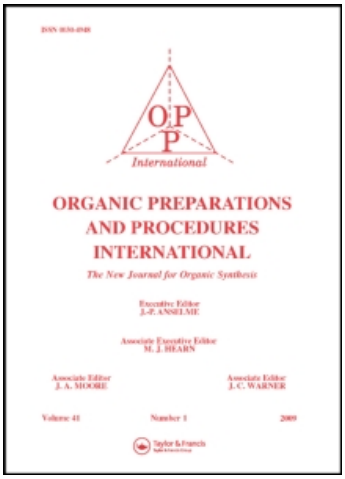

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AN IMPROVED SYNTHESIS OF *bis*(*p*-PHENYLENE)-32-CROWN-4

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4. T. Miyamoto and J.-I. Matsumoto, *Chem. Pharm. Bull. Jpn*, **38**, 3211 (1990).

5. D. T. W. Chy, P. B. Fernandes, A. K. Claiborne, E. H. Gracey and A. G. Pernet, *J. Med. Chem.*, **29**, 2363 (1986).

6. M. W. Rathke and P. J. Cowan, *J. Org, Chem.*, **50**, 2622 (1985).

7. R. J. Clay, T. A. Collom, G. L. Karrick and J. Wemple, *Synthesis*, 290 (**1993**).

8. a) M. Viscontini and N. Merckling, *Helv. Chem. Acta*, **35**, 2230 (1952); b) S. Rosenfeld and A. Williams, *J. Chem. Educ.*, **68**, 66 (1991); c) R. L. Shriner, A. G. Schmidt and L. J. Roll, *Org. Syn.* Col. Vol. **2**, 266 (1943); d) S. M. McElvain and K. H. Weber, *Org. Syn. Col. Vol.*, **3**, 379 (1955); e) J. M. Straley and A. C. Adams, *ibid.*, **4**, 415 (1963).

9. a) T. S. Mansour and C. A. Evans, *Syn. Commun.*, **20**, 773 (1990); b) N. Aubry, R. Plante and R. Deziel, *Tetrahedron Lett.*, **31**, 6311 (1990); c) D. W. Brooks, L. D.-L. Lu and S. Masamune, *Angew. Chem. Int. Ed. Engl.*, **18**, 72 (1979).

10. The X-ray data for **2a** have been submitted to the Cambridge Crystallographic Centre. We thank Dr. Jon Bordner, Pfizer Central Research, Groton, CT for the single crystal X-ray analysis of **2a**.

11. The pH adjustment from 3 to 6.8-7 removed residual acid from the reaction. At higher pH's, the sodium salt of the β-ketoester can be extracted into water.

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AN IMPROVED SYNTHESIS OF *bis*(*p*-PHENYLENE)-32-CROWN-4

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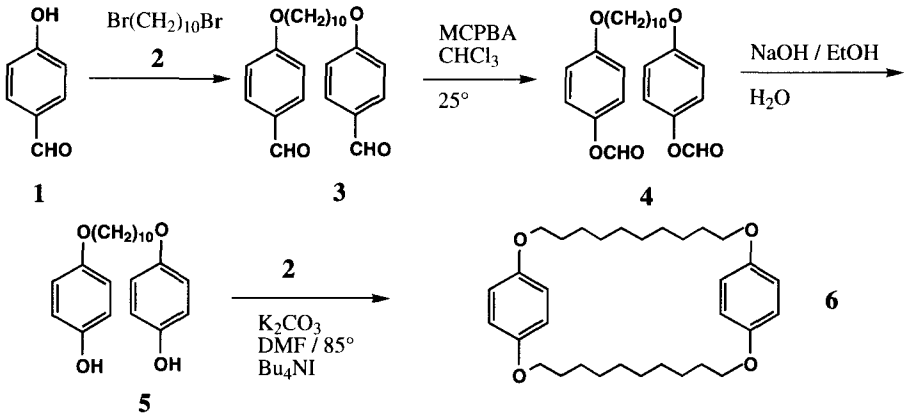
bis(*p*-Phenylene)-32-crown-4 (**6**), a hydrophobic macrocycle containing two decamethylene spacers, is a potentially important cyclic component of polyrotaxanes.[1-3] Herein we report an improved, four-step synthesis of **6**, relative to the previous one-step method[4] (5 to 7% yield).

1,10-*bis*(*p*-Formylphenoxy)decane (**3**) was prepared in 94% yield by alkylation of *p*-hydroxybenzaldehyde (**1**) with 1,10-dibromodecane (**2**).[5] Baeyer-Villiger oxidation[6] of **3** with *m*-chloroperbenzoic acid gave a 97% yield of 1,10-*bis*(*p*-formyloxyphenoxy)decane (**4**). Hydrolysis of **4** with aqueous NaOH in EtOH gave (88%) 1,10-*bis*(*p*-hydroxyphenoxy)decane (**5**). (**5** can also be obtained directly from hydroquinone and **2**.[7,8]) Cyclization of *bis*phenol **5** with **2** was carried out in the

presence of K_2CO_3 and n-Bu_4NI (phase transfer agent) to afford a 28% yield of macrocycle **6**, which does not undergo complexation with Na, K or Cs picrates.



EXPERIMENTAL SECTION

Reagent grade reactants and solvents were used as received from chemical suppliers. Melting points were taken in capillary tubes with a Haake-Buchler apparatus and are uncorrected. NMR spectra were obtained at 20° on a Varian Unity 400 MHz instrument using $CDCl_3$ unless noted and TMS as internal standard. Elemental analysis was performed by Atlantic Microlabs of Norcross, GA.

1,10-*bis*(*p*-Formylphenoxy)decane (3), mp. 80.3-82.4°, lit.[5] mp. 80-83°, was prepared by a known procedure.[5]

1,10-*bis*(*p*-Formyloxyphenoxy)decane (4). 3-Chloroperbenzoic acid (57%, 3.63 g, 12.0 mmol) was added to a solution of 1,10-*bis*(*p*-formylphenoxy)decane (**3**, 1.03 g, 2.69 mmol) in CH_2Cl_2 (20 mL). After 4 hrs the white suspension which resulted was treated with 10% $Na_2S_2O_3$ (30 mL). After 2 hrs, the organic phase was separated and the aqueous phase was extracted with CH_2Cl_2 (2 x 30 mL). The combined organic phase was washed with 10% $Na_2S_2O_3$, then sat. aq. $NaHCO_3$, followed by water and then brine. Drying (Na_2SO_4) and removal of solvent gave 1.09 g (97%) of 1,10-*bis*(*p*-formyloxyphenoxy)decane (**4**) as a white solid, mp. 108.0-112.2°; ^{1}H NMR: δ 1.3 (m, 8H), 1.4 (m, 4H), 1.7 (m, 4H), 3.86 (t, J = 6.6 Hz, 4H), 6.81 (d, J = 8.8 Hz, 4H), 6.96 (d, J = 8.8 Hz, 4H), 8.20 (s, 2H); ^{13}C NMR: δ 25.96, 29.17, 29.29, 29.418, 68.39, 115.20, 121.84, 143.17, 157.20, 159.70. This material was used in the next reaction without further purification.

1,10-*bis*(*p*-Hydroxyphenoxy)decane (5).- A solution of NaOH (394 mg, 9.85 mmol), 1,10-*bis*(*p*-formyloxyphenoxy)decane (**4**, 1.02 g, 2.46 mmol), water (5.0 mL) and EtOH (15 mL) was refluxed for 12 hrs. The solvent was removed and the mixture was neutralized with HCl. The resultant solid was filtered, washed with water and recrystallized from EtOH to give 0.82 g (88%) of 1,10-*bis*(*p*-hydroxyphenoxy)decane (**5**), mp. 154.1-155.8°, lit.[7] mp. 150-151°, not given[8]; ^{1}H NMR (DMSO-d_6): δ 1.3 (m, 8H), 1.4 (m, 4H), 1.6 (m, 4H), 3.83 (t, J = 6.4 Hz, 4H), 6.65 (d, J = 8.8 Hz, 4H), 6.71 (d, J =

8.8 Hz, 4H), 8.87 (s, 2H); ^{13}C NMR (DMSO-d_6): δ 25.55, 28.77, 28.84, 28.94, 67.82, 115.30, 115.65, 151.02, 151.47.

***bis*(*p*-Phenylene)-32-crown-4 (6)**.- A solution of 1,10-*bis*(*p*-hydroxyphenoxy)decane (**5**, 24.98 g, 69.7 mmol) and 1,10-dibromodecane (**2**, 20.88 g, 69.6 mmol) in DMF (500 mL) was added *via* an addition funnel over four days to a suspension of K_2CO_3 (96.54 g, 69.9 mmol) and n-Bu_4NI (150 mg) in DMF (3.4 L) at 90° and then the reaction temperature was maintained for 5 days. The mixture was cooled and filtered to remove salts. Removal of DMF gave a gel which after addition of EtOAc afforded a solid, which was dissolved in CH_2Cl_2 and passed through a short silica gel column to give a white solid. Recrystallization from EtOH gave 9.51 g (28%) of pure *bis*(*p*-phenylene)-32-crown-4 (**6**), mp. 99.4-100.6°, lit.[4] mp. 97-98°; ^1H NMR as reported;[4] ^{13}C NMR: δ 25.53, 28.45, 28.70, 28.887, 68.30, 115.62, 152.99.

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REFERENCES

1. Y. X. Shen, D. Xie and H. W. Gibson, *J. Am. Chem. Soc.*, **116**, 537 (1994).

2. H. W. Gibson, S. Liu, P. Lecavalier, C. Wu and Y. X. Shen, *ibid.*, **117**, 852 (1995).

3. a) H. W. Gibson, M. C. Bheda and P. T. Engen, *Progr. Polym. Sci.*, **19**, 843 (1994); b) D. B. Ambalino and J. F. Stoddart, *Chem. Revs.*, **95**, 2725 (1995); c) P. R. Ashton, J. Huff, S. Menzer, I. W. Parsons, J. A. Preece, J. F. Stoddart, M. S. Tolley, A. J. P. White and D. J. Williams, *Chem. Eur. J.*, **2**, 31 (1996); d) H. W. Gibson in *"Large Ring Molecules"*, J. A. Semlyen, ed., John Wiley & Sons, New York (1996), in press.

4. Y. Delaviz, Y. X. Shen and H. W Gibson, *Polymer*, **33**, 212 (1992).

5. B. Guilani, M. L. Rasco, C. F. K. Hermann and H. W. Gibson, *J. Heterocyclic Chem.*, **27**, 1007 (1990).

6. G. R. Krow, *Org. Reactions*, **43**, 251-798 (1993).

7. M. C. Bheda, Ph.D. Dissertation, *"Synthesis and Characterization of Novel Molecular Architectures: Polyrotaxanes and Catenanes"*, Virginia Polytechnic Institute and State University (1992).

8. A. C. Griffin and S. J. Havens, *J. Polym. Sci., Polym. Phys. Ed.*, **19**, 951 (1981).

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