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Dedicated to the 110th anniversary of M.I. Kabachnik's birth

Synthesis and Antimicrobial Activity of New Dialkyl(diaryl)-2-(5-chloro-2-hydroxyphenyl)- 2-(phenylethenyl)pentylphosphonium Salts

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Abstract—New dialkyl(diaryl)-2-(5-chloro-2-hydroxyphenyl)-2-(phenylethenyl)pentylphosphonium salts bearing various substituents at the phosphorus atom were synthesized. Antimicrobial activity of the salts obtained was estimated. Derivatives with 2-methoxyphenyl substituents at the phosphorus atom are most active against gram-positive bacteria. Herewith, dibenzyl-substituted phosphonium derivatives possess the best antifungal activity.

Keywords: phosphonium salts, antimicrobial activity, antifungal activity

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The search for new antimicrobial agents is one of the urgent tasks of modern medicine and chemistry. The emergence of new antibiotic-resistant bacteria, and especially hospital strains, is a serious threat to human health due to the slow process of replacement of medications that have lost their efficacy. One of the classes of antimicrobial agents, to which the development of resistance in microorganisms is complicated, is cationic surfactants [1–3].

In recent years there is an increasing interest in the class of cationic surfactants like phosphonium salts due to their pronounced antimicrobial effect [4, 5] and anti-tumor activity [6–8], often due to their ability to selectively permeate and accumulate in mitochondria owing to the difference in the negative membrane potential of healthy and tumor cells [9]. The latter circumstance, as well as high selectivity, sometimes reaching a difference of a thousand times, promote the interest in phosphonium salts [9].

One of the key stages in the interaction of a bactericide with a pathogen is its adsorption on a

negatively charged cell membrane [10, 11]. The antimicrobial properties of biocides based on cationic surfactants, including quaternary ammonium and phosphonium salts, depend on the number and length of the hydrocarbon chain of aliphatic substituents [12–14]. Phosphonium salts show a higher activity than ammonium analogs [14, 15].

Previously, we report a new method for obtaining phosphonium salts based on the reactions of cyclic quasiphosphonium salts with organomagnesium compounds [16]; the resulting phosphonium salts exhibited high antimicrobial activity.

The aim of this work was to synthesize new dialkyl (diaryl)-2-(5-chloro-2-hydroxyphenyl)-2-(phenylethenyl)pentylphosphonium salts with various substituents at the phosphorus atom and evaluate their antimicrobial activity.

The starting compounds were synthesized according to the previously described two-step procedure. The first step involves the reaction of trichlorobenzophosphole **1** [17] obtained from pyrocatechin and