2-BENZOPYRYLIUM SALTS

XXII.* SYNTHESIS OF CARBOXYPHENYL-2-BENZOPYRYLIUM SALTS AND ISOQUINOLINES

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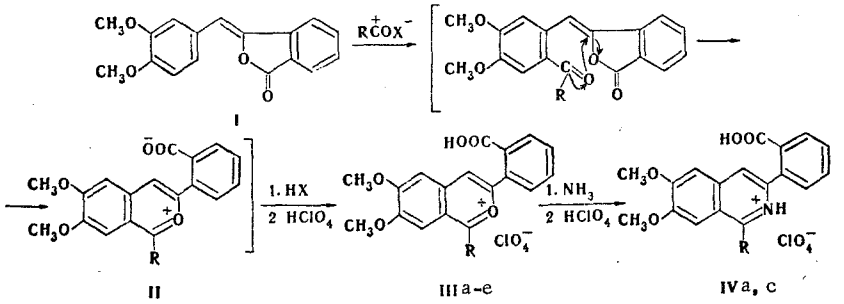
UDC 547.814'833.07

Acylation of 3,4-dimethoxybenzylidene phthalide with aliphatic acid anhydrides in the presence of 70% $HClO_4$ and with aromatic or aliphatic-aromatic acids in polyphosphoric acid gave the previously unknown 3-(2-carboxyphenyl)-2-benzopyrylium salts, which were converted to 3-(2-carboxyphenyl)isoquinolines, isolated in the form of the perchlorates, by the action of ammonium hydroxide.

We recently demonstrated that linear enol acylates can be used in the synthesis of 2-benzopyrylium salts [2].

We have established that treatment of benzylidene phthalide (I) – the cyclic enol acetate of the corresponding desoxybenzoin – with aliphatic acid anhydrides in the presence of $HClO_4$ or with aromatic acids in polyphosphoric acid (PPA) gives the previously unknown 3-(2-carboxyphenyl)-2-benzopyrylium salts (IIIa-e).



The carbonyl group of the acyl residue incorporated as a result of acylation in the ortho position of lactone I probably attacks the lactone ring nucleophilically with subsequent ring expansion to give a new heteroring. The reaction possibly proceeds through the formation of betaine structure II.

Salts IIIa-e are deeply colored high-melting substances, the IR spectra of which contain the absorption band of a carboxyl carbonyl group conjugated with the pyrylium cation at 1710-1730 cm^{-1} and a number of characteristic bands at 1635-1640, 1610, and 1550 cm^{-1}.

As expected, the presence of an electron-acceptor carboxyl group in salt III molecules substantially facilitates replacement of the oxygen heteroatom in them by a nitrogen atom. When salts IIIa,c are treated with ammonium hydroxide, they are converted to the corresponding isoquinolines IVa,c, which were isolated and identified in the form of their perchlorates.

EXPERIMENTAL

The IR spectra of mineral oil suspensions of the compounds were recorded with a UR-20 spectrometer. The PMR spectra of CF_3COOH solutions were recorded with a Tesla BS-467 spectrometer with hexamethyldisiloxane as the internal standard.

*See [1] for communication XXI.

Rostov State University. Scientific-Research Institute of Physical and Organic Chemistry, Rostov-on-Don 344006. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 11, pp. 1479-1480, November, 1977. Original article submitted February 8, 1977.

0009-3122/77/1311-1181 $07.50

TABLE 1. 3-(2-Carboxyphenyl)-2-benzopyrylium Perchlorates

Compound	R	mp, °C	Color	Found, %			Empirical formula	Calc., %			Yield, %
				C	H	Cl		C	H	Cl	
IIIa	CH_3	237	Gray-green	53,7	3,9	8,0	$C_{19}H_{17}ClO_9$	53,8	4,0	8,4	30
IIIb	C_2H_5	204	Light-orange	54,9	4,1	8,2	$C_{20}H_{19}ClO_9$	54,8	4,3	8,1	21
IIIc	C_3H_7	211	Light-green	55,6	4,3	7,7	$C_{21}H_{21}ClO_8$	55,7	4,6	7,9	29
IIId	3,4-$(OCH_3)_2C_6H_3$	226	Dark-brown	57,2	4,3	6,1	$C_{26}H_{23}ClO_{11}$	57,1	4,2	6,5	12
IIIe	$CH_2C_6H_5$	237	Light-brown	60,1	4,3	6,9	$C_{25}H_{21}ClO_9$	60,0	4,2	7,1	15

3,4-Dimethoxybenzylidene Phthalide (I). This compound was obtained by a method similar to that in [3] in 50% yield as light-yellow crystals with mp 129 deg C (from alcohol). Found: C 72.3; H 4.8%. $C_{17}H_{14}O_4$. Calculated: C 72.2; H 5.0%. IR spectrum: 1780, 1667, 1600, and 1520 cm^{-1}.

1-Methyl-3-(2-carboxyphenyl)-6,7-dimethoxy-2-benzopyrylium Perchlorate (IIIa). Fifteen drops of 70% $HClO_4$ were added gradually to a solution of 0.5 g (1.77 mmole) of 3,4-dimethoxybenzylidene phthalide in 5 ml of acetic anhydride, during which the mixture became warm and darkened. The mixture was then cooled and diluted with ether, and the resulting dark oily precipitate was repeatedly reprecipitated from acetic acid solution by the addition of ether (vigorous trituration of the product with a glass rod was necessary). Recrystallization from acetic acid gave 0.22 g (30%) of a gray-green salt with mp 237 deg C. IR spectrum: 3300, 1720, 1643, 1610, 1550, and 1512 cm^{-1}. PMR spectrum, δ: 2.85 (CH_3), 3.78 and 3.85 (two OCH_3), and 7.0-7.6 ppm (seven aromatic H).

Salts IIIb and IIIc were similarly obtained (Table 1).

1-Benzyl-3-(2-carboxyphenyl)-6,7-dimethoxy-2-benzopyrylium Perchlorate (IIIe). A mixture of 0.56 g (2 mmole) of 3,4-dimethoxybenzylidene phthalide, 0.28 g (2 mmole) of phenylacetic acid, and 7 g of PPA was heated with stirring at 120 deg C for 30 min, after which it was hydrolyzed with ice water and treated with 3 ml of 30% $HClO_4$. The resulting brown precipitate was removed by filtration to give 0.15 g (15%) of light-brown crystals with mp 237 deg C (acetic acid). IR spectrum: 3300, 1710, 1640, 1610, and 1550 cm^{-1}.

Salt IIId was similarly obtained (Table 1).

1-Methyl-3-(2-carboxyphenyl)-6,7-dimethoxyisoquinolinium Perchlorate (IVa). Concentrated ammonium hydroxide (5 ml) was added to 0.43 g (0.001 mole) of 1-methyl-3-(2-carboxyphenyl)-6,7-dimethoxy-2-benzopyrylium perchlorate, during which the salt dissolved completely. The mixture was heated gently (at 30-40 deg C) for 5-10 min, after which it was evaporated, and the residue was collected and dissolved in 3 ml of glacial acetic acid containing a few drops of 70% $HClO_4$. The solution was diluted with ether, and the precipitated colorless isoquinolinium perchlorate was removed by filtration and dried to give 0.4 g (93%) of a product with mp 275 deg C (from acetic acid). IR spectrum: 3300, 1725, 1648, 1612, 1552, and 1520 cm^{-1}. Found: C 53.9; H 4.1; Cl 8.6; N 3.0%. $C_{19}H_{18}ClNO_8$. Calculated: C 53.8; H 4.3; Cl 8.4; N 3.3%.

1-Propyl-3-(2-carboxyphenyl)-6,7-dimethoxyisoquinolinium Perchlorate (IVc). This compound was similarly obtained in 82% yield as colorless crystals with mp 248 deg C (from acetic acid). IR spectrum: 3300, 1720, 1650, 1612, and 1520 cm^{-1}. Found: C 55.6; H 4.8; Cl 8.0; N 3.0%. $C_{21}H_{22}ClNO_8$. Calculated: C 55.8; H 4.8; Cl 7.9; N 3.1%.

LITERATURE CITED

1. E. V. Kuznetsov, I. V. Shcherbakova, and G. N. Dorofeenko, Khim. Geterotsikl. Soedin., No. 9, 1176 (1977).
2. E. V. Kuznetsov, I. V. Shcherbakova, and G. N. Dorofeenko, Khim. Geterotsikl. Soedin., No. 1, 50 (1976).
3. Organic Syntheses [Russian translation], Vol. 2, Inostr. Lit., Moscow (1949), p. 80.