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Review on Antimicrobial Activity of Oxadiazole

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ABSTRACT

Oxadiazole is a five-member heterocyclic system containing two nitrogen and one oxygen atom. Oxadiazole is known for its synthetic and biological applications. Oxadiazole compounds are known for their various biological activities like anticancer, anti-inflammatory, antiviral and antimicrobial, so here we are reporting a review on the antimicrobial property of some Oxadiazole derivatives.

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INTRODUCTION

Oxadiazole is a five-member heterocyclic system containing two nitrogen and one oxygen atom. Oxadiazole is known for its synthetic and biological applications. Oxadiazole compounds are known for their various biological activities like anticancer, anti-inflammatory, antiviral and antimicrobial. Oxadiazole was found to be an exist in four different isomeric forms as 1, 2, 3-Oxadiazole, 1, 2, 4-Oxadiazole, 1, 2, 5-Oxadiazole, 1, 3, 4-Oxadiazole. 1,2,3 –Oxadiazole and 1,2,5 oxadiazole and their derivatives are having relatively less biological activity than the other 1, 2, 4-Oxadiazole and 1, 3, 4-Oxadiazole. Due to this, number of researchers are focused on 1, 2, 4-Oxadiazole and 1, 3, 4-Oxadiazole for the development of potent bioactive compounds. All the four isomeric forms of oxadiazole are shown in figure no 1.

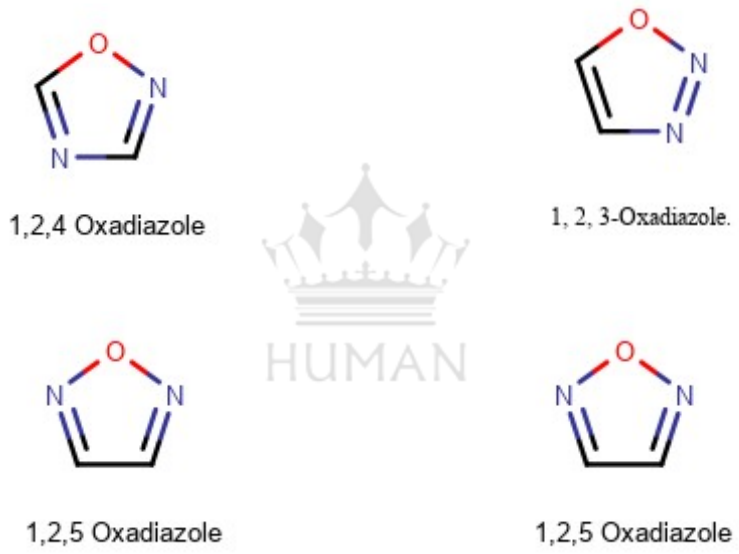
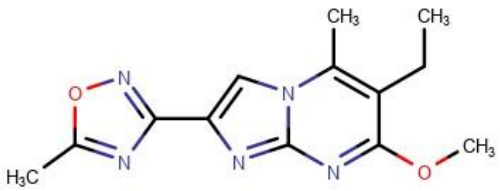
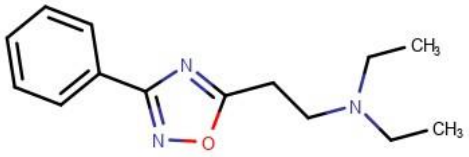


Figure no 1: Isomeric Forms of Oxadiazole

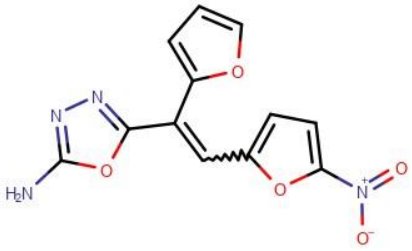
Oxadiazole is found to possess many pharmacological properties like antiviral, anticancer, anti-inflammatory and many more. Many therapeutic agents found to contain oxadiazole nucleus like Furamizole (Antimicrobial), Oxolamine (cough suppressant), Raltegravir (antiviral), Zibotentan (anticancer), Ataluren (Treatment of Duchenne muscular dystrophy), Nesapidil (anti-arrhythmic), Tiodazosin (antihypertensive agent), Fasiplon (anxiolytic) as shown in figure no 2.



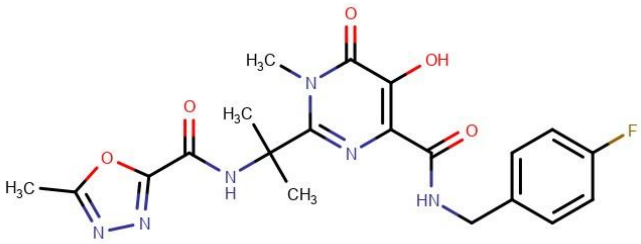
Fasiplon



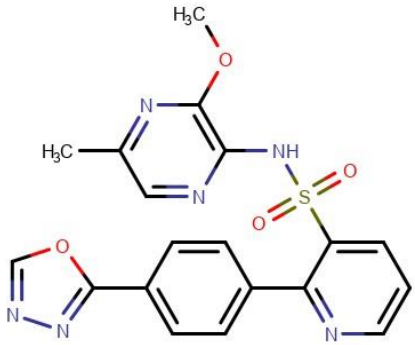
Oxolamine



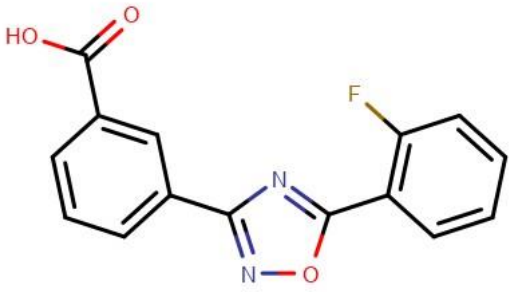
Furamizole



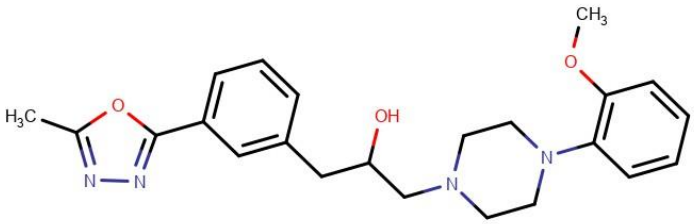
Raltegravir



Zibotentan



Ataluren



Nesapidil

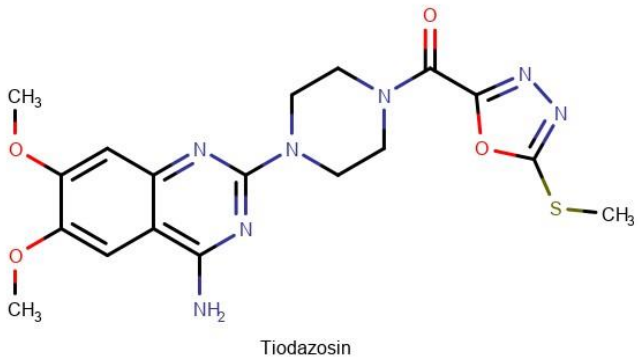
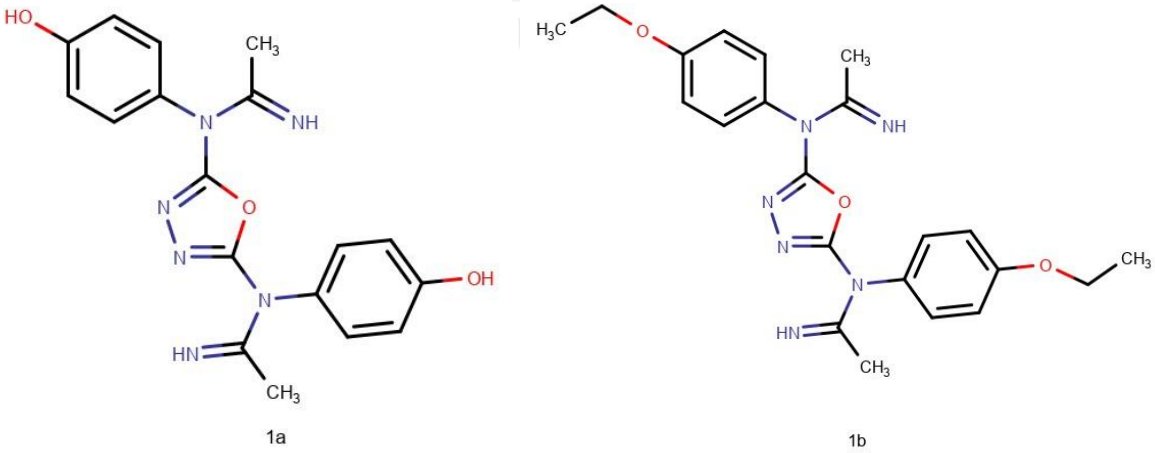


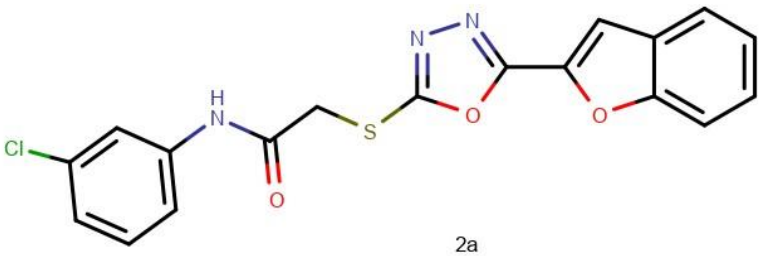
Figure no 2: Oxadiazole nucleus containing therapeutic agents

The number of Oxadiazole derivatives with potent antimicrobial activity has been reported. Here we have summarized some antimicrobial applications of the Oxadiazole.

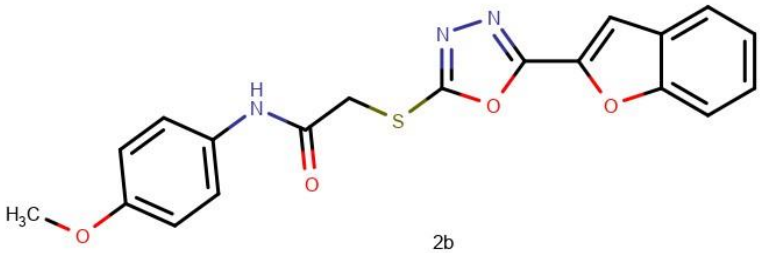
Samarat et. al. (2019) reported the antimicrobial activity of novel symmetrical 2,5-difunctionalized 1,3,4-oxadiazoles. N,N'-(1,3,4-Oxadiazole-2,5-diyl)bis(N-(4-hydroxyphenyl) acetimidamide) (1a) and N,N'-(4-Ethoxyphenyl)bis (acetimidoyl)amino-1,3,4-oxadiazol-2-yl-acetamide(1b) are two potent compounds observed in the series.



Fawad Zahoor et. al. (2019) reported the synthesis and Laccase Catalysis effect of Novel Benzofuran–Oxadiazole and their antimicrobial activity. 2-((5-Benzofuran-2-yl)-1,3,4-oxadiazol-2-yl)thio)-N-(3-chlorophenyl)acetamide (2a) and 2-((5-(Benzofuran-2-yl)-1,3,4-oxadiazol-2-yl)thio)-N-(4-methoxyphenyl)acetamide (2b) are the potent compounds observed in the series.

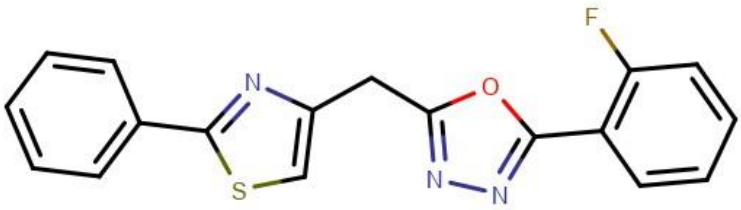


2a



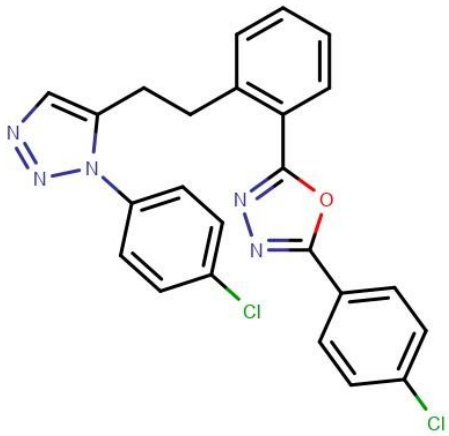
2b

Mhaske et. al. (2016) reported antimicrobial activity of 2-Aryl-5-((2-arylthiazol-4-yl) methyl)-1,3,4-oxadiazole derivatives and 2-(2-Fluorophenyl)-5-((2-phenylthiazol-4-yl)methyl)-1,3,4-oxadiazole(3) is one of the potent derivatives generated from the synthesized series.

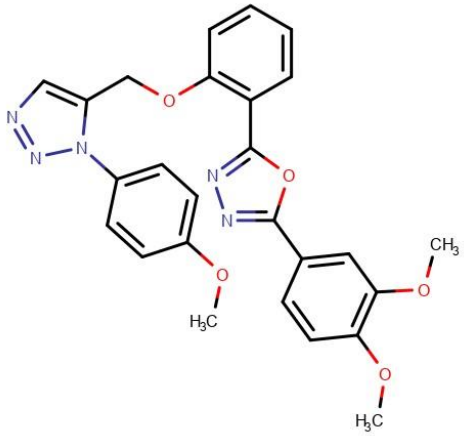


3

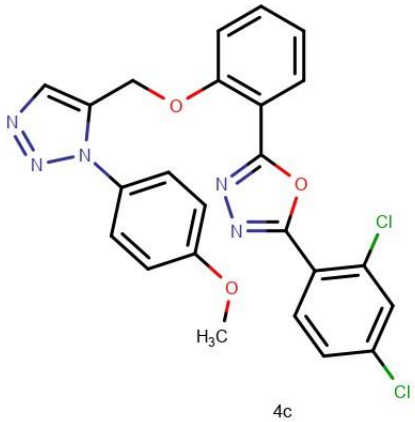
Antimicrobial Triazole conjugated novel 2,5-diaryl substituted 1,3,4- oxadiazoles derivatives have been developed by Atcha et. al. (2020). Results indicated 2-(4-Chlorophenyl)-5-(2-(2-(1-(4-chlorophenyl)-1H-1,2,3-triazol-5-yl)ethyl)phenyl)-1,3,4-oxadiazole (4a), 2-(3,4-Dimethoxyphenyl)-5-(2-((1-(4-methoxyphenyl)-1H-1,2,3-triazol-5yl)methoxy)phenyl-1,3,4-oxadiazole (4b) and (2-(2,4-Dichlorophenyl)-5-(2-((1-(4-methoxyphenyl)-1H-1,2,3-triazol-5-yl)methoxy)phe-nyl)-1, 3,4oxadiazole (4c) was found to be lead compounds.



4a

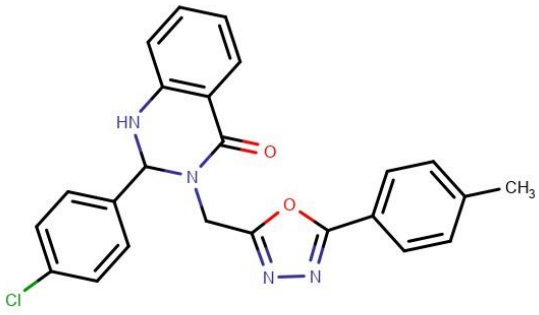


4b

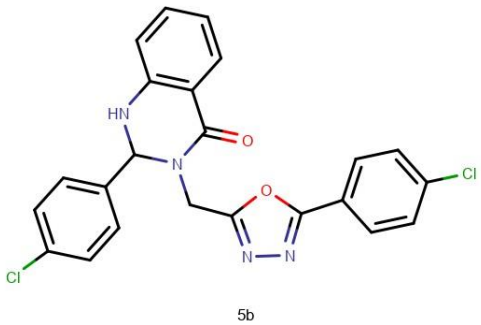


4c

Romdhane et. al.(2020) reported the development of 1,3,4-oxadiazole linked benzopyrimidinones conjugates as antimicrobial, 2-(4-chlorophenyl)-3-{[5-(4-methylphenyl)-1,3,4-oxadiazol-2-yl]methyl}-1,2,3,4-tetrahydroquinazolin-4-one (5a) is the promising antimicrobial agent.

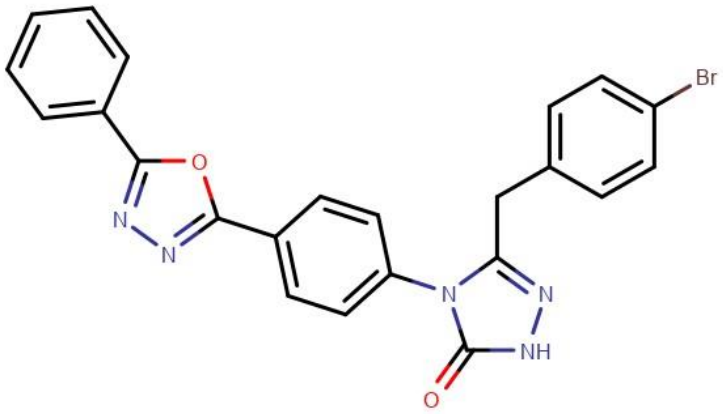


5a



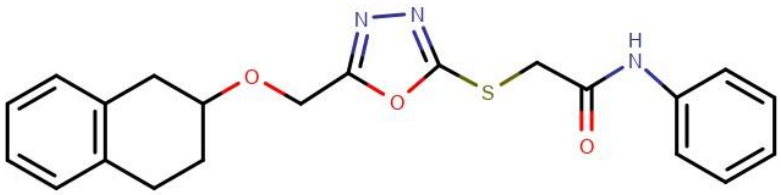
5b

Süleymanoğlu et. al. (2020) reported development of the 5-(4-Bromobenzyl)-4-(4-(5-phenyl-1,3,4-oxadiazole-2-yl)phenyl)-2,4-dihydro-3H-1,2,4-triazole-3-one as antimicrobial agents.



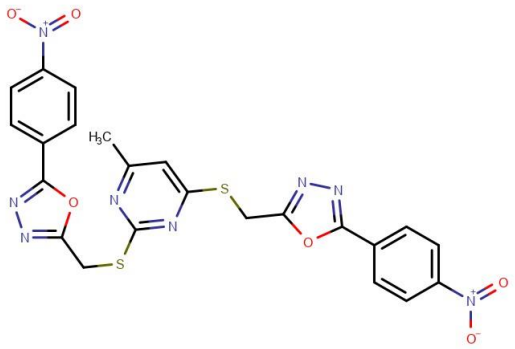
6

Patel et. al. (2018) reported the development of Quinoxaline-Oxadiazole hybrids (7) as antimicrobial agents.



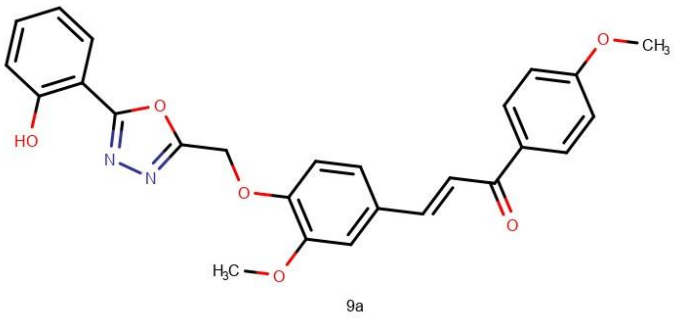
7

Padmaja et. al.(2017) developed substituted pyrimidinyl 1,3,4-oxadiazoles as antimicrobial agents. 4-methyl-2,6-bis({[5-(4-nitrophenyl)-1,3,4-oxadiazol-2-yl]methyl}sulfanyl)pyrimidine (8) found to be active derivative.

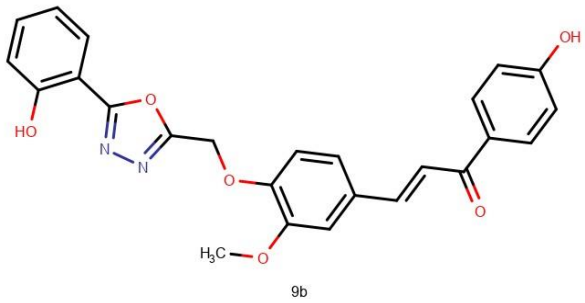


8

Afroz Bakht et. al. (2010) reported molecular properties and antimicrobial activity of some oxadiazole derivative. (E)-3-(4-((5-(2-hydroxyphenyl)-1,3,4-oxadiazol-2-yl)methoxy)-3-methoxyphenyl)-1-(4-methoxyphenyl)prop-2-en-1-one (9a) and (E)-3-(4-((5-(2-hydroxyphenyl)-1,3,4-oxadiazol-2-yl)methoxy)-3-methoxy phenyl)-1-(4-hydroxyphenyl)prop-2-en-1-one (9b) found to be active compounds.



9a



9b

SUMMARY:

Oxadiazole is another promising heterocyclic agent utilized for various biological activities. A number of Oxadiazole compounds had shown antimicrobial activity, so Oxadiazole can be attractive heterocycles for antimicrobial development.

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