

SYNTHESIS OF NEW 2-SUBSTITUTED 4-(2-FURYL)-4H-PYRANS

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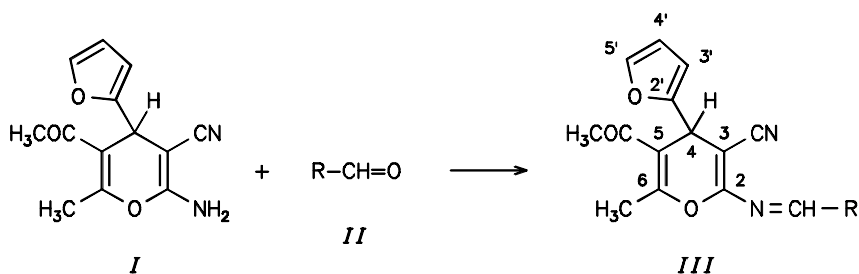
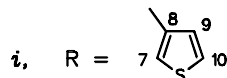
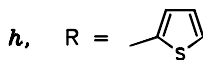
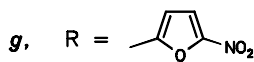
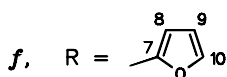
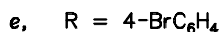
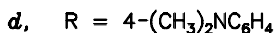
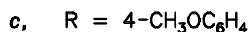
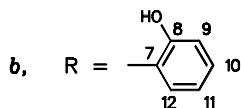
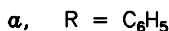
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Dedicated to Professor J. Kuthan on the occasion of his 60th birthday.

Substituted 2-amino-3-cyano-4H-pyrans represent important precursors in syntheses of condensed heterocycles containing a 4H-pyran nucleus¹⁻⁵. In the context of studies of reactivity of 2-amino-5-acetyl-4-(5-X-2-furyl)-3-cyano-6-methyl-4H-pyrans^{6,7} we were interested in the possibility of preparing 2-aryl(heteroaryl)methyleneamino-4H-pyrans *III* (see Scheme 1).

In formulae *II*, *III* :

SCHEME 1

EXPERIMENTAL

The melting points of products were determined with the help of a Boetius apparatus and were not corrected. The reaction course and purity of the products synthesized were monitored by TLC (Silufol; detection with UV light and iodine vapours).

The IR absorption spectra were measured with a Specord M 80 (Zeiss, Jena) in KBr pellets (0.7 – 1 mg sample per 300 mg KBr). The apparatus was calibrated with the use of a polystyrene film. The UV absorption spectra were measured with a Specord M 40 spectrophotometer (Zeiss, Jena) in methanol at 10^{-4} – 10^{-5} mol l⁻¹ concentrations. The ¹H NMR spectra were measured with an 80 MHz spectrometer Tesla BS 487 C and a 300 MHz spectrometer Varian XR-300 in hexadeuteriodimethyl sulfoxide (with hexamethyldisiloxane as the internal reference). The ¹³C NMR spectra were measured with a JEOL FX-100 (25 MHz) and the Varian XR-300 (75 MHz) with indirect

TABLE I
2-Substituted 5-acetyl-4-(2-furyl)-3-cyano-6-methyl-4H-pyrans *IIIa* – *IIIi*

Compound	R	M.p., °C Yield, %	Formula M.w.	Calculated/Found		
				% C	% H	% N
<i>IIIa</i>	C ₆ H ₅	153 – 154	C ₂₀ H ₁₆ N ₂ O ₃	72.28	4.85	8.43
		72	332.4	71.98	5.01	8.70
<i>IIIb</i>	2-HOC ₆ H ₄	182 – 185	C ₂₀ H ₁₆ N ₂ O ₄	68.96	4.63	8.04
		63	348.4	69.18	4.69	8.30
<i>IIIc</i>	4-CH ₃ C ₆ H ₄	178 – 179	C ₂₁ H ₁₈ N ₂ O ₄	69.60	5.01	7.76
		77	362.4	69.51	4.93	7.51
<i>IIId</i>	4-(CH ₃) ₂ NC ₆ H ₄	221 – 222	C ₂₂ H ₂₁ N ₃ O ₃	70.38	5.64	11.24
		67	375.4	70.59	5.54	11.22
<i>IIIe</i>	4-BrC ₆ H ₄	212 – 213	C ₂₀ H ₁₅ BrN ₃ O ₃	58.41	3.68	6.84
		74	411.3	58.62	3.87	7.14
<i>IIIf</i>	2-C ₄ H ₃ O	187 – 189	C ₁₈ H ₁₄ N ₂ O ₄	67.08	4.38	8.69
		44	322.3	66.98	4.77	8.88
<i>IIIg</i>	5-NO ₂ -2-C ₄ H ₃ O	196 – 199	C ₁₈ H ₁₃ N ₃ O ₆	58.86	3.57	11.49
		32	367.3	58.73	3.62	11.54
<i>IIIh</i>	2-C ₄ H ₃ S	178 – 179	C ₁₈ H ₁₄ N ₂ O ₃ S	63.89	4.17	8.31
		60	338.4	63.80	4.20	8.44
<i>IIIi</i>	3-C ₄ H ₃ S	172 – 174	C ₁₈ H ₁₄ N ₂ O ₃ S	63.89	4.17	8.31
		53	338.4	63.65	4.17	8.26

TABLE II
UV and IR spectra of 2-substituted 4*H*-pyrans IIIa – IIIi

Compound	UV spectrum		IR spectrum					
	λ_{\max} , nm	log ϵ	$\nu(\text{C}\equiv\text{N})$	$\nu(\text{C}=\text{O})$	$\nu(\text{C}=\text{C})^a$		$\nu(\text{C}-\text{O}-\text{C})$	
IIIa	224	3.22	2 220	1 698	1 667	1 572	1 216	
	283	3.31			1 651	1 455		1 199
	334	3.06			1 620			
IIIb	221	3.33	2 215	1 700	1 665	1 568	1 214	
	287	3.33			1 628	1 455		1 199
	342	3.09			1 604			
	377	3.12						
IIIc	240	3.26	2 220	1 700	1 665	1 595	1 192	
	320 i	3.36			1 655	1 564		1 170
	353	3.45			1 615			
III d	217 ^b	–	2 205	1 696	1 645	1 565	1 184	
	256	–			1 611	1 528		1 160
	294	–						
	420	–						
IIIe	228 ^b	–	2 213	1 700	1 660	1 562	1 190	
	292	–			1 620	1 450		1 180
	343 i	–			1 584			
III f	215	3.16	2 220	1 698	1 664	1 548	1 187	
	292	2.92			1 627	1 476		1 160
	328 i	3.24			1 592			
	342	3.26						
III g	238	3.45	2 222	1 702	1 660	1 534	1 198	
	306	3.18			1 627	1 485		1 172
				1 570				
III h	215	3.28	2 217	1 697	1 665	1 621	1 190	
	287	3.29			1 657	1 580		
	354	3.36						
III i	209	3.27	2 222	1 698	1 667	1 620	1 195	
	288	3.36			1 650	1 583		1 180
	328	3.26						

^a Skeletal vibrations; ^b measured as the saturated solution.

standardization using hexadeuteriodimethyl sulfoxide ($\delta[(\text{CD}_3)_2\text{SO}] = 39.50$ ppm). The spectra were measured by the method of wide-band decoupling, by the NOE technique with retained ^{13}C - ^1H interactions, technique of extraresonance decoupling, DEPT and APT.

The mass spectra were measured with an MS 902 S apparatus (Manchester) with direct inlet system. The ionization energy was 70 eV, trapping current 100 μA .

5-Acetyl-2-aryl(heteroaryl)methyleneamino-4-(2-furyl)-3-cyano-6-methyl-4H-pyrans *III*

A mixture of 5 mmol 4H-pyran *I*, 5.5 mmol corresponding aldehyde, 15 ml toluene, and a catalytic amount of 4-methylbenzenesulfonic acid was refluxed in an apparatus with azeotropic extension 6 h. Then a half of solvent was distilled off and the residue was cooled to separate the product *III* which was collected by suction and recrystallized from ethanol. The products *III**f* – *III**i* (R = heteroaryl) were purified by chromatography on a silica gel column using chloroform as eluent. The compounds synthesized and their physico-chemical data are presented in Tables I – IV. The 4H-pyrans *III**d* – *III**g* were recrystallized from acetone.

TABLE III
 ^1H NMR chemical shifts of 4H-pyrans *III**a* – *III**i* (δ , ppm)

Compound	CH_3CO^a	CH_3^a	H-4 ^a	H-3 ^{nb}	H-4 ^{nb}	H-5 ^{nb}	N=CH ^a	R
<i>III</i> <i>a</i>	2.24	2.34	5.00	6.30	6.45	7.65	8.90	7.65 m, 3 H; 7.96 m, 2 H
<i>III</i> <i>b</i>	2.25	2.36	5.08	6.30	6.49	7.61	9.09	6.96, 7.05, 7.45, 7.68 m, 4 H; 11.53 s, OH
<i>III</i> <i>c</i>	2.24	2.36	5.04	6.35	6.44	7.63	8.88	7.13 d, 2 H, $J = 8.9$ Hz; 7.97 d, 2 H; 3.87 s, OCH_3
<i>III</i> <i>d</i>	2.23	2.35	4.98	6.31	6.42	7.61	8.71	6.83 d, 2 H, $J = 8.9$ Hz; 7.81 d, 2 H; 3.07 s, $\text{N}(\text{CH}_3)_2$
<i>III</i> <i>e</i>	2.24	2.37	5.08	6.37	6.45	7.63	8.96	7.80 d, 2 H, $J = 8.4$ Hz; 7.94 d, 2 H
<i>III</i> <i>f</i>	2.24	2.34	5.04	6.34	6.43	7.63	8.70	6.82, 7.49, 8.13 m, 1 H
<i>III</i> <i>g</i>	2.25	2.36	5.13	6.39	6.45	7.64	8.83	7.66 d, 1 H, $J = 4.0$ Hz; 7.84 d, 1 H
<i>III</i> <i>h</i>	2.24	2.36	5.04	6.35	6.44	7.63	9.08	7.31 dd, 1 H, $J_1 = 3.8$, $J_2 = 4.9$ Hz; 7.95 d, 1 H; 8.06 d, 1 H
<i>III</i> <i>i</i>	2.24	2.35	5.05	6.35	6.44	7.63	8.93	7.59 dd, 1 H, $J_1 = 1.2$, $J_2 = 5.1$ Hz; 7.72 dd, 1 H, $J = 3.0$ Hz; 8.49 dd, 1 H

^a Singlet; ^b a doublet of doublets, $J_1 = 2.9 - 3.2$ Hz, $J_2 = 1.8 - 1.9$ Hz.

TABLE IV
 ^{13}C NMR chemical shifts of carbon atoms in compounds III (δ , ppm)

Carbon	IIIa	IIIb ^a	IIIc ^b	IIIc ^c	IIIe	IIIf	IIIg	IIIh	IIIi
C-2	157.3 s	156.5 s	157.6 s	158.1 s	157.0 s	157.2 s	156.4 s	157.0 s	157.5 s
C-3	86.0 s	85.0 s	84.3 s	81.1 s	86.2 s	85.1 s	88.7 s	84.7 s	84.9 s
C-4	34.4 d	33.9 d	34.2 d	34.2 d	34.2 d	34.3 d	34.5 d	34.2 d	34.2 d
C-5	111.7 s	111.9 s	111.8 s	111.8 s	111.7 s	111.7 s	111.7 s	111.7 s	111.8 s
C-6	156.4 s	156.1 s	156.4 s	156.3 s	156.0 s	156.2 s	156.2 s	156.4 s	156.3 s
CN	116.6 s	116.6 s	116.9 s	117.3 s	116.2 s	116.8 s	116.2 s	116.7 s	116.7 s
CO	197.4 s	197.5 s	197.5 s	197.3 s	197.2 s	197.4 s	197.3 s	197.4 s	197.3 s
CH ₃ CO	18.5 q	18.5 q	18.5 q	18.3 q	18.2 q	18.4 q	18.4 q	18.5 q	18.5 q
CH ₃	29.5 q	29.5 q	29.5 q	29.3 q	29.2 q	29.5 q	29.5 q	29.5 q	29.5 q
C-2'	153.5 s	153.5 s	153.7 s	153.9 s	153.3 s	153.6 s	153.1 s	153.6 s	153.5 s
C-3'	107.5 d	107.6 d	107.3 d	106.8 d	107.3 d	107.4 d	107.8 d	107.4 d	107.4 d
C-4'	110.9 d	110.9 d	110.8 d	110.5 d	110.7 d	110.8 d	110.9 d	110.8 d	110.8 d
C-5'	143.4 d	143.4 d	143.3 d	142.8 d	143.1 d	143.3 d	143.5 d	143.3 d	143.3 d
N=CH	164.2 d	163.1 d	163.1 d	162.0 d	163.0 d	150.1 d	150.8 d	157.0 d	158.1 d
C-7	134.3 s	119.2 s	127.2 s	121.5 s	133.4 s	150.6 s	153.4 s	140.8 s	137.2 d
C-8	130.0 d	160.6 s	132.2 d	132.1 d	131.4 d	123.7 d	123.1 d	135.6 d	139.1 s
C-9	129.1 d	117.0 d	114.8 d	111.5 d	132.1 d	113.7 d	113.9 d	129.2 d	125.2 d
C-10	133.6 d	135.8 d	163.8 s	154.1 s	127.3 s	149.6 d	151.1 s	138.1 d	128.6 d

^a 119.9 d (C-11), 131.7 d (C-12); ^b 55.6 q (OCH₃); ^c 40.1 q (N-CH₃).

REFERENCES

1. Abed N. M., Ibrahim N. S., Elnagdi M. H.: *Z. Naturforsch.*, B 41, 925 (1986).
2. Elnagdi M. H., Abdel-Motaleb R. M., Mustafa M., Zayed M. F., Kamel E. M.: *J. Heterocycl. Chem.* 24, 1677 (1987).
3. Martin N., Seoane C., Soto J. L.: *Tetrahedron* 44, 5861 (1988).
4. Harb A. E. A., El-Maghraby A. M., Metwally S. A.: *Collect. Czech. Chem. Commun.* 57, 1570 (1992).
5. Marchalin S., Pavlikova F., Ilavsky D.: *Collect. Czech. Chem. Commun.* 54, 1336 (1989).
6. Marchalin S., Ilavsky D., Kovac J., Bruncko M.: *Collect. Czech. Chem. Commun.* 55, 718 (1990).
7. Marchalin S., Ilavsky D., Bruncko M.: *Monatsh. Chem.* 120, 1101 (1989).

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