

Some Reactions With 7-Hydroxy-3-Carbethoxycoumarin

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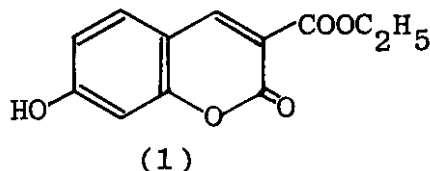
(Received 12th January, 1983)

Summary: In continuation of our previous work on 3-carbethoxycoumarin [1], we are dealing in this paper with the reaction of 7-hydroxy-3-carbethoxycoumarin (1) with hydrazines, amines and Grignard reagents. Some reagents affected fission of the coumarin ring while others reacted with the carbethoxy group.

Introduction

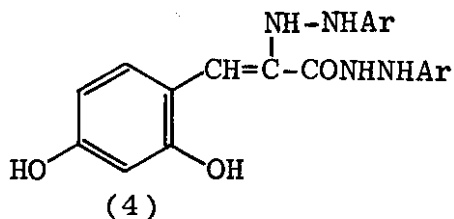
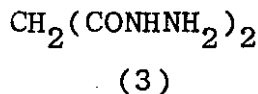
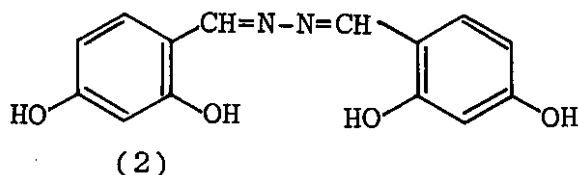
Recently, it has been shown that the heterocyclic ring in coumarins can be opened by reaction with hydrazines [2-4]. In the present investigation the study of the behaviour of (1) towards the action of hydrazines has been undertaken. In agreement with the previous results the reaction of 7-hydroxy-3-carbethoxycoumarin (1) with hydrazine hydrate in boiling ethanol afforded the azine (2) and malonic acid dihydrazide (3).

Similarly, compound (1) reacted with phenylhydrazine, p-nitrophenylhydrazine and 2,4-dinitrophenylhydrazine in boiling ethanol to give x-arylhydrazine-o,p-dihydroxy cinnamic acid-N-arylhydrazide (4 a-c).



The infrared spectrum of the azine (2) exhibited bands attributable to OH (3550-3480 cm^{-1}) and C=N (1640 cm^{-1}). Similarly, the infrared spectra of the cinnamic acid derivatives (4 a-c) showed absorption bands attributable to OH (3570-3360 cm^{-1}); NH (3260-

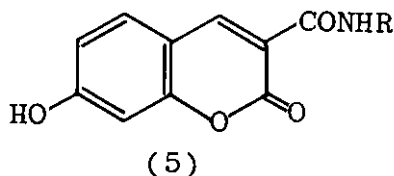
3210 cm^{-1}) and CONH (1680-1660 cm^{-1}).



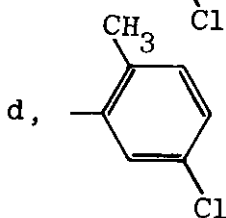
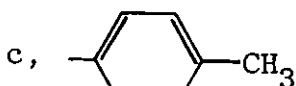
- Ar
- a, $-\text{C}_6\text{H}_5$
 - b, $-\text{C}_6\text{H}_4\text{NO}_2$ (p)
 - c, $-\text{C}_6\text{H}_3(\text{NO}_2)_2$ (o, p)

It has been found in the present study that 7-hydroxy-3-carbethoxycoumarin (1) reacts with primary aliphatic and aromatic amines such as methylamine, isobutylamine, 3-chloro-p-toluid-

ine and 5-chloro-o-toluidine in boiling ethanol to give the corresponding 7-hydroxycoumarin-3-N-alkyl or aryl carbamides (5 a-d).



- a, $-\text{CH}_3$
 b, $-\text{C}_4\text{H}_9$ (i)

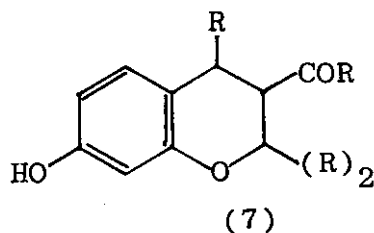
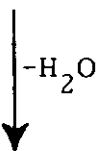
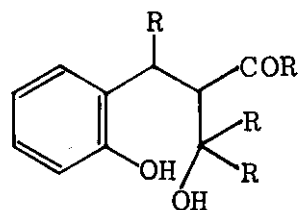


The infrared spectra of (5) reveal the presence of unsaturated γ -lactone ($1730-1705\text{ cm}^{-1}$), CONH ($1685-1650\text{ cm}^{-1}$) and OH ($3540-3300\text{ cm}^{-1}$).

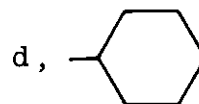
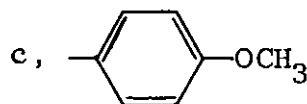
The behaviour of compound (1) toward the action of the Grignard reagents, namely methyl magnesium iodide, phenylmagnesium bromide, p-anisylmagnesium bromide and cyclohexylmagnesium bromide has also been investigated and has found to give 2,2,4-trialkyl or triaryl-3-alkaloyl or aroyl-7-hydroxychroman (7 a-d).

One possible approach to explain the formation of (7) is the assumption that four moles of RMgX are involved in the reaction with formation of the intermediate (6) which is difficult to separate owing to the ease of dehydration and cyclisation to (7).

The infrared spectra of the chroman derivatives (7 a-d) reveals that they showed well defined bands due to CO ($1670-1650\text{ cm}^{-1}$) and OH ($3540-3350\text{ cm}^{-1}$).



- a, $-\text{CH}_3$
 b, $-\text{C}_6\text{H}_5$



Experimental

All melting points reported are uncorrected. Structures of all the compounds prepared were supported by their elemental analysis and characteristic IR data. The IR spectra in KBr were recorded on a Unicam SP 200 Spectrophotometer.

Recation of (1) with hydrazine hydrate.
Formation of (2) and (3).

A mixture of (1) (0.01 mole) and hydrazine hydrate (0.01 mole) in ethanol (20 ml) was refluxed for 2 hrs. Yellow crystals separated first, followed by a white solid after the solution was cooled. The precipitate was filtered

off and treated with hot ethyl acetate in which the yellow crystals dissolved. The insoluble white product was washed with warm ether to yield (3)[6], m.p. and m.m.p. 154°.

The ethyl acetate extract gave the corresponding azine (2). The physical data are given in Table 1.

Table 1. Characterisation of the organic compounds(2-7)

Comp- ound	m.p.° colour	Solvent yield(%)	Mol. formula	Analysis %	
				Calcd.	Found
2	220 yellow	Ethanol 48	$C_{14}H_{12}N_2O_4$	C 61.76	61.92
				H 4.41	4.50
				N 10.29	10.45
4a	250 yellow	Benzene 24	$C_{21}H_{20}N_4O_3$	C 67.02	67.35
				H 5.31	5.50
				N 14.89	15.00
4b	105 yellowish	Ethanol 19	$C_{21}H_{18}N_6O_7$	C 54.07	54.25
				H 3.86	4.10
				N 18.02	18.00
4c	130 orange	Acetone 58	$C_{21}H_{16}N_8O_{11}$	C 45.32	45.55
				H 2.87	3.10
				N 20.14	20.30
5a	280 brown	Ethanol 66	$C_{11}H_9NO_4$	C 60.27	60.45
				H 4.10	4.27
				N 6.39	6.50
5b	120 yellow	Ethanol 84	$C_{14}H_{15}NO_4$	C 64.36	64.50
				H 5.74	5.95
				N 5.36	5.60
5c	170 colour- less	Ethanol 73	$C_{17}H_{12}ClNO_4$	C 61.91	62.00
				H 3.64	3.95
				N 4.24	4.50
5d	164 colourless	Ethanol 46	$C_{17}H_{12}ClNO_4$	C 61.91	62.10
				H 3.64	3.80
				N 4.24	4.35
7a	186 yellow	Ethyl- acetate 38	$C_{14}H_{18}O_3$	C 71.79	72.00
				H 7.69	8.00
7b	185 yellow	Ethanol 27	$C_{34}H_{26}O_3$	C 84.64	84.95
				H 5.39	5.60
7c	165 yellow	Benzene 40	$C_{38}H_{34}O_7$	C 75.74	76.00
				H 5.64	5.90
7d	190 yellow	Dioxane 54	$C_{34}H_{50}O_3$	C 80.63	80.95
				H 9.88	10.05

Reaction of (1) with phenylhydrazine, p-nitrophenylhydrazine and 2,4-dinitrophenylhydrazine; formation of (4 a-c).

A mixture of (1) (0.01 mole) and the corresponding hydrazine (0.01 mole) in ethanol (20 ml) was refluxed for 2 hrs. The solids which separated out after colling were crystallized from the suitable solvent to give α -arylhydrazin-o,p-dihydroxy cinnamic acid-N-arylhydrazide (4 a-c). All the results are listed in Table 1.

Condensation of 7-hydroxy-3-carbethoxy-coumarin (1) with primary aliphatic and aromatic amines; formation of (5 a-d).

A mixture of (1) (0.01 mole) and the appropriate amine such as methylamine, isobutylamine, 3-chloro-p-toluidine and 5-chloro-o-toluidine (0.01 mole) in ethanol (20 ml) was refluxed for 4 hrs. On colling the products separated out. It was filtered and crystallized from ethanol to give the corresponding 7-hydroxycoumarin-3-N-alkyl or aryl carbamides (5 a-d). The results are given in Table 1.

Action of the Grignard reagents on the coumarin (1); formation of the chroman derivatives (7 a-d).

A solution of (1) (0.01 mole) in dry ether (50 ml) was treated with an ethe-

real solution of the Grignard reagents, namely methyl magnesium iodide, phenyl magnesium bromide, p-anisylmagnesium bromide or cyclohexylmagnesium bromide (0.04 mole) for one hour more, left overnight at room temperature and then decomposed using ammonium chloride solution. The aqueous solution was extracted with ether; after evaporation the ethereal layer gave a solid substance which could be recrystallized from the suitable solvent to give the chroman derivatives (7 a-d). The results are given in Table 1.

References

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