SYNTHESIS OF DIALKYL ESTERS OF 8-QUINOLYL(ARYLAMINO)METHYLPHOSPHINIC ACID

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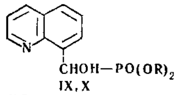
Dimethyl and diethyl esters of 8-quinolyl(arylamino)methylphosphinic acid were synthesized by the interaction of 8-quinolylazomethines and dialkylphosphites in the presence of the catalyst sodium methoxides. On condensation of 8-quinolylaldehyde with dialkylphosphites the diethyl and diisopropyl esters of α-hydroxy(quinolyl-8)methylphosphinic acid were obtained.

In continuing the investigations of adding dialkylphosphites to azomethine groups [1] of heterylazomethines [2,3], a study was made of the interaction of 8-quinolidenetoluidines (o-, m- and p-isomers) and 8-quinolidene-n-anisidine with dimethyl- and diethylphosphorous acids in the presence of sodium methoxide. Dimethyl and diethyl esters of 8 quinolyl(tolylamino)methylphosphinic acid (I–VI) and 8-quinolyl(n-methoxyphenylamino)methylphosphinic acid (VII, VIII) were synthesized.

The esters obtained, compounds I–VIII, are crystalline compounds soluble in organic solvents and not readily soluble in water. The majority of these compounds are characterized in the form of picrates (table). In addition, a study is being made of the chemical properites of 8-quinolylaldehyde [4]. By means of adding dialkylphosphites to the carbonyl group of the aldehyde, the diethyl and diisopropyl esters of α-hydroxy(quinolyl-8)methylphosphinic acid (IX, X) were synthesized.



IX, X

IX R=C_2H_5, X R=C_3H_7-*i*

The esters of compounds IX and X are crystalline compounds, soluble in organic solvents and not readily soluble in water. Their picrates have been obtained.

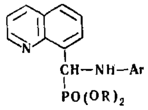
The structures of compounds I–X have been confirmed also by IR spectroscopy. In the IR spectra of 8-quinolidene-m-toluidine there is an absorption band characteristic for the —CH═N— group at 1628 cm^{-1}. In the spectra of all the esters of compounds I–VIII there are wide absorption bands of the N—H group in the 3298–3335 cm^{-1} region, and intensive bands of the P═O group at 1235–1242 cm^{-1} and the P—O—C group at 1038–1067 cm^{-1}. There is no absorption band corresponding to the azomethine group. In the IR spectra of the esters of compounds IX and X are intensive wide bands characteristic for the hydroxyl group at 3225–3250 cm^{-1}. The absorption band of the P—O group is intensive and displaced toward the smaller frequencies of 1200–1208 cm^{-1}, which indicates possible association between the P═O and O—H groups. The P—O—C group absorbs at 1050–1075 cm^{-1}.

The synthesized phosphinic esters of compounds I–X, like the derivatives of quinoline [5], may be of interest for the study of their physiological action.

EXPERIMENTAL

8-Quinolylazomethines. 8-Quinolidene-p-toluidine. A mixture of 1.0 g (6mM) of 8-quinolylaldehyde (mp 98° C) and 0.68 g (6.35 mM) of p-toluidine were heated for 30 min in a boiling water bath. Yield, 1.4 g (89.1%), mp 93–94° C (from benzene). Found, %: N 11.46. Calculated for $C_{17}H_{14}N_2$, %: N 11.38. Picrate, mp 191–192° C (from ethanol). Found, %: N 14.57. Calculated for $C_{17}H_{13}N_2 \cdot C_6H_3N_3O_7$, %: N 14.74. 8-Quinolidene-m-toluidine, yield, 90.0%. The viscous liquid was heated with activated carbon in ethanol. Found, %: N 11.1. Picrate, mp 191–192° C. Found, %: N 14.86. 8-Quinolidene-o-toluidine, yield, 83.0%, mp 103–104° C. According to data in literature, mp 105° C. Picrate, mp 153° C. Found, %: N 14.62. 8-Quinolidene-p-anisidine. A mixture of 1.2 g (7.6 mM) of aldehyde and 0.94 g (7.6 mM) p-anisdine in 4 ml of ethanol was heated in a boiling water bath for 30 min, yield, 1.6 g (80.0%), mp 98° C (from ethanol). Found, %: N 10.41. Calculated for $C_{17}H_{14}N_2O$, %: 1068. Picrate, mp 218–219° C (from ethanol). Found, %: N 14.30.

The Dialkyl Esters of 8-Quinolyl(arylamino)methylphosphinic Acid



Compound	Ar	R	Quantity of reacting substance, g		Mp, ° C	Empirical formula	P, %		Yield %	Picrate of the esters			
										mp, ° C	empirical formula	P, %	
			azomethine	dialkyl phosphite			found	calculated				found	calculated
I	p-Tolyl	CH_3	0,5	0.28	145—146	$C_{19}H_{21}N_2O_3P$	8.72	8.71	83.3	144—145	$C_{19}H_{21}N_2O_3P \cdot C_6H_3N_3O_7$	5,28	5.30
II		C_2H_5	0,5	0,34	95—96	$C_{21}H_{25}N_2O_3P$	7,74	8.07	70.4	143—144	$C_{21}H_{25}N_2O_3P \cdot C_6H_3N_3O_7$	5,23	5.05
III	m-Tolyl	CH_3	0,6	0,34	172—173	$C_{19}H_{21}N_2O_3P$	8.89	8.71	60.0	145—146	$C_{19}H_{21}N_2O_3P \cdot C_6H_3N_3O_7$	5.63	5.30
IV		C_2H_5	0,5	0,34	153—154	$C_{21}H_{25}N_2O_3P$	8,10	8.07	62,0	136—137	$C_{21}H_{25}N_2O_3P \cdot C_6H_3N_3O_7$	5,09	5,05
V	o-Tolyl	CH_3	0.4	0,23	125—126	$C_{19}H_{21}N_2O_3P$	9.02	8.71	70.0	—	$C_{19}H_{21}N_2O_3P \cdot C_6H_3N_3O_7$	4,94	5.30
VI		C_2H_5	0.4	0,27	89—90	$C_{21}H_{25}N_2O_3P$	8.02	8.07	64.5	—	$C_{21}H_{25}N_2O_3P \cdot C_6H_3N_3O_7$	4.65	5,05
VII	p-Methoxyphenyl	CH_3	0.7	0,36	144—145	$C_{19}H_{21}N_2O_4P$	8,60	8.33	76.0	183—184	$C_{19}H_{21}N_2O_4P \cdot C_6H_3N_3O_7$	4,78	5.14
VIII		C_2H_5	0,5	0.28	126—127	$C_{21}H_{25}N_2O_4P$	7.53	7.75	70.0	160—162	$C_{21}H_{25}N_2O_4P \cdot C_6H_3N_3O_7$	4.58	4.91

Calculated for $C_{17}H_{14}N_2O \cdot C_6H_3N_3O_7$, %N 14.26.

Esters of 8-quinolyl(arylamino)methylphosphinic acid (I–VIII). A 0.3 ml volume of a saturated solution of sodium methoxide was added to a mixture of 8-quinolylazomethine and dialkylphosphorous acid (~25% excess) and the mixture was heated with stirring for 2–3 min at 80–85° C. After cooling, the solid products of the reaction were washed with dry ether (2 ml) and crystallized from benzene (with activated carbon). Substances V and VI were extracted from the viscous reaction mixture with dry diethyl ether (10 ml). After evaporation of the solvent the reaction mixture was subjected to a similar treatment and compounds V and VI crystallized on standing. The picrates were obtained in a xylol solution in the form of an oil and crystallized from ethanol (table).

Diethyl ester of α-hydroxy(quinolyl-8)methylphosphinic acid (IX). A 0.3 ml of volume of a saturated solution of sodium methoxide was added to 1.0 g (6 mM) of 8-quinolylaldehyde and 1.1 g (25% excess) of diethylphosphorous acid. In order to terminate the reaction, the mixture was heated for 2–3 min at 80–85° C. After cooling, the solid product was washed with dry ether (1.5 ml). Yield, 1.4 g (74.5%), mp 105–106° C (from dry acetone). Found, %: P 10.37. Calculated for $C_{14}H_{18}NO_4P$, %: P 10.50. The picrate was obtained in a xylol solution in the form of oil. It was crystallized from ethanol, mp 137–138° C. Found, %: P 5.70. Calculated for $C_{14}H_{18}NO_4P \cdot C_6H_3N_3O_7$, %: P 5.90.

Diisopropyl ester of α-hydroxy(quinolyl-8)methylphosphinic acid (X). The compound was synthesized in an analogous manner to compound IX from 2.0 g (1.2 mM) aldehyde and 2.3 g (10% excess) diisopropylphosphite. Yield, 2.1 g (51.0%), mp 116–117° C (from acetone). Found, %: P 9.28. Calculated for $C_{16}H_{22}NO_4P$, %: 9.51. Picrate, mp 161–162° C. Found, %: P 5.28. Calculated for $C_{16}H_{22}NO_4P \cdot C_6H_3N_3O_7$, %: P 5.61.

IR spectra of compounds I–X were recorded in a UR-10 spectrophotometer in the form of suspension in vaseline oil, and liquid azomethine was recorded in the form of a film. I wish to express my thanks to V. S. Vinogradova for measuring the IR spectra.

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