SYNTHESIS AND ANTIMICROBIAL ACTIVITIES OF CARBAZOLE DERIVATIVES AS POTENTIAL ANTIBACTERIAL AGENTS

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Even though there are many antibacterial agents multidrug resistant bacteria poses a huge threat to public health and has become one of the biggest health problems in the last decade. Therefore, there is an urgent need to develop and provide novel and more potent antibacterial agents to overcome drug resistance [1].

Nitrogen containing heterocycles are widely spread in nature, they are found in various forms such as part of amino acid tryptophan, serotonin and they can be essential part of plant alkaloids [2]. That is exactly what carbazole is, a nitrogen containing aromatic heterocyclic compound, which can be found in nature as carbazole alkaloid that is isolated from various part of the plant. Since some carbazole derivatives show a good antioxidative activity they can be also found in some microorganisms [3]. Such carbazole ring containing alkaloids are carbomycins, that were first isolated from *Streptoverticillium ehimense* and showed good activity against various organisms, which made carbazoles a desirable target for further biological research [4]. Carbazole and its derivatives are extensively used in various chemistry fields such as photoelectrical materials, dyes, supramolecular recognition [5,6,7,8]. In medicinal chemistry they show potential activity against various organisms, tumor and they can be a multifunctional agent to help in the treatment of neurological disorders [9]. Therefore, carbazole and its derivatives are attractive target to develop and produce new antibacterial compounds that could help resolve drug resistance problem.

In this work a series of carbazole-based derivatives were synthesized, and their antibacterial activity was evaluated against *Bacillus subtilis* and *Escherichia coli* Various functional groups were introduced into carbazole-based compounds in order to investigate their biological activity. Synthesized compounds were screened for their *in vitro* antibacterial activity against Gram-positive *Bacillus subtilis* and Gram-negative *Escherichia coli* according to the disc diffusion method. The minimum inhibitory concentration (MIC) was determined by the serial dilution technique using dimethylsulphoxide (DMSO) as a solvent. All compounds were evaluated at the concentrations of the antibacterial agents ranging from 62.5 to 1000 μg/mL and compared against chloramphenicol, ciprofloxacin and furacin after overnight microorganisms growth. The results are displayed in Table 1.

Table 1. *Antimicrobial activity data of carbazole-based compounds.*

	Compound	1a	1b	2a	2b	3	4	5	Chloramphenicol	Ciprofloxacin	Furacin
MIC (mg ml-1)	*B. subtilis*	62.5	62.5	62.5	125.0	62.5	62.5	>1000	>512.0[5]	6.0[10]	12.5[11]
	E.coli	250.0	250.0	125.0	125.0	125.0	125.0	>1000	64.0[5]	6.0[10]	6.0[11]

DMSO – negative control.

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