Asymmetric Ring Contraction Reactions Mediated by Chiral I(III)

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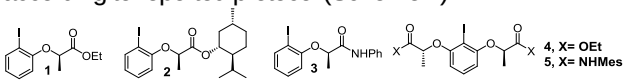
INTRODUCTION

Hypervalent iodine reagents are widely used in chemical synthesis.[1] The development of reaction processes controlled by chiral hypervalent iodine reagents with high enantioselectivity has drawn extensive and enduring attention because of their environmentally friendly profile and avoids the issue of toxicity.[2,3] Rearrangement reaction is one of the important reactions promoted by I(III).[1,3,4] Herein, we describe asymmetric ring contraction reactions mediated by chiral hypervalent iodine reagents.

RESULTS AND DISCUSSION

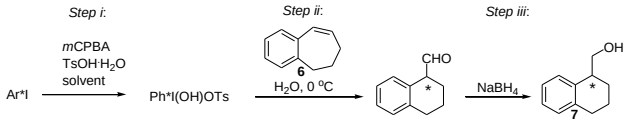
Optically active aryl iodide reagents (**1-5**) were prepared according to reported protocol (Scheme 1).[3]



Scheme 1. Optically active chiral aryl iodide reagents

First step, koser's derivative chiral aryl iodine(III) reagents were generated *in situ* by treating chiral iodobenzene with *m*CPBA and $TsOH{\cdot}H_2O$ at room temperature using appropriate solvents. Second step involve the addition of small amount of water (22 equiv), followed by addition of alkene **6**. The aldehyde formed in this process was reduced *in situ* adding $NaBH_4$. Iodide **2** and **4** afforded alcohol **7** as non-racemic mixture using CF_3CH_2OH (TFE)/DCM as mixed solvent (entries 4 and 6, Table 1).

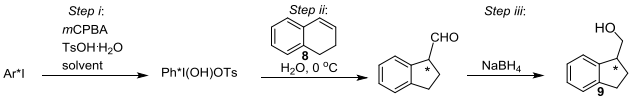
Table 1. Asymmetric ring contraction of alkene **6** with chiral I(III)



Entry	Conditions	Yield	*ee*
1	**1**, HFIP/DCM (1:6)	20	7
2	**2**, HFIP/DCM (1:6)	28 (49 SM)	8
3	**2**, TFE/DCM (1:4)	42 (40 SM)	1
4	**2**, TFE/DCM (1:1)	28 (39 SM)	13
6	**3**, HFIP/DCM (1:6)	SM	-
7	**3**,TFE/DCM (1:1)	SM	-
5	**4**, HFIP/DCM (1:6)	-	3.5
6	**4**, TFE/DCM (1:1) without PTSA	-	16

The use of two arms chiral aryl iodide reagents like **4** and **5**, using mixed solvent system ($(CF_3)_2CHOH$ (HFIP)/CH_2Cl_2), gave corresponding indane **9** in 15% and 20% *ee*, respectively (entries 3 and 7, Table 2). A slight increase in *ee* was observed when (+) camphorsulfonic acid (CSA) was used instead of PTSA (entry 6).

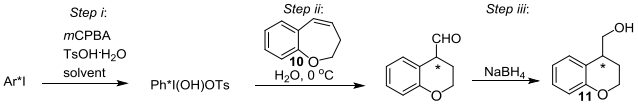
Table 2. Asymmetric ring contraction of alkene **8** with chiral I(III)



Entry	Conditions	Yield	*ee*
1	**2**, HFIP/DCM (1:6)	-	7
2	**2**, TFE/DCM (1:1)	-	6
3	**4**, HFIP/DCM (1:6)	-	15
4	**4**, TFE/DCM (1:1)	59 (25 SM)	5
5	**4**,TFE/DCM (1:1) without PTSA	-	4
6	**4**, HFIP/DCM (1:6) with (+)CSA	37 (11 SM)	25
7	**5**, HFIP/DCM (1:6)	57 (28 SM)	20
8	**5**, TFE/DCM (1:1)	- (66 SM)	6

Chromane **11** was obtained in 18% and 19% *ee* using iodide **4** (entries 4 and 5, Table 3). However, when aryl iodide **4** was used without adding PTSA, desired alcohol was obtained in 23% *ee* (entry 6).

Table 3. Asymmetric ring contraction of alkene **10** with chiral I(III)



Entry	Conditions	Yield%	*ee*%
1	**2**, HFIP/DCM (1:6)	-	13
2	**2**, TFE/DCM (1:4)	-	3
3	**2**, TFE/DCM (1:1)	-	6
4	**4**, HFIP/DCM (1:6)	54(13 SM)	18.5
5	**4**, TFE/DCM (1:1)	33 (25 Sm)	19
6	**4**, TFE/DCM (1:1) without PTSA	-	23

CONCLUSION

The reactivity of several chiral aryl iodine(III) reagents with benzo-fused cyclic alkenes was examined. Studies to get high *ee* and yield are underway.

ACKNOWLEDGEMENTS

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