International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

A Comprehensive Review On Biological Activities Of Naphtho[2,1-B] Furan Derivatives

Rinkukumari Solanki S*, D Visagaperumal, Vineeth Chandy, Sharanagoud Biradar

Department of Pharmaceutical Chemistry, T.John College of Pharmacy, Gottigere, Bannerghatta road, Bangalore 560083, India.

Date of Submission: 15-07-2021 Date of Acceptance: 31-07-2021

ABSTRACT: Napthofuran nuclei belong to sesquiterpene and arylquinone groups. Most of the compounds containing this ring skeleton found to be possessing various biological activities like antibacterial, anthelmentic, anti-inflammatory, antifungal, antiviral, antitumor, adrenolytic, cytotoxic. Naphtho[2,1-b]furan derivatives possess wide spectrum of activities. In this review, we have collected information about the napthofuran derivatives and its pharmacological activities for further research and development.

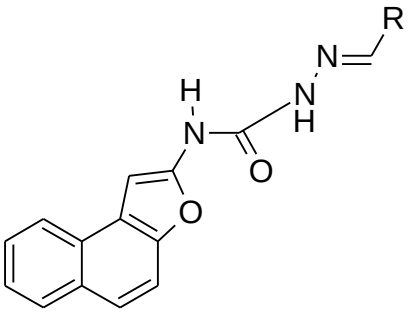
KEYWORDS: Naphtho[2,1-b]furan, antimicrobial, anthelmentic, analgesic, anti-inflammatory, diuretic, antipyretic activity.

I. INTRODUCTION:

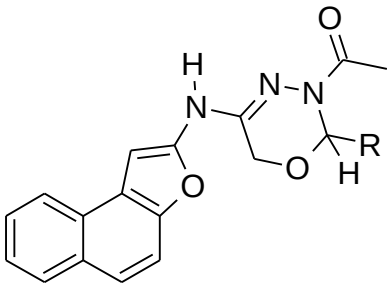
Naphthofuran derivatives are obtained from various natural sources like **Fusariumoxysporum, Gossypiumbarbadens**. Most of the heterocyclic and biheterocyclic compounds incorporated naphthofuran derivatives shown broad range of biological activities such as antimicrobial, anti-inflammatory, analgesic, anthelmentic, antipyretic and diuretic activity.

PHARMACOLOGICAL ACTIVITIES :

H M Vagdevi et al.,(2001) synthesized a series of 2-substituted naphtho[2,1-b]furans, 2-(2'-aryl-3'-acetyl-1',3',4'-oxadiazolyl)aminonaphtho[2,1-b]furan as analgesic agents based on acetic acid induced writhing in mice, as antimicrobial agents by cup plate method against bacteria like Staphylococcus aureus and Klebsiella pneumonia and fungi like Aspergillus niger and Candida albicans with the standard drugs like Ciprofloxacin and ciclopiroxolamine for comparison of antibacterial and antifungal activity showed better antimicrobial activity, as anthelmintic agents on Pherituma posthuma, while the compounds showed equipotent effect in comparison with standard drug like Piperazine citrate.[1]

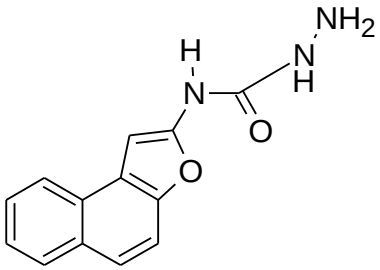


(1)

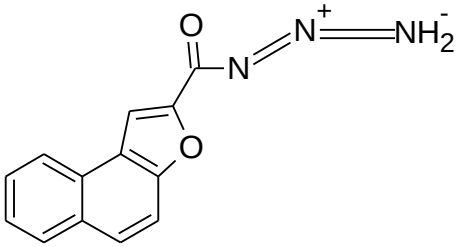


(2)

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

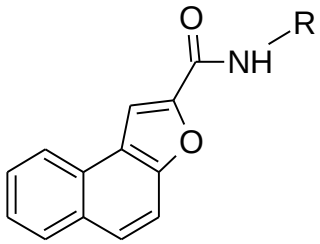


(3)



(4)

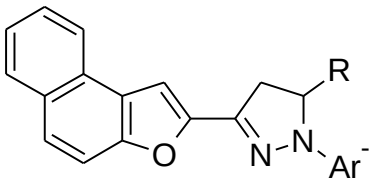
R: a=C_6H_5, b=4-OH-3-$OCH_3C_6H_3$, c=4-N, N-$(CH_3)_2C_6H_4$, d=2-$OCH_3C_6H_4$, e=2-Furyl, f= 3-$NO_2C_6H_4$, g=CH=CHC_6H_5, h=2-OH-C_6H_4, i=4- OCH_3-C_6H_4.



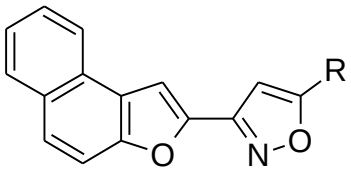
(5)

R: a= 4-$NO_2C_6H_4$, b=4-$OCH_3C_6H_4$, c=4-OH-C_6H_4, d=4-$CH_3C_6H_4$, e= C_6H_5

H M Vagdevi et al.,(2001) synthesized derivatives of some novel naphtho[2,1-b]furo-pyrazolines, isoxazoles and isoxazolines to screen them for antibacterial, antifungal, anthelmintic and analgesic activities**.** Antimicrobial activity was done by cup plate method against bacteria like Staphylococcus aureus and Klebsiella pneumonia and fungi like Aspergillus niger and Candida albicans. Standard drugs used for comparison of antibacterial and antifungal activities were Ciprofloxacin and ciclopiroxolamine. Compound 7e showed better antimicrobial activity, anthelmintic activity was showed by compounds 7b, 7e and 7i as equipotent effect in comparison with standard drug like Piperazine citrate. Compound 6d was found to be more active in analgesic activity.[2]



(6)



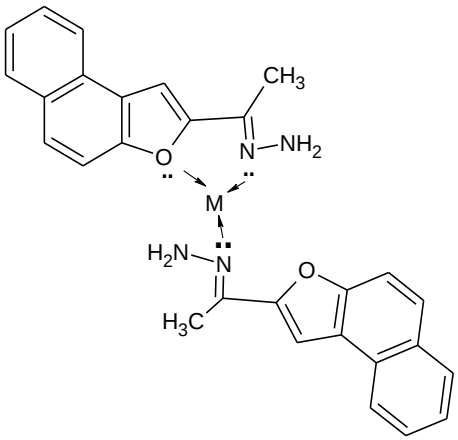
(7)

Ar: 4-$NO_2C_6H_4$

R: a=C_6H_5, b=4-OH-3-$OCH_3C_6H_3$, c=4-N, N-$(CH_3)_2C_6H_4$, d=2-$OCH_3C_6H_4$, e=Furyl, f=3-$NO_2C_6H_4$, g=CH=CHC_6H_5, h=2-OH-C_6H_4, i=4- OCH_3-C_6H_4

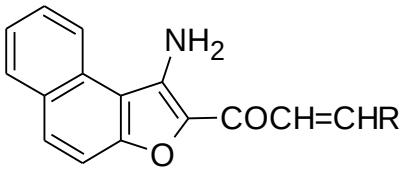
K P Latha et al.,(2001) synthesized some complexes of 2-acetylnaphtho[2,1-b]furan hydrazone for antimicrobial activity by cup plate method against bacteria like Staphylococcus aureus and Klebsiella pneumonia, fungi like Aspergillus niger and Candida albicans. Standard drug used were Norfloxacin and Miconazole. Cu (II), Ni (II), Cd (II), Hg (II) and Zn (II) complexes shows good antimicrobial activity, anthelmintic activity with standard drug like Piperazine citrate, while compound showed better anthelmintic activity, whereas metal salts, ligand and complexes were less active as analgesic agents. [3]

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

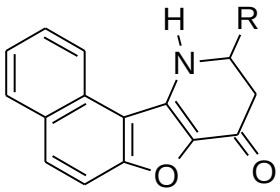


(8)
M: Cu (II), Ni (II) and Co (II)

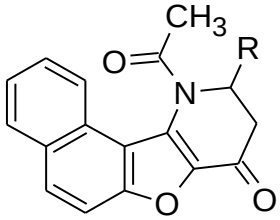
K M Mahadevan et al.,(2001) synthesized a series of 2-aryl-1,2,3,4-tetrahydropyrido (naphtho [2,1-b]furan)-4-ones for antimicrobial activity against Staphylococcus aureus, Klebsiella pneumonia and Aspergillus niger by cup-plate method with the standard drugs like Streptomycin and Griseofulvin, anthelmintic activity against Pherituma posthuma. Compounds exhibited moderate antimicrobial activity whereas all the compounds showed poor anthelmintic activity in comparison with standard drug, Mebendazole.[4]



(9)



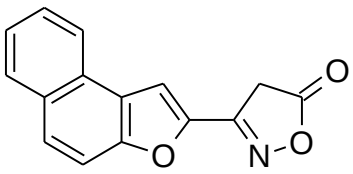
(10)



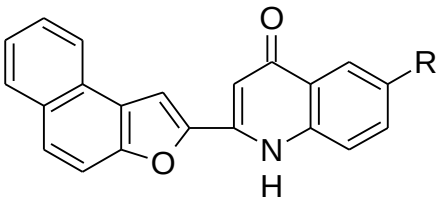
(11)

R: a=C_6H_5, b=4-ClC_6H_4, c=4-$NO_2C_6H_4$, d=4-$OCH_3C_6H_4$, e=2-Furyl, f=4-OH-3-$OCH_3C_6H_3$

K M Mahadevan et al.,(2001) synthesized some 2-isoxazolyl, pyrazolyl, pyrimidyl and quinolinyl naptho[2,1-b]furan derivatives for antibacterial activity against Pseudomonas diminuta by paper disc method, antifungal activity against Aspergillus niger and Candida albicans by agar plate diffusion method. Ciprofloxacin and ciclopiroxolamine were used as standard drugs and anthelmintic activity on Pherituma posthuma. All the compounds showed poor antibacterial activity against Pseudomonas diminuta NTCC,1609, while compounds 12, 13h showed better antifungal activity and 13c, 14a, 15b exhibited highly significant anthelmintic activity than Piperazine citrate as standard drug.[5]



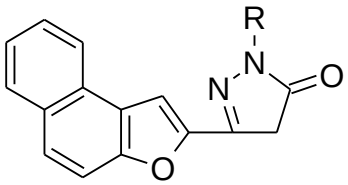
(12)



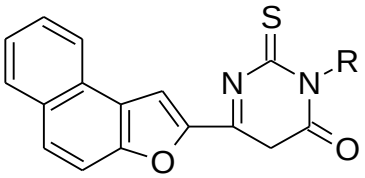
(13)

R: a=H, b=CH_3, c=OCH_3,d=OH, e=$COOC_2H_5$, f=NH_2,g=COOH, h=Cl, i=Br

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

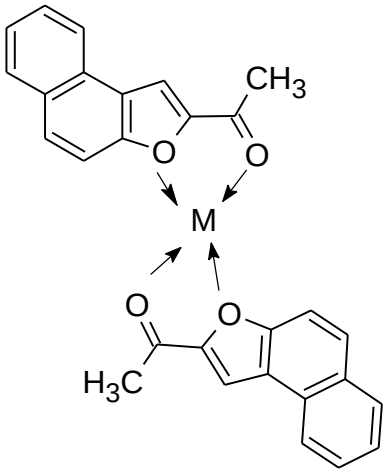


(14)
R: a=H, b=C_6H_5, c= 4-$NO_2C_6H_4$



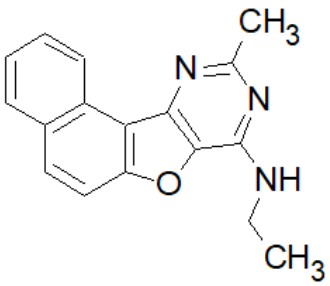
(15)
R: a=H, b=C_6H_5

K P Latha et al.,(2002) synthesized some metal complexes of 2-acetylnaphtho [2,1-b] furan and all the complexes, ligand and metal salts are investigated for antibacterial, antifungal, anthelmintics and anti-inflammatory activity by winter's hind paw method. All the complexes showed equivalent antimicrobial effect as that of standard drugs like Norfloxacin and Miconazole while exhibited highly significant anthelmintic activity.[6]

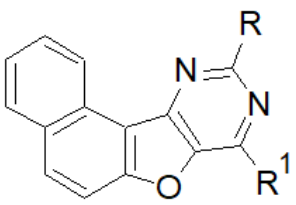


(16)
M: Cu(II), Ni(II) ,Co (II), Hg(II), Cd(II), Zn complexes

Basavaraj Padmashali et al.,(2002) synthesized derivatives of some naphtho[2,1-b]furo[3,2-d]pyrimidines to screen them for antimicrobial, anthelmintic and anti-inflammatory activities. antibacterial activity against Proteus vulgaris and Pseudomonas aeruginosa, antifungal activity against Aspergillus niger and Candida albicans with the standard drugs like Ciprofloxacin and Chlotrimazole. Compounds exhibited poor antimicrobial and anti-inflammatory activity but 17, 18a, 18b compounds showed moderate anthelmintic activity in comparison with standard drug like Piperazine citrate.[7]



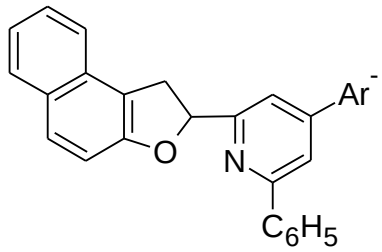
(17)



(18)

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

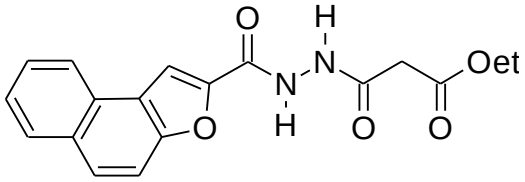
H M Vagdevi et al.,(2002) synthesized a series of 2-[(4-aryl-6-phenyl) pyridin-2-yl]naptho[2,1-b]furans for antimicrobial activity by cup plate method. All the compounds showed poor antibacterial activity, 19c showed highly significant antifungal activity, while 19c, 19e, 19g and 19h exhibited better anthelmintic activity in comparison with Piperzine citrate as standard drug.[8]



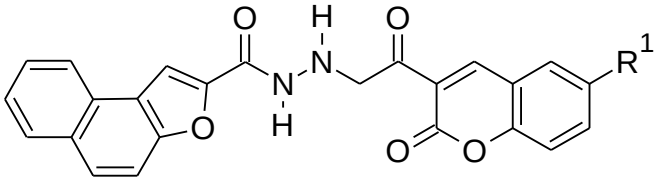
(19)

R: a=C_6H_5, b=2-OHC_6H_4, c=2-$OCH_3C_6H_4$, d=4-$OCH_3C_6H_4$, e=4-OH-3-$OCH_3C_6H_3$, f=4-ClC_6H_4, g=3-$NO_2C_6H_4$, h= Furyl

K M Mahadevan et al.,(2002) synthesized some potent naphtho[2,1-b]furo-pyrazolyl, oxadiazolyl and coumaryl derivatives for antimicrobial, anthelmintic, anti-inflammatory, analgesic and diuretic activities. antimicrobial activity was carried out by agar cup-plate method against bacteria like Staphylococcus aureus and Klebsiella pneumonia and fungi like Aspergillus niger. Antimicrobial activity was shown by 20, 21d, while 21c, 21d showed equipotent effect in anthelmintic activity, whereas 21a and 21c exhibited moderate diuretic activity and compounds showed moderate analgesic activity.[9]



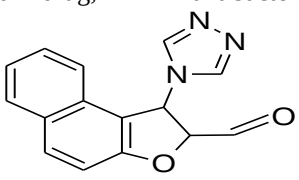
(20)



(21)

R: a=H, b=Br, c=NO_2, d=C_4H_4

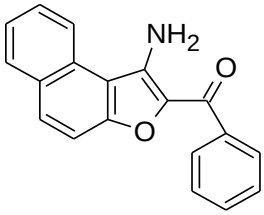
K M Mahadevan et al.,(2003) synthesized derivatives of novel compounds of naphtho[2,1-b]furopyrimidine and investigated for antimicrobial activity where Streptomycin and Griseofulvin were used as standard drug, anthelmintic activity where mebendazole was used as a standard drug and anti-inflammatory activity by Carrageenan induced paw edema method. Compound exhibited highly significant antibacterial, antifungal and anthelmintic activity.[10]



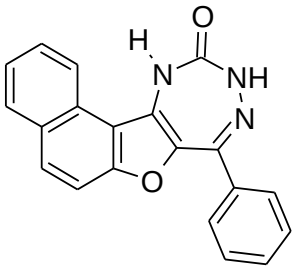
(22)

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

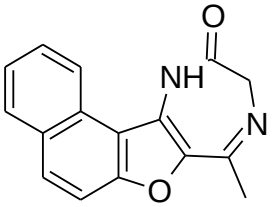
V P Vaidya et al.,(2004) synthesized derivatives of naphtho[2,1-b]furo[3,2-e]-1,4-diazepin-2-ones and naphtho[2,1-b]furo[3,2-e]-1,3,4-triazepin-2-ones for antimicrobial, anthelmintic, analgesic activities. Standard drugs used were Ciprofloxacin and Ciclopirox olamine for antimicrobial activity, Piperzine citrate for anthelmintic activity and Acetyl salicylic acid for analgesic activity. Compounds 23, 24 showed better anthelmintic activity while 25 exhibited better analgesic activity. [11]



(23)

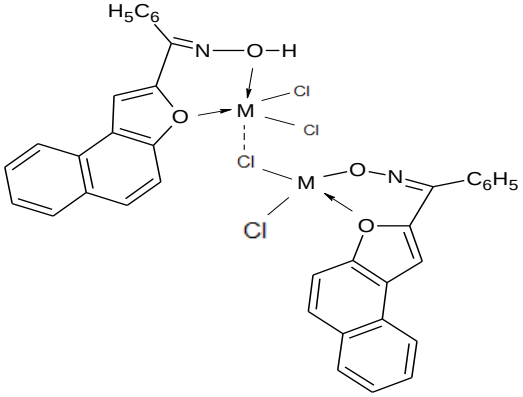


(24)



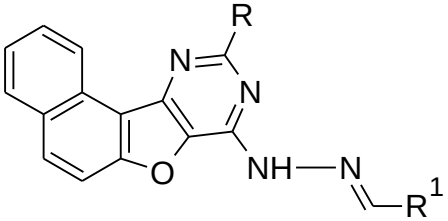
(25)

K P Latha et al.,(2004) synthesized some metal complexes of 2-acetylnaphtho[2,1-b]furan oxime and 2-benzoylnaphtho[2,1-b]furanoxime and screened for antimicrobial, anthelmintic and analgesic activities. Activity increased on complexation with metal ions.[12]

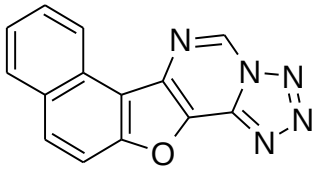


(26)
M: Cu (II) and Ni (II)

Basavaraj Padmashali et al., (2005) synthesized a series of 4-arylidine-hydrazinonaphtho[2,1-b]furo[3,2-d]pyrimidines to screen them for antimicrobial activity against bacteria like Proteus vulgaris ,Pseudomonas aueroginosa and fungi like Aspergillus niger and Candida albicans, for anthelmintic activity against Pherituma posthuma, anticonvulsant and antipyretic activities. Standard drugs used were Ciprofloxacin and Chlotrimazole for antimicrobial activity and acetyl salicylic acid for antipyretic activity. Compounds 27a, 27b, 27c exhibited moderate antimicrobial activity, 28 and 29c showed significant anthelmintic activity with standard drug like Piperazine citrate, 29a and 29c were found to possess better anticonvulsant activity, while 29a and 29b showed equipotent effect in antipyretic activity.[13]

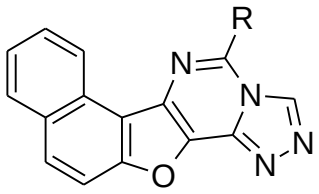


(27)



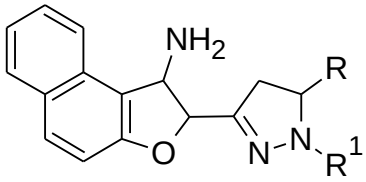
(28)

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781



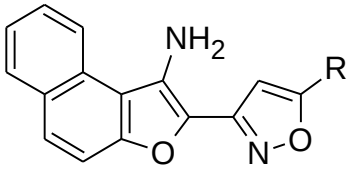
(29)

K M Mahadevan et al.,(2005) synthesized novel naphtho[2,1-b]furo pyrazolyl, isoxazolyl and pyridyl derivatives and screened for antimicrobial activity. Compounds 30a, 30b, 30f, 31b, 31e, 32a, 32c, 32d showed better antibacterial activity and 30a-f, 31a, 31c, 31d , 32a, 32b exhibited significant antifungal activity.[14]



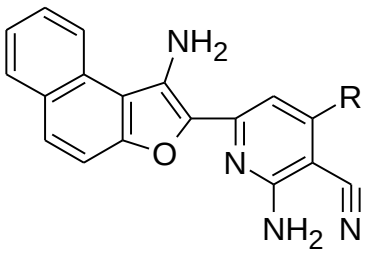
(30)

R: a=4-$OCH_3C_6H_4$, b=4-ClC_6H_4, c=4-$NO_2C_6H_4$, d=C_6H_5,e=4-$OCH_3C_6H_4$, f=4-ClC_6H_4



(31)

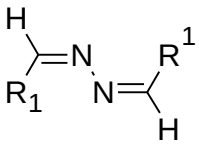
R: a=4-OHC_6H_4, b=4-$OCH_3C_6H_4$, c=4-$OCH_3C_6H_4$, d=4-$NO_2C_6H_4$



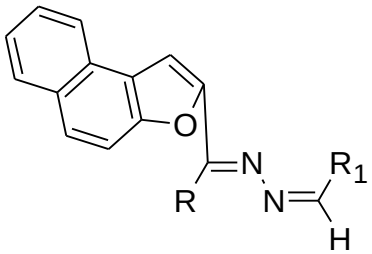
(32)

R: a=C_6H_5, b=4-OHC_6H_4, c=4-$OCH_3C_6H_4$, d=4-$NO_2C_6H_4$

M N Kumarswamy et al.,(2005) synthesized novel compounds of symmetrical and asymmetrical azines involving naphtho[2,1-b] furan for antimicrobial activity by MIC method. Compounds exhibited better antimicrobial activities in comparison with Chloramphenicol and Fluconazole as standard drugs.[15]



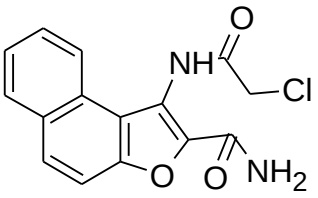
(33)



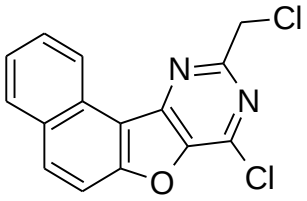
(34)

Prathima Mathias et al.,(2005) synthesized some series of naphtho[2,1-b]furo[3,2-d]pyrimidines to evaluate their to evaluate their antibacterial, antifungal and anthelmintic activities.. Compounds 36, 38 showed better antibacterial activity in comparison with Chlotrimazole and Benzyl penicillin and 35 and 37 a-c exhibited highly significant anthelmintic activity.[16]

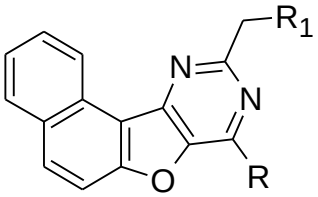
International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781



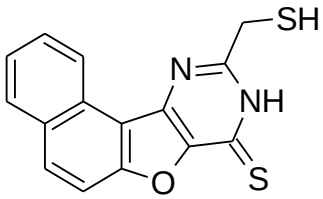
(35)



(36)



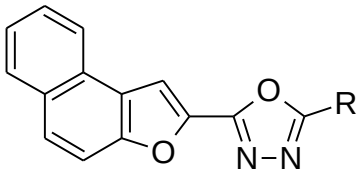
(37)



(38)

R: a=NHC_2H_5, b= NHC_6H_5, c= NHC_6H_4-4-CH_3

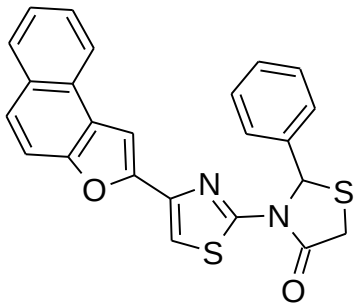
K C Ravindra et al.,(2006) synthesized some series of 1,3,4-oxadiazoles linked to naphtho[2,1-b] furan to evaluate their antimicrobial and anti-inflammatory activities. Compounds exhibited significant antimicrobial activity in comparison with Chloramphenicol and Fluconazole, while greater anti-inflammatory activity was shown by 39b.[17]



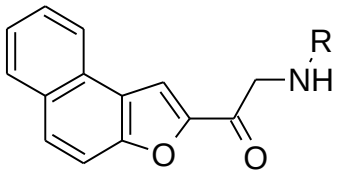
(39)

R: a=C_6H_4-4-OCH_3, b= C_6H_4-4-Cl

H M Vagdevi et al.,(2006) synthesized a series of thiazolidinone derivatives of naphtho[2,1-b] furan for antimicrobial, anthelmintic, anti-inflammatory and diuretic activities. Ciprofloxacin and Ciclopiroxolamine were used as standard drug. Compounds 41a, 41b, 42a, 42b, 4c exhibited significant antimicrobial activity, while 40 showed better anti-inflammatory, anthelmintic and diuretic activities.[18]

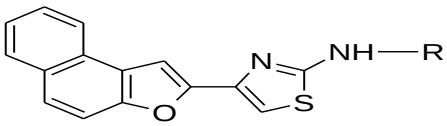


(40)



(41)

R: a=C_6H_5, b=4-$CH_3C_6H_4$

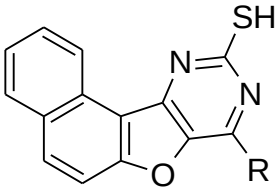


(42)

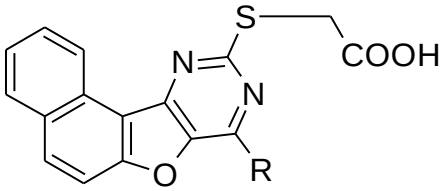
R:a=C_6H_5,b= 4-BrC_6H_4,c=4-CH_3 C_6H_4

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

M N Kumarswamy et al.,(2006) synthesized a, diuretic and anti-inflammatory activities. Compounds 43a, 43b, 44b, 44c were showed better antimicrobial activity, better anti-inflammatory activity was shown by 44b and 44c, while 43a, 44a, 44b exhibited significant diuretic activity in comparison with standard drug like Frusemide.[19]



(43)
R:a=4-Cl-C_6H_5,b= 4-OH-C_6H_5

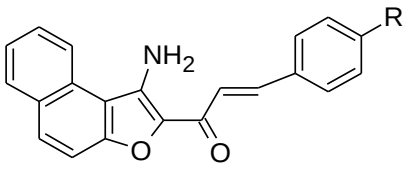


(44)
R:a=C_6H_5,b= 4-Cl-C_6H_5,c=4-OH-C_6H_5

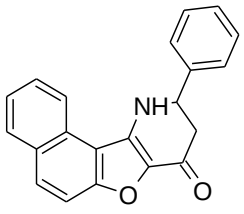
K C Ravindra et al.,(2006) synthesized a series of substitutedbiheterocycles of triazole, thiadiazole and oxadiazole involving naphtho[2,1-b]furan derivatives to evaluate their antibacterial activity against Escherichia coli, Micrococcus luteus and Staphylococcus aureus, antifungal activity against Aspergillus niger, Aspergillus flavus and Curvuliaria lunata, where Chloramphenicol and Flucanazole used as standard drug.[20]

(45)
R: p-NO_2-C_6H_4

Gundibasappa K et al.,(2006) synthesized a series of novel compounds of 2-aryl-2, 3-dihydronaphtho[2,1-b]furo[3, 2-b] pyridine-4(1H)-ones for antibacterial and antifungal activity.[21]



(46)

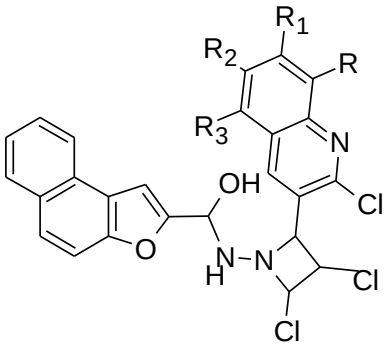


(47)

R: H, Cl, Br, CH_3, OCH3, NO_2

Gundibasappa K et al.,(2006) synthesized a derivatives of novel nitrogen containing naphtho [2,1-b]furan for antibacterial and antifungal activities. Compounds 48c, 48e, 48i, 48l, 48k exhibited significant antimicrobial activity.[22]

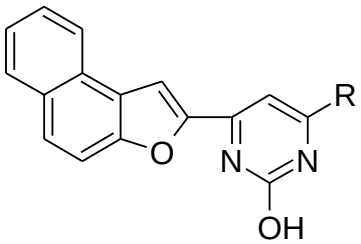
International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781



(48)

	R	R1	R2	R3
48a	H	H	H	H
48b	H	H	CH_3	H
48c	H	CH_3	H	H
48d	CH_3	H	H	H
48e	H	H	OCH_3	H
48f	H	OCH_3	H	H
48g	OCH_3	H	H	H
48h	H	H	Br	H
40i	H	H	Cl	H
48j	H	Cl	H	H
48k	H	OCH_3	OCH_3	H
48l	H	OCH_3	OCH_3	OCH_3

D Ramesh et al.,(2006) synthesized a derivatives of 4-(aryl substituted)-6-naphtho[2,1-b]furan-2-ylpyrimidin-2-ols and evaluated their antibacterial activity against Staphylococcus aureus and Escherichia coli, antifungal activity against Aspergillus niger and Curvularia lunata by cup plate method, anti-inflammatory activity and analgesic activity by acetic acid induced writhing model. Standard drugs used were Chloramphenicol and Fluconazole for antimicrobial activity, Diclofenac for anti-inflammatory activity and Aspirin for analgesic activity. Compounds 49a and 49h exhibited better anti-inflammatory activity, while the compounds showed moderate antimicrobial and analgesic activities.[23]

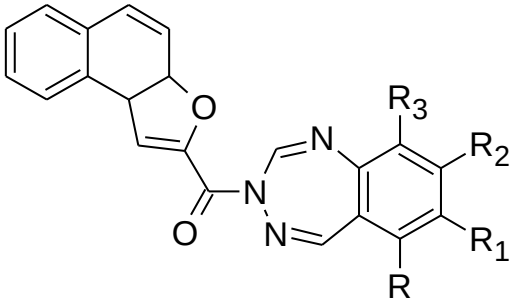


(49)

R: a=C_6H_5, b=4-Cl-C_6H_4, c=2-Furyl, d=2-OHC_6H_4, e=CH=CHC_6H_5, f=4-OCH_3-3OHC_6H_3, g=4-$OCH_3C_6H_4$, h=3-$NO_2C_6H_4$

Gundibasappa K et al.,(2006) synthesized a series of 3-(naphtho [2, 1-b] furan-2-ylcarbonyl)-3H-1, 3, 4-benzotriazepine by microwave assisted technique and screened for antibacterial and antifungal activity. Compounds showed significant antimicrobial activity. [24]

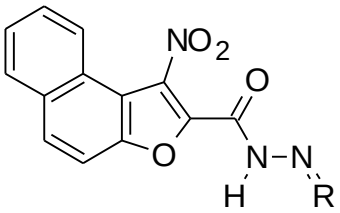
International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781



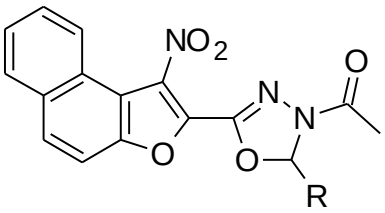
(50)

	R	R1	R2	R3
50a	H	H	H	H
50b	H	H	CH_3	H
50c	H	CH_3	H	H
50d	CH_3	H	H	H
50e	H	H	OCH_3	H
50f	H	OCH_3	H	H
50g	OCH_3	H	H	H
50h	H	H	Br	H
50i	H	H	Cl	H
50j	H	Cl	H	H
50k	H	OCH_3	OCH_3	H
50l	H	OCH_3	OCH_3	OCH_3

H Rajashekhara et al.,(2007) synthesized 2-(3-nitronaphtho[2,1-b]furan-2-yl)-5-aryl substituted2,3-dihydro-1,3,4-oxadiazole derivatives to screen them for antibacterial and antifungal activity. Presence of nitro group in 3-position of furan nucleus increased both antibacterial and antifungal activity.[25]



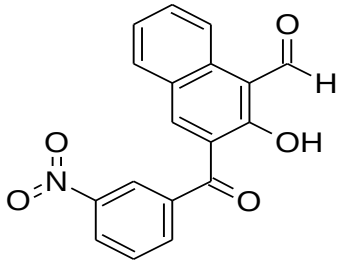
(51)



(52)

R: a=C_6H_4-OCH_3, b=C_6H_4Cl, c=C_6H_4-NO_2, d= C_6H_5, e= C_4H_3O, f= $C_{10}H_7O$, g=CH=CH-C_6H_5

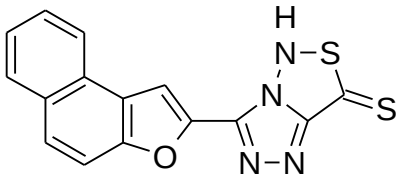
C Chandrashekar et al.,(2007) synthesized derivatives of ethyl-9-benzoylnaphtho[2,1-b] furan-2-carboxylate and evaluated their antibacterial, antifungal and anthelmintic activities.[26]



(53)

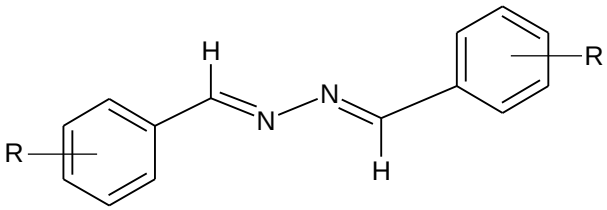
International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

K C Ravindra et al.,(2008) synthesized a series of 3-naphtho[2,1-b]furan-2-yl-6-phenyl[1,2,4]triazolo[3,4-b][1,3,4]thiadiazoles to screen them for antibacterial activity against Escherichia coli, Micrococcus luteus, Staphylococcus aureus, antifungal activity against Aspergillus flavus, Aspergillus niger, Curvularia lunata and analgesic activity. Chloramphenicol and Fluconazole were used as standard drug for antimicrobial activity.[27]



(54)

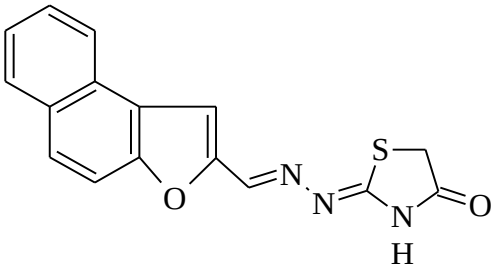
K Veena et al.,(2011) synthesized a series of novel compounds of symmetrical and asymmetrical azines involving naphtho[2,1-b]furan to screen them for antimicrobial activity. 55a showed better antibacterial activity while 55c greater antifungal activity.[28]



(55)

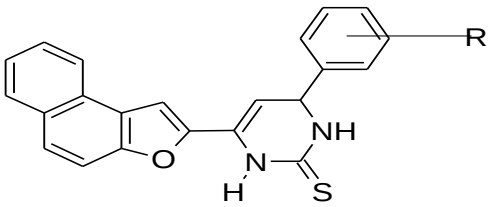
R: a=H, b=4-OCH_3, c=3-NO_2, d=4-Cl, e=2-Cl

Ashraf H F et al.,(2011) synthesized derivatives of naphtho[2,1-b] furan involving pyrazole nucleus for antimicrobial activity. Compound 48 exhibited highest antibacterial and antifungal activity.[29]



(56)

Sanjeevan .S. Gaikwad et al.,(2012) synthesized a series of 3, 4-dihydro-4(4-substituted-aryl)-6-(naphtho[2,1-b] furan-2-yl) pyrimidine-2[1H]thiones for antimicrobial activity. Standard drugs used were Penicillin for antibacterial activity and Griseofulvin for antifungal activity. All the compounds exhibited significant antibacterial and antifungal activity.[30]



(57)

R: a=4-H, b=4-CH_3, c=4-OH, d=4-OCH_3, e=4-Cl

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

II. CONCLUSION:

This review highlights the broad spectrum of antimicrobial activity associated with Naphtho[2,1-b] furan along with anthelmintic, anti-inflammatory, analgesic, anti-convulsant, diuretic activity. This puts impetus on the need to explore Naphtho[2,1-b] furan moiety for further research and screening.

REFERENCES:

[1]. H M Vagdevi, V P Vaidya. Studies in naphthofurans : Part-III Synthesis of 2-substitutednaphtho[2,1-b]furans, 2-(2'-aryl-3'-acetyl-1,3,4-oxadiazolyl)aminonaphtho[2,1-b]furans and their biological activities. Indian Journal of heterocyclic chemistry, April-June 2001; 10: 253-60.

[2]. H M Vagdevi, K P Latha, V P Vaidya, M L Vijayakumar, K S R Pal. Synthesis and pharmacological screening of some novel naphtho[2,1-b]furo-pyrazolines, isoxazoles and isoxazolines. IJPSc. 2001; 63(4) 286-91.

[3]. K P Latha, V P Vaidya, J Keshavayya, H M Vagdevi. Synthesis, characterization and biological studies of complexes of 2-acetylnaphtho[2,1-b]furan hydrazone. Journal of the Indian council of chemists 2001; 18(1): 31-36.

[4]. K M Mahadevan, Basavaraj Padmashali, V P Vaidya. Studies in naphthofurans: Part-V-Synthesis of 2-aryl-1, 2, 3, 4-tetrahydropyrido (naphtho [2, 1-b] furan)-4-ones and their biological activity. Indian Journal of heterocyclic chemistry, July-Sept.2001; 2: 15-20.

[5]. K M Mahadevan, V P Vaidya. Studies in naphthofurans: Part-V Synthesis of some 2-isoxazolyl, pyrazolyl, pyrimidyl and quinolinyl naptho[2,1-b]furan derivatives and their biological activities. Journal of the Indian council of chemists 2001; 18 (2): 78-82.

[6]. K P Latha, V P Vaidya, J Keshavayya, M L Vijay kumar, C S Shreedhara. Synthesis,characterisation and biological studies of metal complexes of 2-acetylnaphtho[2,1-b]furan. Science letters, 2002; 25 (5): 5-6.

[7]. Basavaraj Padmashali, V P Vaidya, M L Vijayakumar. Synthesis and pharmacological evaluation of some naphtho[2,1-b]furo[3,2-d]pyrimidines. Indian Journal of heterocyclic chemistry, Oct-Dec. 2002; 12: 89-94.

[8]. H M Vagdevi, V P Vaidya, K M Mahadevan. Synthesis of 2-[(4-aryl-6-phenyl) pyridin-2-yl]naptho[2,1-b]furans and its antimicrobial and anthelmintic activity. Kuvempu Univ.Sci.J.2002; 13-17.

[9]. K M Mahadevan, V P Vaidya. Synthesis and pharmacological evaluation of some potent naphtho[2, 1-b] furo-pyrazolyl, oxadiazolyl and coumaryl derivatives. IJPSc. 2003, 65(2):128-34.

[10]. K M Mahadevan, V P Vaidya, H M Vagdevi. Synthesis of novel naphtho[2,1-b]furopyrimidine derivatives. Indian Journal of chemistry, Aug 2003; 42B 1931-36.

[11]. V P Vaidya, H M Vagdevi, K M Mahadevan, C S Shreedhara. Synthesis of naphtho[2,1-b]furo[3,2-e]-1,4-diazepin-2-ones and naphtho[2,1-b]furo[3,2-e]-1,3,4-triazepin-2-ones of pharmacological interest. Indian Journal of chemistry, July 2004; 43B: 1537-43.

[12]. K P Latha, V P Vaidya, J Keshavayya. Comparative studies on metal complexes of 2-acetylnaphtho[2,1-b]furan oxime and 2-benzoylnaphtho[2,1-b]furan oxime. Synthesis and reactivity in inorganic and metal organic chemistry, 2004; 34(4): 667-86.

[13]. Basavaraj Padmashali, V P Vaidya, K M Mahadevan, K P Latha. Synthesis of novel angularly fused pentacyclic heterocycles of pharmacological interest. . Indian Journal of chemistry, July 2005; 44B: 1446-51.

[14]. K M Mahadevan, K M Basavaraj, D A Prathima Mathias, V P Vaidya. Synthesis of novel naphtho [2,1-b] furo pyrazolyl, isoxazolyl and pyridyl derivatives as potential antimicrobial agents. Indian Journal of chemistry, April 2005; 44B: 789-93.

[15]. M N Kumarswamy and V P Vaidya. Novel method for synthesis of symmetrical and asymmetrical azines involving naphtho [2,1-b] furan and their antimicrobial activity. Indian Journal of heterocyclic chemistry, Jan–March, 2005; 14: 193-96.

[16]. Prathima Mathias and V P Vaidya. Synthesis and pharmacological evaluation of some naphtho [2,1-b] furo [3,2-d]pyrimidines. Indian Journal of heterocyclic chemistry, Jan-March, 2005; 14: 189-92.

International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 4 July-Aug 2021, pp: 644-657 www.ijprajournal.com ISSN: 2249-7781

[17]. K C Ravindra, H M Vagdevi, V P Vaidya, Basavaraj padmashali. Synthesis, antimicrobial and anti-inflammatory activities of 1, 3, 4-oxadiazoles linked to naphtho[2,1-b] furan. Indian Journal of chemistry, November 2006; 45B: 2506-11.
[18]. H M Vagdevi, V P Vaidya, K P Latha, B.Padmashali. Synthesis and pharmacological examination of some thiazolidinone derivatives of naphtho [2,1-b] furan. IJPSc, 2006, 68(6):719-25.
[19]. M N Kumarswamy, D A Prathima Mathias, C Chandrashekar and V P Vaidya. Synthesis and pharmacological evaluation of 2-mercapto-4-substituted-naphtho[2,1-b]furo[3,2-d] pyrimidines. IJPSc., 2006, 68(6) :731-36.
[20]. K C Ravindra, V P Vaidya, C Chandrashekhar, M H Vagdevi. Synthesis of substituted biheterocycles of triazole, thiadiazole and oxadiazole involving naphtho [2, 1-b] furan and their antimicrobial activity. Indian Journal of heterocyclic chemistry, Jan-March, 2006; 15: 283-86.
[21]. Gundibasappa K Nagaraja, Gowdara K Prakash, Nayak D Satyanarayan, Vijayavittala P Vaidya, Kittappa M Mahadevan. Synthesis of novel 2-aryl-2,3-dihydronaphtho[2,1-b]furo[3,2-b]pyridin-4(1H)-ones of biological importance. ARKIVOC 2006; 15: 142-52.
[22]. Gundibasappa K Nagaraja, Gowdara K Prakash, Marlingaplara N Kumaraswamy, Vijayavittala P Vaidya and Kittappa M Mahadevan. Synthesis of novel nitrogen containing naphtho[2,1-b]furan derivatives and investigation of their antimicrobial activities. ARKIVOC 2006; (XV): 160-68.
[23]. D Ramesh, C Chandrashekhar, V P Vaidya. Synthesis, analgesic, anti-inflammatory and antimicrobial activities of naphtho[2,1-b] furan incorporated substituted pyrimidines. Indian Journal of heterocyclic chemistry, April-June 2006; 15: 319-22.
[24]. Gundibasappa K Nagaraja, Marilingaplara N Kumaraswamy, Vijayavittala P Vaidya, Kittappa M Mahadevan. Microwave assisted synthesis of (naphtho[2,1-b]furan-1, 3, 4-benzotriazepines: a potent antimicrobial agent. ARKIVOC 2006; (X): 211-19.
[25]. H Rajashekhara, D Ramesh, C Chandrashekhar, K M Mahadevan, V P Vaidya. Synthesis of 2-(3-nitronaphtho[2,1-b]furan-2-yl)-5-substituted-1, 3, 4-oxadiazoles and their biological activities. . Indian Journal of heterocyclic chemistry, April-June, 2007; 16: 353-56.
[26]. C Chandrashekar, M N Kumaraswamy, K M Basavaraja, V P Vaidya. Synthesis, antimicrobial and anthelmintic activities of 2, 9-disubstitutednaphtho[2,1-b] furans. Indian Journal of heterocyclic chemistry, April-June, 2007; 16: 341-44.
[27]. K C Ravindra, H M Vagdevi, V P Vaidya. Synthesis, characterization and pharmacological studies on some triazolothiadiazines and triazolothiadiazoles containing naphtho[2,1-b]furan. Indian Journal of chemistry, August 2008; 47B: 1271-76.
[28]. K Veena, M Ramaiah, G K Vanita, T S Avinash, V P Vaidya. Synthesis of symmetrical and asymmetrical azines encompassing naphtho [2,1-b]furan by a novel approach. E-Journal of chemistry 2011; 8(1): 354-60.
[29]. Ashraf H F, Abd El-Wahab, Zarrag Isa A Al-Fifi, Ahmed H Bedair, Fawzy M Ali, Ahmed H A Halawa, Ahemed M El-Agrody. Synthesis,reactions and biological evaluation of naphtho[2,1-b]furan derivatives bearing a pyrazole nucleus. Molecules 2011; 16: 307-18.
[30]. Sanjeevan S Gaikwad, Venkat S Suryawanshi, Dilip R Kulkarni, Dhanaji V Jadhav, Narayan D Shinde. Synthesis and characterisation of 3, 4-dihydro-4(4-substituted-aryl)-6-(naphtho[2,1-b]furan-2-yl) pyrimidine-2[1H] thiones as potential antimicrobial agents. OCAIJ, 2012; 8(7): 241-44.