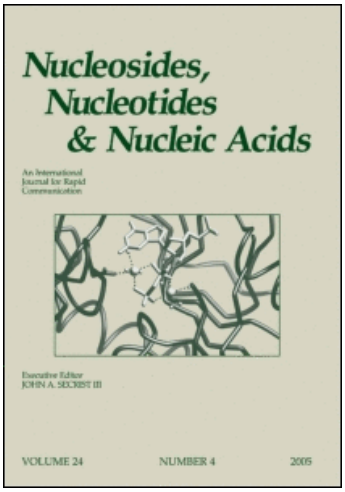

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SYNTHESIS OF ARYL PHOSPHORODICHLORIDOTHIOATES FROM ARYL PHOSPHORODICHLORIDITES *VIA* ARBUZOV-TYPE REARRANGEMENT

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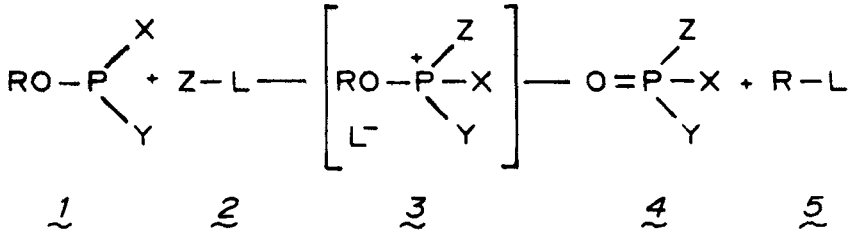
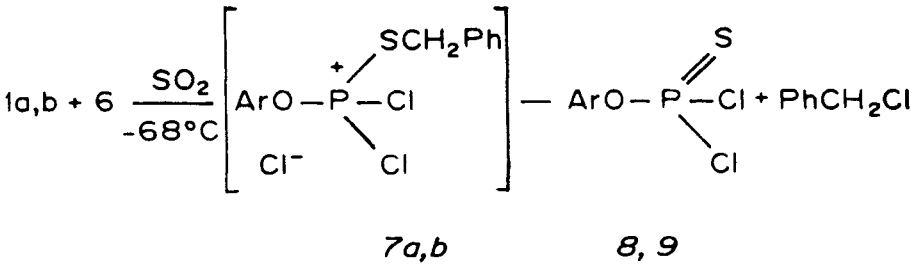
Abstract: *Some aryl phosphorodichloridothioates have been synthesized from aryl phosphorodichloridites, by reaction with benzylsulfenyl chloride in liquid sulfur dioxide, via an Arbuzov- type rearrangement.*

Phosphorochloridothioates have been employed in the formation of the 3'-5' phosphorothioate linkage of dinucleotides.[1,2,3] The P=O functional group of phosphates and phosphonates can be easily developed by the classic Arbuzov rearrangement (scheme1).[4]

Under appropriate experimental conditions and by a proper choice of the substituents on intermediate **3**, it is possible to induce the formation of the P=S functionality.[4] The transformation of intermediate **3** into compounds **4** and **5** is driven by a nucleophilic displacement occuring unimolecurlarly or bimolecularly as a function of the substituents and/or of the solvent polarity.[5]



Scheme 1



7a,b *8, 9*

Scheme 2

When **1a,b** [R= (a) 2-dichlorophenyl; (b) 2,4-diclorophenil; X=Y=Cl] reacted with benzysulfenyl chloride (6), in liquid sulfur dioxide, high yields of 2-chlorophenyl [**8**, 80% yield; b.p.$_{3torr}$: 98- 102 °C; ^{31}P nmr: 53.6 ppm; m/z 260 (M^+, 10%), m/z 225 (b. peak, 100%)] and 2,4- dichlorophenyl [**9**, 77% yield, b.p.$_{3torr}$: 119-123 °C; ^{31}P mr: 52.9 ppm; m/z 294 (M^+, 31%), m/z 259 (b. peak, 100%)] phosphorodichloridothioates were obtained together with equimolar amounts of benzyl chloride, identified by i.r. and n.m.r. spectroscopy. This novel Arbuzov rearrangement is induced by the relative stability of the O-aryl and S-benzyl bonds of the intermediate phosphonium salts **7a,b** (scheme 2).

The presence of two strong electron withdrawing groups on the intermediates **7** and the dielectric constant of the solvent (SO_2, ε=17.6) are conditions[5] which favor the dissociation of the S- benzyl bond, according to an S_N1 mechanism. The synthesis of **8** and **9** *via* the Arbuzov rearrangement represents a valuable alternative to other existing methods and allows large scale preparations of thiophosphorylating agents.

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Experimental

Synthesis of 8 and 9: Freshly distilled sulfuryl chloride (4.05 ml, 50 mol) were added dropwise to dibenzyldisulfide (12.3 g, 50 m.mol) kept at -68 °C. The orange mixture, thus obtained, was transferred into a reaction flask containing 100 mmol of the appropriate phosphorodichloridite in 20 ml of liquid SO_2, at 68 °C. The yellow mixture was swirled for 30 min. and then left at room temperature until complete evaporation of the solvent. The crude yellow mixture afforded pure **8** and **9**, after distillation.

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