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Oligomerization of phenothiazin-5-ium tetraiodide in the presence of bases

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Abstract

Methylene blue and its structural analogs (phenothiazine derivatives) are well known photodynamically and photochemically active agents, which are used in modern medicine, biology, and industry due to their low toxicity, high absorption in the therapeutic window region (600-660 nm). Methylene blue being one of the most studied phenothiazine derivative is employed as an antibacterial agent and also as an antidote to cyanide, carbon monoxide and hydrogen sulfide. Phenothiazin-5-ium tetraiodide is one of the most convenient precursors for the synthesis of structural analogues of methylene blue among the variety of modern synthetic approaches. Nucleophilic addition of aromatic and aliphatic amines to phenothiazin-5-ium tetraiodide can be used to obtain a wide range of 3,7-phenothiazine-5-ium derivatives. The specificities of addition reactions of dialkylamines and aromatic amines to phenothiazin-5-ium tetraiodide are low yields and formation of difficultly separable mixtures of products. It was found that reactions of phenathiazin-5-ium tetraiodide with amines containing secondary and tertiary amino groups lead to oligomerization of phenathiazin-5-ium tetraiodide (3,10-positions). Basicity of tertiary amino group is crucial in oligomerization of phenathiazin-5-ium tetraiodide. It is shown, that triethylamine use as a base allows to synthesize of oligo(3,10)phenothiazines with high yields. According to ^{1}H, ^{13}C NMR, IR spectroscopy data and MALDI mass-spectrometry data, thereaction product is a mixture of oligomers, consisting mainly of three to four units.

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