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Synthesis of Two Isomeric [2.2](2,4)Pyridinophanes[1)]

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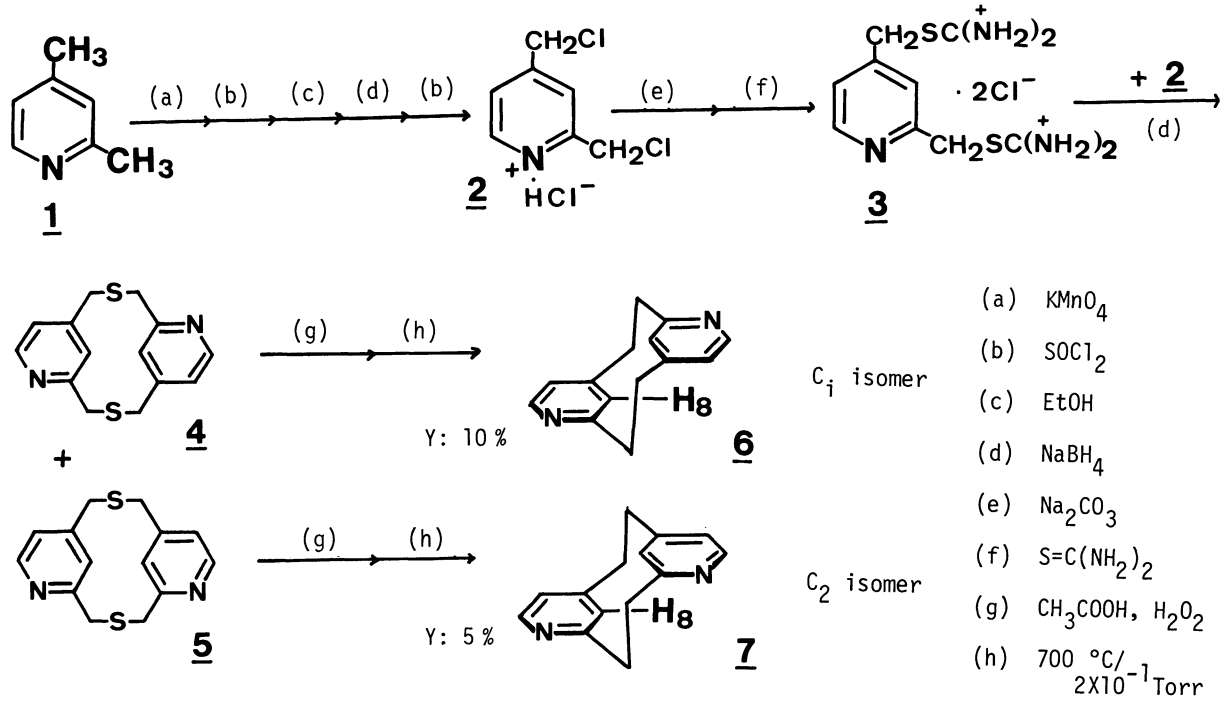
Two isomeric [2.2](2,4)pyridinophanes having C_i and C_2 symmetry were synthesized by the thermal sulfur extrusion method from the corresponding disulfones and characterized by their ^{1}H-NMR spectra.

Since 1933, pyridinophane which incorporates pyridine ring is a familiar heterophane system including widely known muscopyridine. However, a few [2.2](2,4)pyridinophanes containing [2.2]metacyclophane-like framework have been investigated so far,[2)] regardless the interesting electronic interaction of the pyridine ring.[3)] Here we report the synthesis of two isomeric [2.2](2,4)pyridinophanes, 6 and 7, and their structural characterization.



The thiouronium salt 3 and its precursor 2 were prepared from 2,4-lutidine 1

as shown in the Scheme. The cyclic disulfides 4 and 5 were obtained by a new process, i.e. direct coupling of thiouronium salt 3 and HCl-salt 2, because the conventional process using labile free-base of 2 gave a low yield of the disulfides. After purification by SiO_2 column-chromatography, sulfide 4 was obtained from the first eluate of 10%EtOH-$CHCl_3$ in 35% yield, and sulfide 5 from the second eluate in 43% yield(4: colorless columns from benzene, mp 180.5-181.5 °C; 5: colorless plates from benzene, mp 156.0-157.0 °C). This improvement has extended a scope of ring contraction method for preparation of [2.2]phane via cyclic disulfide. Cyclic disulfone given from the sulfide 4 by H_2O_2-acetic acid treatment was pyrolyzed at 700 °C/2 $\times 10^{-1}$ Torr to afford the target cyclophane, [2.2](2,4)pyridinophane 6 in 10% yield, and from the other disulfide 5 to pyridinophane 7 in 5% yield, respectively (6: colorless columns from petroleum benzine, mp 147.5-149.0 °C; 7: colorless plates from hexane-benzene, mp 141.0-141.5 °C). The structures of the [2.2]-(2,4)pyridinophanes, 6 and 7, were confirmed with ^{1}H-NMR spectra. Aromatic inner protons H_8 of 6 (δ 4.38) and 7 (δ 4.35)[4] reveal marked upfield shift, which indicates that the two pyridine rings of both isomers are fixed in the stepped form just as in [2.2]-metacyclophane. Signal of bridge methylene protons of 6 appears as ABCD system , whereas those of 7 two pairs of doublet, as shown in Fig. 1. The fact shows that the compound 6 is evidently C_i isomer of [2.2](2,4)pyridinophane and 7 is C_2 isomer. Further work is in progress.

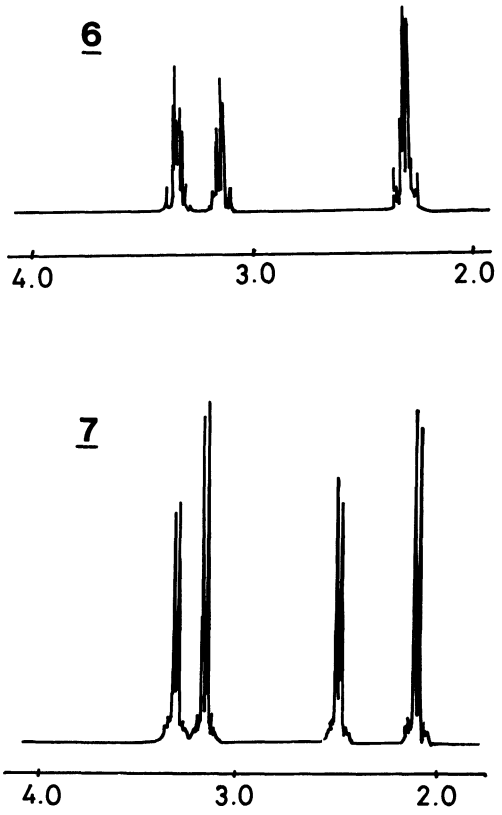


Fig. 1. ^{1}H-NMR spectra of 6 and 7 in $CDCl_3$(360 MHz).

References

1) The Chemistry of Constrained Hetero Aromatics. VI.
2) T.Kawashima, S.Kurioka, Y.Tohda, M.Ariga, Y.Mori, and S.Misumi, Chem. Lett., 1985, 1289.
3) W.W.Paudler and M.D.Bezoari, "Synthesis and Properties of Heterophanes," of "Cyclophane II," ed by P.M.Keehn and S.M.Rosenfeld, Academic Press, New York, N.Y. (1983), p.359.
4) δ value in $CDCl_3$, 360 MHz.

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