Commentary

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Commentary on Pyridine Compounds & its Antimicrobial Activities

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Abstract

Pyridine is a privileged nucleus among heterocycles; its compounds have been noted for their therapeutic properties, such as antimicrobial, antiviral, antitumor, analgesic, anticonvulsant, anti-inflammatory, antioxidant, anti-Alzheimer's, anti-ulcer or antidiabetic. It is known that a pyridine compound, which also contains a heterocycle, has improved therapeutic properties. The singular presence of the pyridine nucleus, or its one together with one or more heterocycles, as well as a simple hydrocarbon linker, or grafted with organic groups, gives the key molecule a certain geometry, which determines an interaction with a specific protein, and defines the antimicrobial and antiviral selectivity for the target molecule. Moreover, an important role of pyridine in medicinal chemistry is to improve water solubility due to its poor basicity.

Keywords: pyridine synthesis •heterocyclic compounds •antimicrobial •antiviral

Introduction

Pyridine (from the Greek pyr = fire and idine—which is used for aromatic bases contains a single heteroaromatic ring, which comes from the replacement of a CH group in the benzene ring with the nitrogen atom. Ramsay (1877) synthesizes pyridine for the first time, by the reaction of acetylene with hydrogen cyanide in a red-hot iron tube furnace, this being the first synthesized heterocycle[1]. Arthur Hantzsch later synthesized (1881) pyridine compounds by the synthesis that bears his name, through a multicomponent reaction, starting from a β-ketoester, an aldehyde and ammonia. An important role of pyridine is that it is used as an organic solvent or as ligand for coordination complexes[2]. The pyridine nucleus is found in many natural products, such as vitamins, alkaloids and coenzymes, as well as in many drugs and pesticides.

Description

Synthesis of Antimicrobial Compounds Containing Only Pyridine Ring Sarova et al. synthesized three dodecanoic acid derivatives 1–3 with yields of 59–61%, starting from dodecanoic acid in two steps, chlorination with thionyl chloride and reaction with the corresponding aminopyridine. All compounds possessed good antibacterial activity against B. subtilis, S. aureus and E. coli and antifungal activity against A. niger and C. albicans[3]. Synthesis of Antimicrobial Pyridine Salts Furdui et al. reported efficient synthesis of symmetrical diquaternary salts by alkylation of 4-[2-(pyridin-4-yl)ethyl]pyridine or 4,4′-bipyridine, with various bromo- or chloro-acetophenone analogues and investigated their antimicrobial activity against nine different microorganisms: B. subtilis, B. cereus, S. lutea, R. glutinis, C. utilis, S. cerevisiae, A. niger, G. candidum and P. roqueforti. Compounds 42a–42d, 43a and 43d show efficient inhibitory properties at least against one bacterial strain. Marek et al. synthesized a set of pyridine-4-aldoxime-based quaternary ammonium salts with differing lengths of alkyl side chains 44–50. The in vitro antibacterial activity of all compounds was tested on a panel of eight bacterial strains (S. aureus CCM 4516/08,

S. aureus nMRSA H 5996/08, S. epidermidis HK6966/08, Enterococcus sp. HK14365/08, E. coli CCM 4517, K. pneumoniae D 11750/08, K. pneumoniae J 14368/08, and P. aeruginosa CCM 1961), four yeasts (C. albicans ATCC 44859, C. krusei E28, C. tropicalis 156, C. glabrata 20/I) and four filamentous fungi (Trichosporon asahii 1188, Aspergillus fumigatus 231, Absidia corymbifera 272, Trichophyton mentagrophytes 445). The compounds with an alkyl chain of C12–C16 possessed the best antimicrobial activity of all[4].

Synthesis of pyridine-indole compounds Tamilvendan et al. [36] synthesized two Mannich pyrol-pyridine bases 1-((pyridin-2-ylamino)methyl)pyrrolidine-2,5-dione 74 and 1-(phenyl(pyridin-2-yl amino)methyl) pyrrolidine-2,5-dione 75 using a classical Mannich reaction between succinimide, aniline, and formaldehyde or benzaldehyde in good yields (78–80%). Both compounds showed moderate antimicrobial activity against the antibacterial panel (Escherichia coli, Salmonella typhi, and Bacillus subtilis) and antifungal agents (Aspergillus oryzae and Aspergillus fumigates), using Penicillin, Streptomycin[5].

In recent years, several important viral infections have emerged and antiviral chemotherapeutic agents are not sufficiently effective in clinic, leading to serious human diseases and mortality. Therefore, novel antiviral candidates are urgently desirable, which is undoubtedly essential for the therapy of various fatal viral infections. Pyridine compounds are obtaining importance in the field of medicinal chemistry because of the broad spectrum of their physiological activities. In this part of the review is highlighted antiviral behavior of pyridine compounds. The pandemic of coronavirus disease 2019 (COVID-19) caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) presents an unprecedented challenge to identify effective drugs for prevention and treatment Balzarini et al reported the synthesis of pyridine N-oxide derivatives and the inhibitory effect of these compounds on human SARS and feline infectious peritonitis coronavirus in cell culture. Thus, compounds 222 and 223 were the most interesting compounds that had a comparable (potent) cytotoxic. Further- more, they reported that a lack of the oxide moiety proved detrimental for anti-SARS-CoV and anti-FIPV activity, as none of the tested compounds was antivirally active at subtoxic concentrations. syntheses of pyridine compounds with the antimicrobial and antiviral properties mentioned in the literature.

Acknowledgement

None

Conflict of Interest

No conflict of interest

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