**.** 105-107 ^{0}C, IR (KBr): 1695 cm-$^{-1}$ (-C=O), 1645 cm^{-1} (-C=CH), 787 cm^{-1} (C-O-C-); 878 cm^{-1} (C-Br); ^{1}HNMR ($CDCl_3$): δ 3.0 (s ,6H, -N(CH_3)$_2$), δ 6.90 (s, 1H, =CH-Ar, H-10), δ 6.58 (s, 1H, H-7), δ 6.92 (d, 1H, H-5), δ 6.52 (d, 2H, H-3', H-5') δ 7.27 (d, 2H, H-2', H-6'), M.S. (m/z): = 379 Molecular formula: $C_{17}H_{13}BrClO_2N$.

4 – Bromro - 6 – Chloro – 2 - (4'-dimethylamino - benzylidene) – 5 – methyl – benzofuran - 3-one (aurone) 2g: Yield 56 % and M. P**.** 139-141 ^{0}C, IR (KBr): 1697 cm-$^{-1}$ (-C=O), 1636 cm^{-1} (-C=CH), 781 cm^{-1} (-C-O-C-); 884 cm^{-1} (C-Br); ^{1}HNMR ($CDCl_3$): δ 3.0 (s ,6H, -N(CH_3)$_2$), δ 2.34 (s, 3H, -CH_3), δ 6.98 (s, 1H, =CH-Ar, H-10), δ 6.58 (s, 1H, H-7), δ 6.56 (d, 2H, H-3', H-5') δ 7.21 (d, 2H, H-2', H-6'), M.S. (m/z): = 393 Molecular formula: $C_{18}H_{15}BrClO_2N$.

4 – Chloro – 2 - (4' – dimethylamino - benzylidene) – 6 – methyl – benzofuran – 3 - one (aurone) 2i: Yield 60 % and M. P**.** 139-141^{0}C, IR (KBr): 1697 cm-$^{-1}$ (-C=O), 1646 cm^{-1} (-C=CH), 782 cm^{-1} (-C-O-C-); 782 cm^{-1} (C-Cl); ^{1}HNMR ($CDCl_3$): δ 2.99 (s ,6H, -N(CH_3)$_2$), δ 2.31(s, 3H, -CH_3), δ 6.92 (s, 1H, =CH-Ar, H-10), δ 6.48 (s, 1H, H-7), δ 6.96 (d, 1H, H-5), δ 6.62 (d, 2H, H-3', H-5') δ 7.42 (d, 2H, H-2', H-6'), M.S. (m/z): = 314 Molecular formula: $C_{18}H_{16}ClO_2N$.

CONCLUSION: In this work, we have demonstrated the synthesis of substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one derivatives using simple experimental procedure with good yields, relatively short reaction time, easily work up and low cost. From the result of antibacterial and antifungal activities, it can be concluded that the substituted 2-benzylidene-1-benzofuran-3 (2*H*)-one derivatives and the ring system, presence of halogen and dimethylamino groups are responsible for the antibacterial and antifungal effects. The obtained results in all these assays during the study will be certainly useful to go for further research for drug designing. This might provide interesting and additional synthesizing of new derivatives.

ACKOWLEDGEMENTS: The authors are thankful to the Principal, Yeshwant College, Nanded for providing necessary facilities for carrying out the research work. Authors are thankful to the Director IICT Hyderabad for providing the spectral data and also thankful to the principal, N.S.B. College, Nanded for providing antimicrobial data.

CONFLICTS OF INTEREST: The authors declare no conflict of interest.

REFERENCES:

1. Naqvi A, Pandey A, Gupta V, Malasoni R, Srivastava A, Pandey RR, Satyanarayana M and Pratap R and Dwivedi A: Assay method for quality control and stability studies of a new anti-diabetic and anti-dyslipidemic flavones. Pharmacognosy Magazine 2015; 11(42): 53-59.
2. Dhanasekaran S and Pushparaj SP: Exploration of bioflavonoids targeting dengue virus NS5 RNA-dependent RNA polymerase *in-silico* molecular docking. Journal of Applied Pharmaceutical Science 2020; 10(5): 16-22.
3. Karale BK, Nirmal PR and Akolkar HN: Sythesis and biological screening of some novel Chromone and auron. Idian Journal of Chemistry 2015; 54: 434-438.
4. Ashok D, Ravi S, Arram GB, Vijaya L, Shaikh A and Murthy S: Microwave-assisted synthesis and biological evaluation of carbazole-based chalcones, aurones and flavones. Medicinal Chemistry Research 2016; 25: 909–922.
5. Alsayari A, Muhsinah AB, Hassan MZ, Ahsan MJ, Alshehri JA and Begum N: Aurone: a biologicall attractive scaffold as anticancer agent. European Journal of Medicinal Chemimstry 2019; 166: 417-431.
6. Seref D, Leyla Y, Nalan GK, Ahmet CK and Ismail K: Synthesis and anti-cancer activity evaluation of new aurone derivatives. Journal of Enzyme Inhib Medicinal Chemistry 2015; 30(5): 816–825.
7. Tajammal A, Batool M, Ramzan A, Malka MS, Mahnoor I, Verpoort F, Ahmad I, Al-Sehemi AG, Munawar AM and Basra MAR: Synthesis, antihyperglycemic activity and computational studies of antioxidant chalcones and flavanones derived from 2, 5-dihydroxyacetophenone. Journal of Molecular Structure 2017; 1148: 512-520.
8. Hardik HJ and Manish PP: Antimicrobial and antioxidant evaluation of new quinolone based aurone analogs. Arabian Journal of Chemistry 2017; 10: 3781-3791.
9. Karmkar A, Ambure A, Mallick T, Das S, Roy K and Ara N: Exploration of synthetic antioxidant flavonoid analogs as acetylcholinesterase inhibitors an approach towards

finding their quatitative structure-activity relationship. Medicinal Chemistry Research 2019; 28: 723-741.

10. Hamza O, Samir Y, Brayan R, Elise CD, Josette P, Basile P, Akram H, Elias B, Josette R, Ahcène B, Marc M and Romain H: Aurone derivatives as promising antibacterial agents against resistant Gram-positive pathogens. European Journal of Medicinal Chemistry 2019; 165: 133-141.
11. Adki N and Gutha NR: Synthesis and biological evaluation of novel tetrazole analogues of flavones as antimicrobial agents. Internal Journal Pharmaceutical Science and Ressearch 2023; 14(7): 3444-3451.
12. Anand S, Chintakrindi D, Gohil J, Abhay S, Chowdhary and Meena AK: Design, synthesis and biological evaluation of substituted flavones and aurones as potential anti-influenza agents. Bioorganic and Medicinal Chemistry 2020; 28(1): 115191.
13. Devi AP, N Dhingra N, Chundawat RS and Ameta KL: Green synthesis of 2-benzylidene-1-benzofuran-3-ones and *in-vitro* neuraminidase study using molecular docking, SAR and QSAR in Environmental Research 2022; 33(7): 499-12.
14. Bandgar BP, Patil SA, Korbad BL, Biradar SC, Nile SN and Khobragade CN: Synthesis and biological evaluation of a novel series of 2, 2-bisaminomethylated aurone analogues as anti-inflammatory and antimicrobial agents. European J of Medicinal Chemistry 2010; 45(7): 3223-27.
15. Gupta AK, Singh P and Sabarwal N: Rationalization of molecular descriptors of aurone analogs toward antimalarial activity. Asian Journal of Pharmacuitical Clinical Ressearch 2014; 7: 186–192.
16. Carrasco MP, Newton AS and Goncalves L: Probing the aurone scaffold against Plasmodium falciparum design, synthesis and antimalarial activity. European Journal of Medicinal Chemistry 2014; 80: 523–534.
17. Benouda, Hind, Bouchal, Btissam, Challioii, Allal, Oulmidi, Abdelkader, Harit, Tarik, Malek, Fouad, Riahi, Abdelkhalek, Bellaoui, Mohammed, Bouammali and Boufelja: Synthesis of a series of chalcone and related flavones and evaluation of their antibacterial and antifungal activities. Letters in Drug Design and Discovery 2019; 16(1): 93-100.
18. Kannan VK, Patil DV, Patil SR, Patil RM and Lokhande RS: Synthesis, characterization and biological activity study of new flavones. International Journal of Advanced Scientific Research and Managemen 2019; 4(2): 7-11.
19. Olleik H, Yahiaoui S, Roulier B, Courvoisier-Dezord E, Perrier J, Pérès B, Hijazi A, Baydoun E, Raymound J, Boumendjel A, Maresca M and Haudecoeur R: Aurone derivatives as promising antibacterial agents against resistant Gram-positive pathogens. European Journal of Medicinal Chemistry 2019; 165: 133-141.
20. Sanjeev K, Lathwal1 E, Bhavna S, Gourav K, Ramesh K, Suresh K, Naveen K and Aggarwal NK: Synthesis and Molecular Docking Studies of Some Pyrazole and Coumarin-based Hybrid Aurones as Antimicrobial Agents. Indian Journal of Heterocyclic Chemistry 2023; 33(01): 23-31.
21. Benouda, Hind, Bouchal, Btissam, Challioii, Allal, Oulmidi, Abdelkader, Harit, Tarik, Malek, Fouad, Riahi, Abdelkhalek, Bellaoui, Mohammed, Bouammali and Boufelja: Synthesis of a series of chalcone and related flavones and evaluation of their antibacterial and antifungal activities. Letters in Drug Design and Discovery 2019; 16(1): 93-100.
22. Yi Li, Haiqing Z, Chao N and Haji AA: Synthesis and antimicrobial activity of aurone derivatives containing heterocyclic substituents. Russian Journal of General Chemistry 2022; 92(8): 1562-1573.
23. Irshad M, Ali Q, Iram F, Ahamad SA, Saleem M, Saadia M, Batool M, Kanwal A and Tabassum S: Aurones and analogues: promising heterocyclic scaffolds for development of antioxidant and antimicrobial agents, Russian Journal of General Chemistry 2019; 89: 1519-1527.
24. Agrawal NN and Soni PA: A new process for the synthesis of aurones by using mercury (II) acetate in pyridine and cupric bromide in dimethyl sulfoxide, Indian Journal of Chemistry 2006; 45:1301-1303.
25. Sudhakar H and Naveen M: Facile synthesis of aurones using amberlyst-15 as a reusable catalyst and their biological evaluation. Indian Journal of Advance Chemical Science 2016; 4(2): 160-167.
26. Tamanna N, Sharma MC and Bhargav S: Synthesis, docking studies and antioxidant activity of some chalcone and aurone derivatives. Medicinal Chemistry Research 2013; 22: 4059–4068.

How to cite this article:
Kendre MM and Vidule RR: Synthesis, characterizations and antimicrobial activity of new aurone derivatives. Int J Pharm Sci & Res 2024; 15(3): 733-38. doi: 10.13040/IJPSR.0975-8232.15(3).733-38.