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ISOMERIZATION OF N-ACYL-1,2,5,6-TETRAHYDROPIRIDINES TO N-ACYL-ENAMINES BY
PALLADIUM ON CARBON

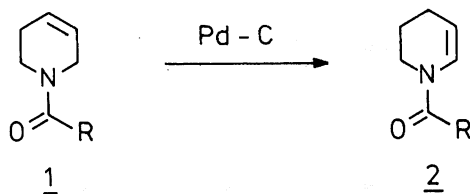
Klaus Th. Wanner and Annerose Kärtner

Institut für Pharmazie und Lebensmittelchemie der Universität München,

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Abstract - Allylic amides 1 were rearranged to enamides 2 using palladium on carbon as catalyst.

Carbon-carbon bond formation at the α - and β -positions of amines is of considerable interest in preparative organic chemistry; it can be achieved (e.g. by) utilizing enamides (e.g. 2) as starting compounds¹. As some of the most important synthetic pathways to this class of compounds may be mentioned the acylation of imines with acid chlorides or anhydrides^{1b} and the elimination of methanol from α -methoxylated amides², which are readily available by electrochemical methods³.



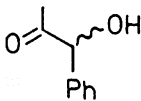
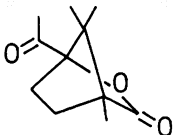
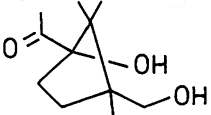
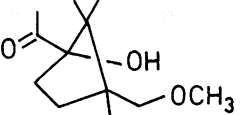
In the course of our studies concerning the asymmetric α -amidoalkylation⁴ mediated by chiral enamides, we looked for a simple and efficient route to cyclic enamides of type 2. In this case the imine acylation sequence was not feasible, since the corresponding imine does not exist⁵, and the electrochemical oxidation did not appear promising since a high degree of substitution in the acyl moiety is known to reduce the yield⁶. We therefore envisaged the synthesis of enamides 2 from 1 by double bond isomerization as an attractive alternative. Similar isomerizations effected by iron, rhodium and ruthenium catalysts, have been reported⁷.

After several experiments employing various rhodium complexes we found that the isomerization of 1a to enamide 2a is best effected by palladium on carbon in THF-NEt₃ at 120°C. The conversion (1a-2a) was almost complete within 3 h (>90% by NMR) and after 6 h (conversion >95%) we isolated 2a in 80.5% yield. This reaction appears to represent a general method for the synthesis of enamides of type 2. The results are shown in the Table. Crucial to this process, when employed for the synthesis of hydroxy substituted enamides is the presence of NEt₃. Without this additive

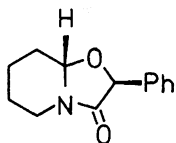
the rearrangement (to afford e.g. 2a) was followed by an intramolecular ring closure (entry 2). It is worthwhile to note that in the isomerization excellent results were obtained even with 1/50(w/w) of catalyst (entry 3).

In a typical procedure, a mixture of 217.3 mg (1.0 mmol) 1a, 10.9 mg Pd-C(10% Pd) and 1 ml THF/NEt₃ (8/2) was heated 6 h at 120°C in a sealed tube. After filtration the organic layer was evaporated under reduced pressure and the residue was purified by radial chromatography (SiO₂, n-hex/EtOAc) to give 2a (174.9 mg, 80.5%).

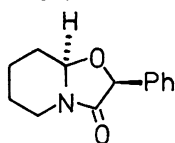
Table

entry	substr. ⁸	R	NEt ₃	conditions ^a	prod.	yield(%) ^b	[α] ^c _D
1	<u>1a</u>		+	1:20, 120°C, 6h	<u>2a</u>	80.5 (100/0/0) ^d	-
2	<u>1a</u>	-"	-	1:20, 120°C, 6h	<u>2a, 3, 4</u> ^e	(75/17/8) ^d	-
3	<u>1b</u>		-	1:50, 110°C, 3h	<u>2b</u>	90.7	+ 2.7°
4	<u>1c</u>		+	1:20, 120°C, 3h	<u>2c</u>	81.7	-10.8°
5	<u>1d</u>		+	1:20, 120°C, 3h	<u>2d</u>	78.7	-26.6°

a) Pd-C (10% Pd)/substr. (w/w), temp., reaction time. b) Yield of pure products from radial chromatography. All compounds were fully characterized by ¹H-NMR, IR and MS spectra and by C,H,N combustion analyses. c) Calculated from [α]₅₄₆ and [α]₅₇₈, c=1.0, CH₃OH. d) Ratio 2a/3/4 determined by HPLC. e) 3:



; 4:



ACKNOWLEDGEMENT

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REFERENCES AND NOTES

- (1) For reviews, see: a) H.E. Zaugg, *Synthesis*, 1984, 85; H.E. Zaugg, *ibid.*, 1984, 181; b) G. R. Lenz, *ibid.*, 1978, 489. See also: c) T. Shono, Y. Matsumura, K. Tsubata, and Y. Sugihara, *Tetrahedron Lett.*, 23, 1201 (1982).
- (2) K. Nyberg, *Synthesis*, 1976, 545.
- (3) T. Shono: *Electroorganic chemistry as new tool in organic synthesis*. Springer-Verlag, Berlin 1984, p. 63.
- (4) See the accompanying paper.
- (5) K. Warning and M. Mitzlaff, *Tetrahedron Lett.*, 1979, 1565.
- (6) M. Mitzlaff, K. Warning, and H. Jensen, *Liebigs Ann. Chem.*, 1978, 1713.
- (7) J.K. Stille and Y. Becker, *J. Org. Chem.*, 45, 2139(1980).
- (8) The starting compounds were prepared as follows: 1a: treatment of 2,2-dimethyl-5-phenyl-1,3-dioxolan-4-one with 1,2,5,6-tetrahydropyridine (2 eq.) in THF(25°C, 45 h, 82.8%); 1b: reaction of (-)-camphanic acid chloride and 1,2,5,6-tetrahydropyridine; 1c: reduction of 1b with 1.5 eq. NaBH₄ in diglyme (120°C, 60 h, 64.6%); 1d: methylation of 1c (1.1 eq. KH, THF, 0°C; 2.0 eq. CH₃I -60°C→-20°C, 60.4%).

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