Reaction of 3-Halogenated *cis*-Cyclohexa-3,5-diene-1,2-diol Derivatives with Pd on Charcoal

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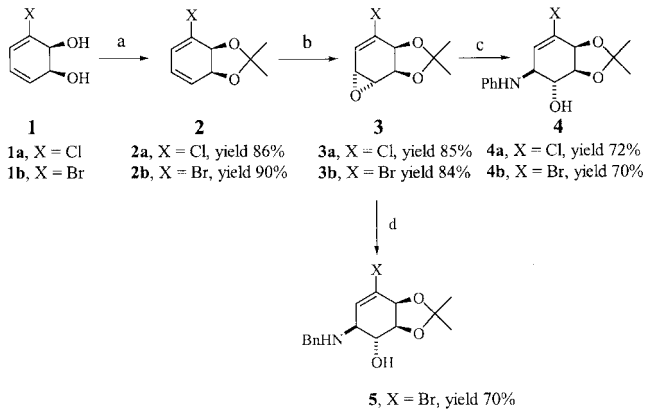
The bacterial biotransformation of substituted benzenes by mutant strains of *pseudomonas putida*[1] produced 3-halogenated *cis*-cyclohexa-3,5-diene-1,2-diols (**1**).[2] Compounds **1** have been used as useful chiral synthons in the preparation of a variety of conduritols and conduramines,[3] aza-sugars,[4] sphingosines,[5] inositols[6] and other naturally occurring substances.[7] *cis*-Diol derivatives **4** and **5** were synthesized from *cis*-diols **1**, and they showed peculiar reactivity with Pd on charcoal. Here, we report the reaction in detail.

Compounds **4** and **5** were prepared in three steps from arene dihydrodiols **1** as shown in Scheme 1.[3a] Arene dihydrodiols **1** were treated with dimethoxypropane in *p*-toluenesulfonic acid, followed by stereospecific anti-epoxidation to the protecting group and nucleophilic ring opening with aniline or benzylamine in neutral alumina, to give **4** and **5**, enantioselectively pure, respectively.

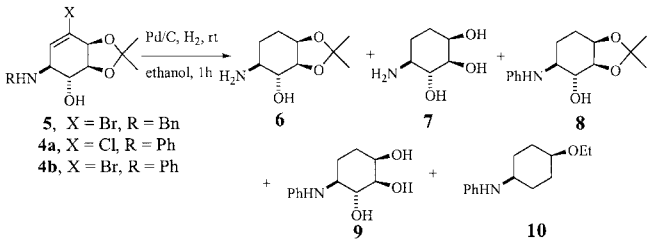
The reaction of **4** or **5** with Pd on charcoal afforded several products as shown in Scheme 2. Compound **5** was reacted with 10% Pd on charcoal in ethanol under hydrogen atmosphere, giving **7** as the major product (Table 1, entry 1). Reaction with 5% Pd on charcoal, gave **6** as the major product (entry 2). Compound **4a** was reacted with 10% Pd on charcoal, giving **8** and the major product **6** (entry 3), whereas the reaction of **4a** with 5% Pd on charcoal, gave **8**, **10** and the major product **6** (entry 4).

Also, compound **4b** was reacted with 10% Pd on charcoal to give **9** as the major product (entry 5). Generally, it is known that the benzyl group and double bond can be easily reduced by Pd on charcoal, but the isopropylidene group can not. The deisopropylidenation reaction in **4** and **5** was thought to be concerned with the acidity of hydrogen halides formed in the reaction. Table 1 (entry 1 and 2) shows that compound **5** reacted more rapidly with 10% Pd on charcoal than with 5% Pd on charcoal to give the deisopropylidenation compound **7**. Also, the hydrogen bromide formed in the reaction (entry 5) was more acidic than the hydrogen chloride formed in the reaction (entry 4), and the deisopropylidenation compound **9** was obtained.



a) 2,2-dimethoxypropane, TsOH, CH_2Cl_2, 1 h, b) *m*-CPBA (70%), CH_2Cl_2, rt, 8h, c) aniline, neutral alumina,$CHCl_3$, rt, 12h, d) $BnNH_2$, neutral alumina, $CHCl_3$, rt, 12h.

Scheme 1. Syntheses of *cis*-diol derivatives **4** and **5**.



Scheme 2. Reaction of *cis*-diol derivatives **4** and **5** with Pd/C.

Table 1. The reaction yield of **4** and **5** with Pd on charcoal

Entry	Comp. No.	Pd/C (%)	Yield (%)[a]				
			6	**7**	**8**	**9**	**10**
1	**5**	10	25	60	–	–	–
2	**5**	5	85	5	–	–	–
3	**4a**	10	60	–	10	–	–
4	**4a**	5	75	–	8	–	10
5	**4b**	10	–	–	10	75	–

[a]Isolated yield

Compound **4a** was dephenylated in the reaction with Pd on charcoal, giving **6** regardless of content percentage of Pd on charcoal, but **4b** was not dephenylated in the reaction, which gave **9**. Generally, *N*-debenzylation is common, but *N*-dephenylation is not.

This method can be used to synthesize various dihydroconduritols[8] and dihydroconduramines from *cis*-diols **1**, using various nucleophiles.

The reaction of 1,3-cyclohexadien-*cis*-diol derivatives **4** and **5** with Pd on charcoal to give the compounds **6**, **7** and **9**, which included the hydrogenation of the double bond, dehalogenation, deisopropylidenation, debenzylation and dephenylation spontaneously or in tandem, suggest an efficient route to pharmaceutical polyoxygenated compounds derived from *cis*-diols **1**.

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