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Dedicated to V. F. Mironov on His 60th Anniversary

Synthesis, Structure, and Antimicrobial Activity of (Carboxyalkyl)dimethylsulfonium Halides

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Abstract—Reactions of a series of ω-halocarboxylic acids (2-bromo-, 2-chloroethanoic, 3-bromo- and 3-chloropropanoic) with dimethyl sulfide resulted in the formation of stable (carboxylalkyl)dimethylsulfonium bromides and chlorides. Composition and structure of the salts obtained were established by a complex of chemical, physical and physicochemical methods. The sulfonium salts obtained showed high antibacterial and antimycotic activities with respect to the pathogenic microflora of humans and animals.

Keywords: dimethyl sulfide, 2-bromoacetic acid, 3-chloropropanoic acid, (carboxylalkyl)dimethylsulfonium halides, biological activity

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A large number of carboxylate organoelemental betaines based on phosphorus, arsenic, sulfur, nitrogen, silicon and antimony is known [1–9]. These compounds are widely used as medications. The most known and studied carboxylate betaine is glycine, which is a part of many proteins and plays an important role in biological processes [10]. Arsenobetain can be isolated from the most seafood [11–13]. $Me_2S^+CH_2COO^-$ and $Me_2S^+(CH_2)_2COO^-$ are produced by various types of photosynthesizing organisms, including algae, phytoplankton, cyanobacteria, and some higher plants [10, 14, 15].

The most common method for the synthesis of carboxylate organoelemental betaines is based on the treatment of the corresponding onium salts with solutions of alkali or silver oxide [1, 9, 15–19]. One of the first and most complete studies in this direction concerns the reactions of triphenylphosphine with ω-chlorocarboxylic acids (Scheme 1) [1]. The treatment of phosphonium salts (n = 2, 3) with aqueous sodium hydrogen carbonate resulted in the formation of phosphabetaines (Scheme 2).

The Denny–Smith method used for the preparation of carboxylate phosphabetaines is based on the dehydrohalogenation of the corresponding onium salts [9, 17, 20–22]. Previously we have reported on the synthesis of new phosphonium salts **1**–**7** (Scheme 3) [19].

Scheme 1.

$$Ph_3P + Cl(CH_2)_nCOOH \longrightarrow [Ph_3\overset{+}{P}\text{—}(CH_2)_nCOOH]\ Cl^-$$

$$n = 1, 2, 3.$$

Scheme 2.

$$[Ph_2\overset{+}{P}\text{—}(CH_2)_nCOOH]\ Cl^- \xrightarrow[-NaCl]{NaHCO_3} Ph_3\overset{+}{P}(CH_2)_nCOO^-$$

$$n = 2, 3.$$