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Peculiar Sharpless Kinetic Resolution of 2-Furylmethanol and its Application to the Synthesis of (+)-Asperlin

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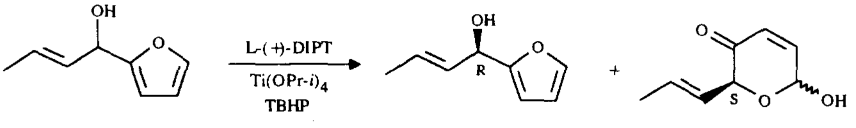
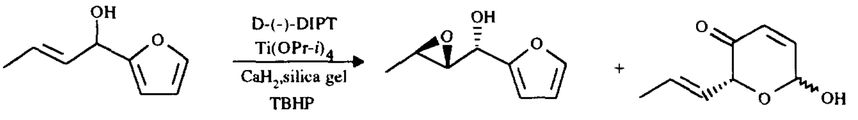
Abstract: A peculiar kinetic resolution of E-1-(2-furyl)-2-buten-1-ol (**1**), which produced two oxidation products, pyranone (**2**) and epoxyalcohol (**3**), was developed by using the modified Sharpless reagents. A short synthesis of (+)-Asperlin was achieved starting from the optically active resolution products.

After the discovery of the highly efficient kinetic resolution of secondary allylic alcohols by asymmetric epoxidation using Sharpless reagent,[1] the kinetic resolution of racemic 2-furylmethanol has been developed by Sato[2,3] and Kametani[4] to produce an optically active slow-reaction enantiomer, furylmethanol and a fast oxidation product, 3-pyranone. Both of the two optically active compounds could be applied to synthesis of natural products.[3,5] It is noteworthy that only the furyl ring was oxidized in this kinetic resolution when another double bond was present in this compound (eq. 1).[3-5] Herein we report a peculiar kinetic resolution of (*E*)-1-(2-furyl)-2-buten-1-ol (±)-**1** that afforded two oxidation products, (*1S, 2R, 3R*)-1-(2-furyl)-2,3-epoxybutan-1-ol (+)-**3** and (*2R*)-6-hydroxy-2-propenylpyran-3-one (-)-**2** (eq. 2).[6]

During investigation of the kinetic resolution of 2-furylmethanol (±)-**1** employing the modified Sharpless reagent[7], we found another oxidation product (+)-**3** in 4% yield, $[\alpha]_D^{20}$ +11°(c 1.0, EtOH), > 95% e.e.[8] (eq. 2). When 1.0 eq. of TBHP was used, the yield of (+)-**3** was increased to 34%, while its optical purity remained unchanged.

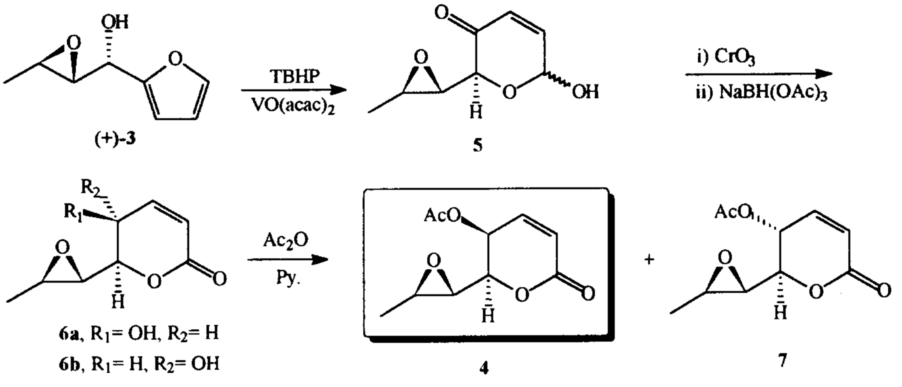


(±)-**1** (**R**)-**1** (+)-**2** eq. 1



(±)-**1** (+)-**3** (-)-**2** eq. 2

	(+)-3	(-)-2
0.5 eq. TBHP	4% (> 95% e.e.)	32%
1.0 eq. TBHP	34% (> 95% e.e.)	33%



Scheme 1

As described before, the products of the kinetic resolution are recognized as important chiral building blocks. We next describe a short synthetic route to natural asperlin (**4**)[9,10], which has been shown to exhibit antitumor and antibacterial activity, from (+)-**3** (Scheme 1). Oxidation of (+)-**3** with TBHP in the presence of a catalytic amount of VO(acac)$_2$ afforded pyranone **5** in 74.5% yield as a mixture of α- and β-anomers, which was oxidized with chromium (VI) oxide, followed by immediate reduction with sodium triacetoxyborohydride in one pot to provide the alcohol **6a** and **6b** (**6a** : **6b** ≈ 1:1). Finally, acetylation of **6a** and **6b** with acetic anhydride gave (+)-asperlin (**4**) in 21% yield (from **5**), m.p. 70-71°C, $[\alpha]_D^{20}$ +330° (c 0.3, EtOH) {lit.:[9b,10c] m.p. 71°C, $[\alpha]_D^{20}$ +332° (EtOH)}, together with the 5-*epi*-asperlin (**7**) in 19% yield (from **5**), m.p. 80-81°C, $[\alpha]_D^{20}$ -186° (c 0.5, EtOH) {lit.:[10c] m.p. 81-81.5°C, $[\alpha]_D^{20}$ -185 ° (c 0.5, EtOH)}. The mixture of **4** and **7** was easily separated by flash chromatography on silica gel [EtOAc-petroleum ether (1:4)].

In summary, the peculiar kinetic resolution of 2-furylmethanol (±)-**1** by the modified Sharpless reagent, which provided two oxidation products, proceeds highly efficiently. The utility of the present reaction was illustrated by the convenient synthesis of (+)-asperlin. Furthermore, the study on kinetic resolution of divinyl methanols is under way in our laboratory.

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References and Notes:

1. a. Martin, V.S.; Woodard, S.S.; Katsuki, T.; Yamada, Y.; Ikeda, M.; Sharpless, K.B. *J. Am. Chem. Soc.* **1981**, *103*, 6237; b. Hatakeyama, S.; Sakurai, K.; Takano, S. *J. Chem. Soc., Chem. Commun.* **1985**, 1759.
2. Kobayashi, Y.; Kusakabe, M.; kitano, Y.; Sato, F. *J. Org. Chem.* **1988**, *53*, 1586.
3. Kusakabe, M.; Kitano, Y.; Kobayashi, Y.; Sato, F. *J. Org. Chem.* **1989**, *54*, 2085.
4. Kametani, T.; Tsubuki, M.; Tatsuzaki, Y.; Honda, T. *Heterocycles* **1988**, *27*, 2107.
5. Honda, T.; Kametani, T.; Kanai, K.; Tatsuzaki, Y.; Tsubuki, M. *J. Chem. Soc., Perkin Trans. 1* **1990**, 1733.
6. After finishing this manuscript, We saw the similar work in Honda, T.; Sano, N.; Kanai, K. *Heterocycles* **1995**, *41*, 425.
7. Zhou, W-S.; Lu, Z-H.; Wang, Z-M. *Tetrahedron Lett.* **1991**, *32*, 1467.
8. Enantiomeric excesses were determined by ^{1}H NMR (300 MHz) analysis of MTPA esters.
9. Isolation of **4**: a. Argoudelis, A.D.; Zieserl, J.F. *Tetrahedron Lett.* **1966**, *18*, 1969; b. Mizuba, S.; Lee, K.; Jiu, J. *Can. J. Microbiol* **1975**, *21*, 1781. Confirmation of the absolute configuration of asperlin: Shing, T. K.M.; Aloui, M. *J. Chem. Soc., Chem. Commun.* **1988**, 1525; *Can. J. Chem.* **1990**, *68*, 1035.
10. Syntheses of **4**: a. Ramesh, S.; Franck, R.W. *Tetrahedron: Asymmetry* **1990**, *1*, 137; b. Masaki, Y.; Imaeda, T.; Oda, H.; Itoh, A.; Shiro, M. *Chem. Lett.* **1992**, 1209; c. Murayama, T.; Sugiyama, T.; Yamashita, K. *Agric. Biol. Chem.* **1987**, *51*, 2055.

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