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Overview of Antimicrobial Properties of Furan

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ABSTRACT

Antimicrobial are the compounds that are utilized against microbial infections. Furan is a five-membered heterocycle containing oxygen atoms as heteroatom. Furan is commonly observed in various biological systems. Furan derivatives are known for their various therapeutic properties. Here we are reviewing the antimicrobial properties associated with the furan derivatives.

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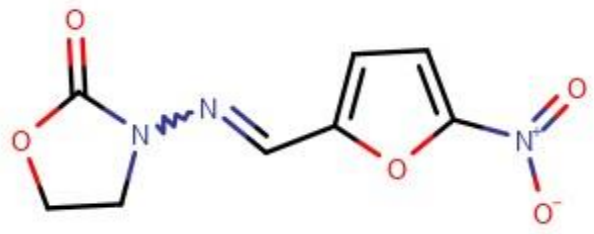
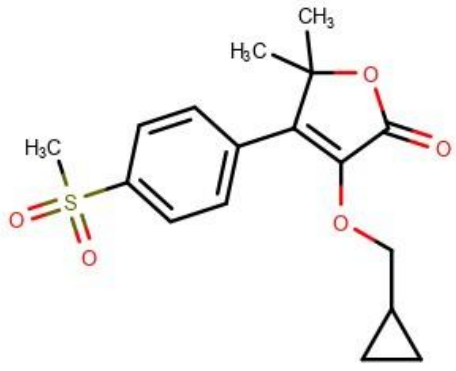
INTRODUCTION:

Microbial infections are one of the leading causes of mortality. Microbial infections like Tuberculosis and HIV are quite difficult to treat. The development of resistance and Mutations in the microorganisms have been increasing the threats associated with these types of infections. The development of chemotherapeutic agents against these types of infections is continuously growing. Chemotherapeutic agents are compounds that are developed using various synthetic processes. Heterocycles are major contributors to various chemotherapeutic agents which are developed to date. Most of the currently available chemotherapeutic agents are developed using heterocyclic scaffolds. The structure and physicochemical properties associated with these heterocyclic systems make them unique agents which can be utilized for the development of potent and selective agents against microbial infections. Furan is one of the most common heterocycles observed in nature as most of the carbohydrates contain furan in their structure. Furan is a unique heterocycle containing a five-member system and oxygen as heteroatom in its structure. Furan derivatives have been observed in many therapeutic agents as shown in figure no 1.



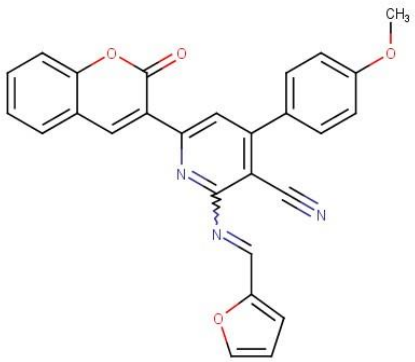
Furazolidone



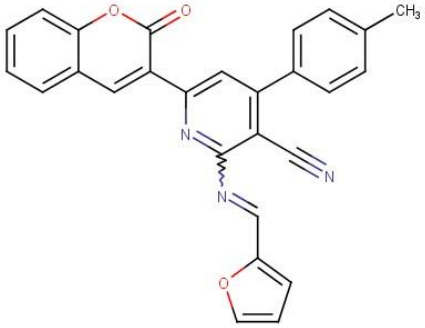
Firocoxib

Some Furan derivatives with antimicrobial activities are reported here we are summarizing the antimicrobial potential of Furan derivatives with their development.

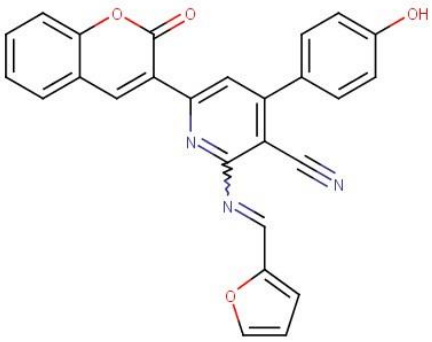
Desai et. al. (2017) reported a microwave-assisted development of coumarin derivatives containing cyanopyridine and furan as potent antimicrobial compounds. 2-(Furan-2-ylmethyleneamino)-4-(4-methoxyphenyl)-6-(2-oxo-2H-chromen-3-yl)nicotinonitrile (1a), 2-(Furan-2-ylmethyleneamino)-6-(2-oxo-2H-chromen-3-yl)-4-p-tolylnicotinonitrile(1b) , 2-(Furan-2-ylmethyleneamino)-4-(4-hydroxyphenyl)-6-(2-oxo-2H-chromen-3-yl)nicotinonitrile (1c), 2-(Furan-2-ylmethyleneamino)-4-(4-methoxyphenyl)-6-(2-oxo-2H-chromen-3-yl)nicotinonitrile (1d), 2-(Furan-2-ylmethyleneamino)-4-(3-hydroxyphenyl)-6-(2-oxo-2H-chromen-3-yl)nicotinonitrile (1e) were found to be most promising agent.



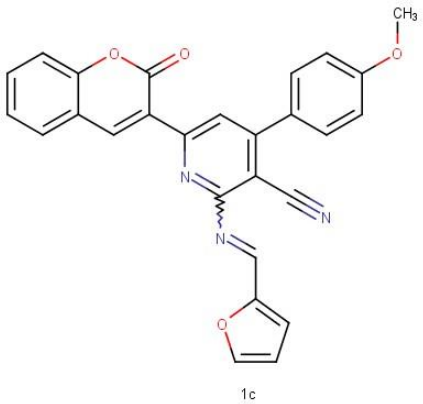
1a



1b



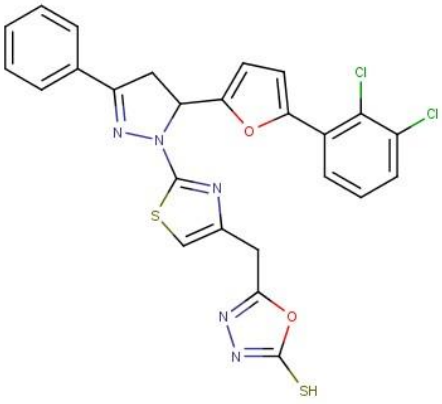
1c



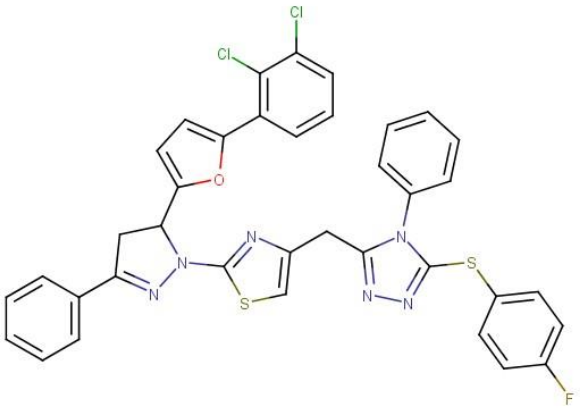
1c

Bhandare et. al. (2022) reported multistep synthesis of heterocyclic tetrads containing furan, as antimicrobial and anticancer agents. 5-((2-(5-(5-(2,3-dichlorophenyl)furan-2-yl)-3-phenyl-4,5-dihydropyrazol-1-yl)thiazol-4-yl)methyl)-1,3,4-oxadiazole-2-thiol(2a) and 2-(5-(5-(2,3-dichlorophenyl)furan-2-yl)-3-phenyl-4,5-dihydro-1H-pyrazol-1-yl)-4-((5-((4-

fluorophenyl)thio)-4-phenyl-4H-1,2,4-triazol-3-yl)methyl)thiazole (2b) are two promising lead obtained from the series for both anticancer as well antimicrobial activity .

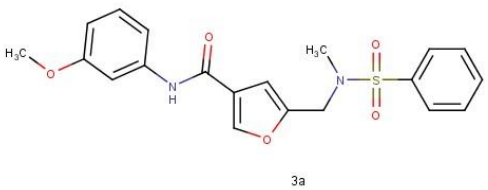


2a

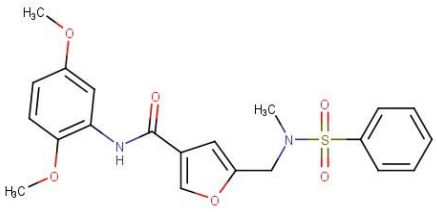


2b

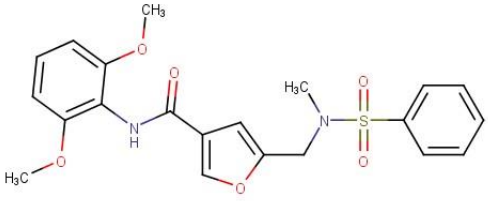
Nadh et. al. (2017) reported development of 2,4-di substituted furan derivatives as antimicrobial agents, 5-[(Benzene sulfonyl-methyl-amino)-methyl]-furan-3-carboxylic acid (3-methoxy-phenyl)-amide (3a), 5-[(Benzene sulfonyl-methyl-amino)-methyl]-furan-3-carboxylic acid (2,5,-dimethoxy-phenyl)-amide(3b), 5-[(Benzene sulfonyl-methyl-amino)-methyl]-furan-3-carboxylic acid (2,6-dimethoxy-phenyl)-amide (3c), 5-[(Benzene sulfonyl-methyl-amino)-methyl]-furan-3-carboxylic acid (2-chloro-4-hydroxy-phenyl)-amide (3d) were found to be most active compounds from the series.



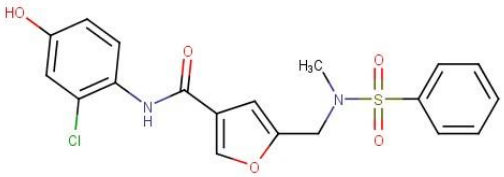
3a



3b



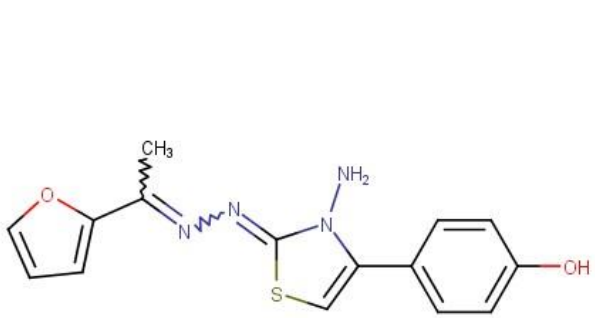
3c



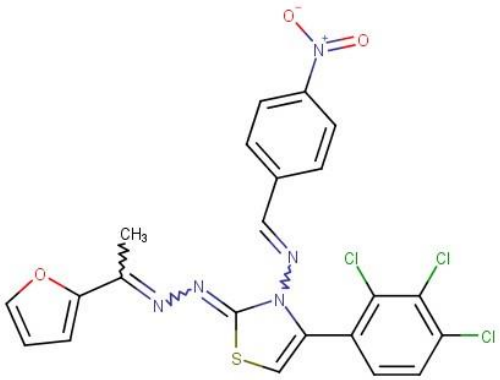
3d

Turan-Zitounet .al. (2018) reported the synthesis of 2-phenyl or methyl-4H-1-benzopyran-4-ones containing amidinobenzimidazoles (4)as antimicrobial compounds. (4-{3-Amino-2-[(1-

(furan-2-yl)ethylidene)hydrazono]-2,3-dihydrothiazol-4-yl}phenol)(4a) and (2-[(1-(Furan-2-yl)ethylidene)hydrazono]-N-(4-nitrobenzylidene)-4-(2,3,4-trichloro phenyl)thiazol-3(2H)-amine)(4b) was found to be most active derivatives.

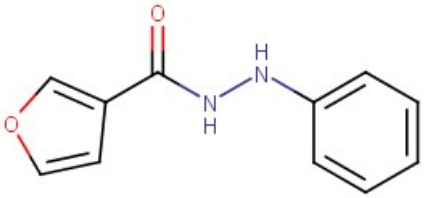


4a



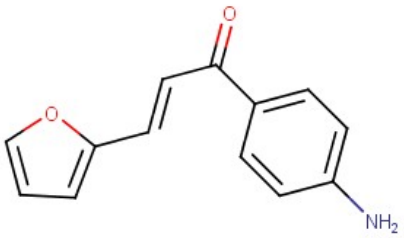
4b

Zanatta et .al. (2007) reported synthesis antimicrobial and QSAR analysis of furan-3-carboxamides derivatives. N'-phenylfuran-3-carbohydrazide (5) was found to be an active molecule from the series.



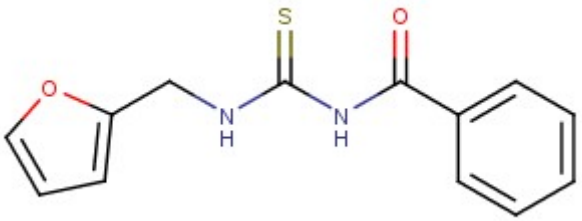
5

Coutinho et .al. (2020) reported Potentiation of antibiotic activity using (E)-1-(4′-aminophenyl)-3-(furan-2-yl)-prop-2-en-1-one (6) against gram positive and MDR gram negative organisms.



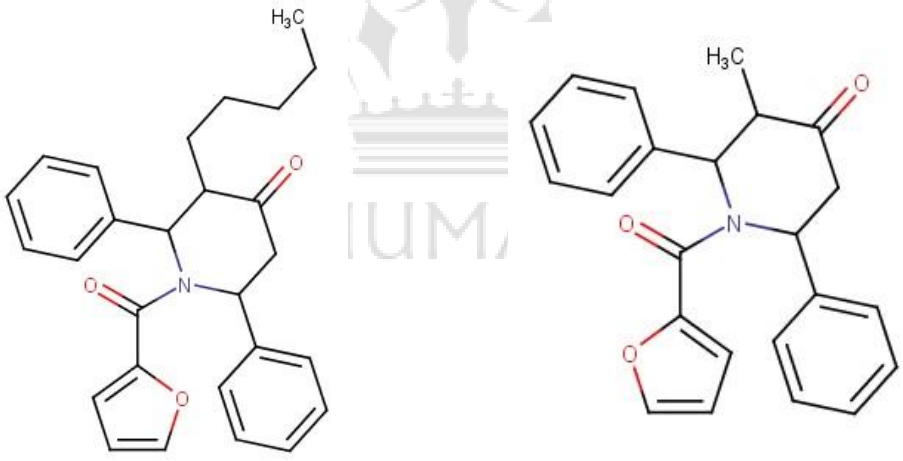
6

Atis et .al. (2013) reported development of (1-benzoyl-3-furan-2-ylmethyl-thiourea (7) as antimicrobial compounds.



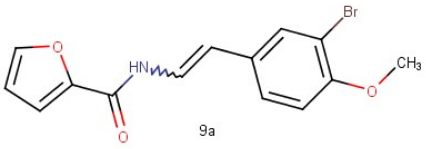
7

Srikanth et.al.(2016) reported development of -(furan-2-carbonyl)-3-alkyl-2,6-diphenylpiperidin-4-onederivatives as antimicrobial agents and carried out their docking studies, 1-Furoyl-2,6-diphenyl-3-pentylpiperidin-4-one(8a) , 1-Furoyl-2,6-Fluoro-diphenyl-3-methylpiperidin-4-one (8b) were found to be active compound.

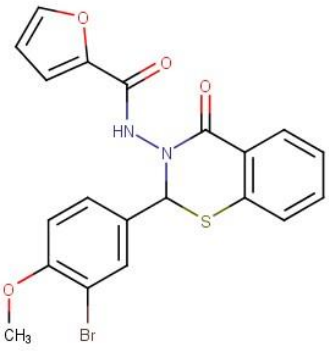


8a 8b

Popiołek et. al. (2019) reported antimicrobial activiyty of Furan/Thiophene-1,3-Benzothiazin-4-one Hybrids. N-[2-(3-bromo-4-methoxyphenyl)ethenyl]furan-2-carboxamide(9a), N-[2-(3-bromo-4-methoxyphenyl)-4-oxo-2H-1,3-benzothiazin-3(4H)-yl]furan-2-carboxamide(9b) were observed to be active compounds.

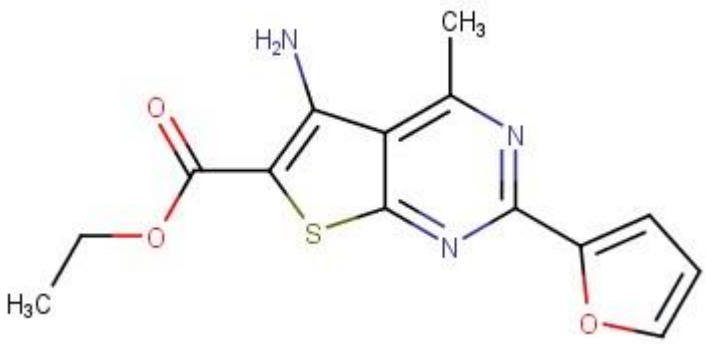


9a



9b

Abdel Hamid et. al. (2018) reported Novel Furan-tagged Thienopyrimidine derivatives as anti-bacterial agents. Ethyl 5-amino-2-(furan-2-yl)-4-methylthieno[2,3-d]pyrimidine-6-carboxylate (10) was found to be one of the active compounds from the series.



10

SUMMARY:

The development of chemotherapeutic agents against microbial infections is continuously growing. Chemotherapeutic agents are compounds that are developed using various synthetic processes. Heterocycles are major contributors to various chemotherapeutic agents which are developed to date.The development of antimicrobial agents is a need of time and furan can be an attractive option for the development of potent antimicrobial agents.

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