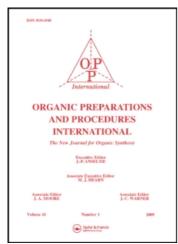
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ASYMMETRIC INDUCTIVE SYNTHESIS OF α -AMINOARYLACETIC ACIDS IN THE PRESENCE OF β -CYCLODEXTRIN

Weiliang Xua; Yongmin Zhangb

 $^{\rm a}$ Basic Course Division, Zhejiang Agricultural University, Hangzhou, PR CHINA $^{\rm b}$ Department of Chemistry, Hangzhou University, Hangzhou, PR CHINA

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R. G. Page, J. W. Dean, D. K. Phillips, G. O. Potts, A. Arnold, A. L. Beyler and R. O. Clinton, J. Med. Chem., 6, 1 (1963); R. O. Clinton, A. J. Manson, F. W. Stonner, H. C. Neumann, R. G. Christiansen, R. L. Clarke, R. G. Ackermann, R. G. Page, J. W. Dean, W. B. Dickinson and C. Carabatais, J. Am. Chem. Soc., 83, 1478 (1961).

- 4. A. U. Siddiqui, U. M. Rao, M. Srinivas and A. H. Siddiqui, Org. Prep. Proced. Int., 24, 355 (1992).
- S. Coffey, "Chemistry of Carbon Compounds Steroids", Vol. 2D, p 257, Elesevier Amsterdam, 1970.
- 6. N. S. Bhacca and D. H. Williams, "Application of NMR Spectroscopy in Organic Chemistry", Holden Day, San Francisco, 1964.
- 7. L. J. Bellamy, "The Infrared Spectra of Complex Molecules", Wiley, New York, 1956.

ASYMMETRIC INDUCTIVE SYNTHESIS OF α -AMINOARYLACETIC ACIDS IN THE PRESENCE OF β -CYCLODEXTRIN

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Weiliang Xu*† and Yongmin Zhang††

† Basic Course Division Zhejiang Agricultural University Hangzhou, 310029, P. R. CHINA

†† Department of Chemistry
Hangzhou University
Hangzhou, 310028, P. R. CHINA

Landini¹ has reported the synthesis of α -aminoarylacetic acids in the presence of a quaternary salt TEBA as phase transfer catalyst from the reaction of chloroform with corresponding aldehydes. Optically active α -aminoarylacetic acids could be obtained in chiral micellar systems by a similar scheme^{2,3}. We now report that asymmetric induction in this reaction occurs in the presence of β -cyclodextrin (β -CD).

The highest yield of pure products is 85% for α -amino(4-bromophenyl)acetic acid ($[\alpha]_D^{25}$ +9.08). The value of e.e. % is about 2.6% for α -aminophenylacetic acid and about 28.2% for phenylalanine. All of the amino acids obtained are optically active. Moreover, some yields of pure products are higher than those obtained from the phase-transfer or the chiral micellar conditions (Table 1). In particular, the synthesis of phenylalanine from phenylacetaldehyde in the presence of β -CD has not

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been reported previously.

PhCH₂CHO + CHCl₃
$$\xrightarrow{\beta\text{-CD}}$$
 PhCH₂CHCO₂ $\xrightarrow{\text{NH}_3 (aq.)}$ PhCH₂CHCO₂ $\xrightarrow{\text{NH}_2}$ RC₆H₄CHO + CHCl₃ $\xrightarrow{\beta\text{-CD, KOH}}$ C₆H₄CHCO₂ $\xrightarrow{\text{NH}_3 (aq.)}$ $\xrightarrow{\text{NH}_2}$

 $R = H, m-CH_3, p-CH_3, m-Br, p-Br, p-Cl, p-CH_3O$

It is suggested that the substrate is captured by the β -CD in the chiral cavity thus favoring somewhat attack of CCl₃⁻ of carbonyl group in one direction, and the hydroxy group of β -CD plays an important role in the process. It can be seen that the S-form is enriched for α -aminophenylacetic acid and the R-form for phenylalanine. The favored configuration of other aminoacids cannot be determined because the absolute configuration and the $[\alpha]_{max}$ have not been reported in literature.

TABLE 1. Asymmetric Syntheses of α -Aminoarylacetic Acids and Phenylalanine in the Presence of β -Cyclodextrin

Cmpd No	ArCHO	Yield (%)	mp. (°C)	$[\alpha]_D^{25}(g/l)$ (in 1 M HCl)	e.e. %ª
1	C ₆ H ₅	51.7	257-258	+3.41 (c: 0.22)	2.6 ^b
2	m-CH ₃ C ₆ H ₄	19.4	243-245	+8.33 (c: 0.12)	
3	p-CH ₃ C ₆ H ₄	25.4	259-260	+3.30 (c: 0.30)	
4	p-CH ₃ OC ₆ H ₄	27.6	238-239	+8.59 (c: 0.16)	
5	m-BrC ₆ H ₄	39.1	268-270	+8.25 (c: 0.08)	
6	p-BrC ₆ H ₄	84.5	255-257	+9.08 (c: 0.34)	
7	p-ClC ₆ H ₄	45.3	262-264	+15.83 (c: 0.12)	
8	C ₆ H ₅ CH ₂	30.0	259-261	+1.26 (c: 1.45) ^c	28.2°

a) e. e. % = ($[\alpha]_D/[\alpha]_{D,max}$) x 100%. b) $[\alpha]_{D,max}^{25}$ + 130.7 (c: 1.1M HCl)⁴. c) The value + 1.26 was measured in 5 M HCl. $[\alpha]_{D,max}^{25}$ +4.47(c: 1.5M HCl)⁵

EXPERIMENTAL SECTION

The optical rotations were measured with WZZ-1 polarimeter. The IR spectra were taken with PE-683 spectrophotometer. Microanalyses were performed with Carbo Erba 1106 analyzer. β -Cyclodextrin (>97%) was recrystallized from water. All reported melting points were uncorrected. All other materials were standard reagent grade.

General Procedure. -To an aqueous ammonia solution (20 mL, 25%), 214.3 mmol KOH (solid), 10 mmol LiCl (solid) and 1 mmol β -CD were added. The mixture was stirred at -10 to -5°. A solution of

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TABLE 2. IR and Elemental Analysis of α-Amino Acids Synthesized

No.		IR(KBr) (cm ⁻¹)						Elemental Analysis Calcd (Found)		
							С	H	N	
1	3460	3000	2680	1645-1600	1530	1410	63.57 (63.42)	6.00 (5.93)	9.27 (8.62)	
2	3440	2990	2660	1640-1585	1520	1400	65.44 (65.43)	6.71 (6.91)	8.48 (8.45)	
3	3450	3000	2680	1640-1600	1530	1409	65.44 (65.02)	6.71 (6.72)	8.48 (8.26)	
4	3450	3000	2680	1640-1600	1530	1409	59.66 (58.93)	6.12 (6.14)	7.73 (7.67)	
5	3400	2940	2660	1640-1585	1530	1400	41.77 (41.70)	3.50 (3.45)	6.09 (5.80)	
6	3420	2980	2660	1640-1585	1530	1400	41.77 (41.72)	3.50 (3.42)	6.09 (5.83)	
7	3450	2980	2660	1640-1590	1530	1400	51.77 (51.54)	4.34 (4.21)	7.55 (7.11)	
8	3450	2980	2670	1635-1590	1525	1362	65.44 (65.06)	6.71 (6.80)	8.52 (8.10)	

a) See Table 1.

the aldehyde (5 mmol) in 1-1.5 mL CHCl₃ was added dropwise with stirring over 3 hrs while the temperature was kept at -5-0°; then the mixture was stirred at room temperature overnight. The pH of the mixture was adjusted to 6-7 with conc. hydrochloric acid and cooled to 0°. The precipitated solid was collected, washed successively with water, ether and ethanol. Recrystallization from water:ethanol (5:1) and drying afforded pure α-aminoarylacetic acids or phenylalanine. Positive ninhydrin tests were obtained on compounds 1-8.

REFERENCES

- 1. D. Landini and F. Montanari, Synthesis, 26 (1979).
- 2. Y. C. Shi, Y. Pan and H. W. Hu, Chem. J. Ch. Univ., 8, 41 (1987); Chem. Abstr., 108, 37316g (1988).
- 3. Y. M. Zhang and W. X. Li, Synth. Commun., 18, 1685 (1988).
- 4. Heilbron's "Dictionary of Organic Compounds", A-024483, Chapman and Hall, New York, 1982.
- 5. ibid., P-00921.
