

SUPPORTING INFORMATION

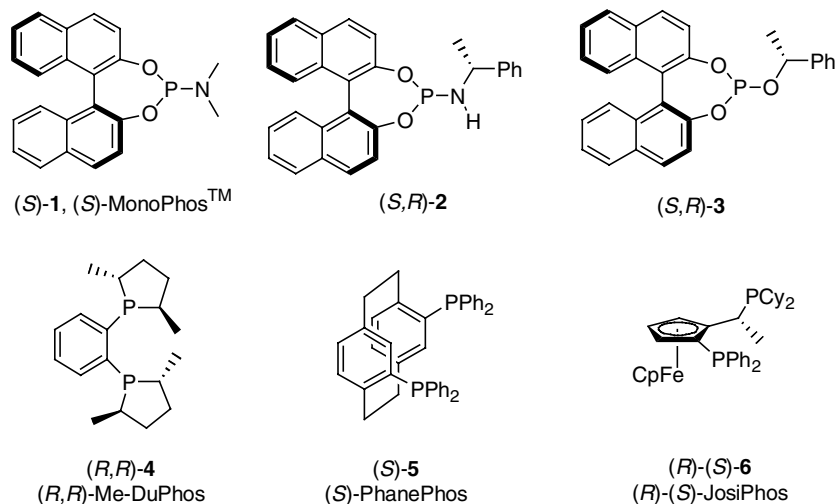
Mono- versus Bidentate Ligands in the Rhodium-Catalyzed Asymmetric Hydrogenation. A Comparative Rate Study.

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General procedures.

All reactions and manipulations were performed in a dry nitrogen or argon atmosphere using standard Schlenk techniques. Reagent grade dried solvents were purchased from Fluka and used as received. Monodentate ligands **1**,¹ **2**² and **3**² were prepared in our laboratories. Bidentate ligands **4**, **5** and **6** were purchased from Strem Chemicals and used as received. Substrates **7**⁴ and **9**² were prepared in our laboratories according to literature procedures. Enantiomeric excesses were determined by capillary GC analysis with a CP-Chirasil-L-Val column (25.0 m x 250 m x 0.25 m) for **8**^{1b} and with a CP-Chirasil-Dex-CB column (25.0 m x 250 m x 0.25 m) for **10**.²



General procedure for the hydrogenation of methyl 2-acetamido cinnamate (**7**).

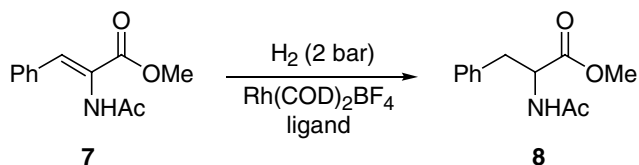
In a Schlenk tube equipped with septum and stirring bar, a mixture of Rh(COD)₂BF₄ (16.2 mg, 40 μmol) and the appropriate ligand [(S)-**1** (28.8 mg, 80 μmol), (S,R)-**2** (34.8 mg, 80 μmol), (S,R)-**3** (34.9 mg, 80 μmol), (R,R)-**4** (12.3 mg, 40 μmol), (S)-**5** (23.1 mg, 40 μmol) or (R)-(S)-**6** (23.8 mg, 40 μmol)] was dissolved in CH₂Cl₂ (2 mL). After stirring under argon at room temperature for 15 min, volatiles were removed under vacuum and the appropriate solvent was added [(S)-**1** (CH₂Cl₂, 2 mL, 20 mM), (S,R)-**2** (EtOAc, 40 mL, 1 mM), (S,R)-**3** (CH₂Cl₂, 2 mL, 20 mM), (R,R)-**4** (MeOH, 2 mL, 20 mM), (S)-**5** (MeOH, 2 mL, 20 mM) or (R)-(S)-**6** (MeOH, 2 mL, 20 mM)]. In a glass tube, an aliquot of this solution [**1**, **3**-**6** (0.25 mL, 5 μmol of complex) or **2** (5 mL, 5 μmol of complex)] was added over a mixture of **7** (219 mg, 1 mmol) in the appropriate solvent [**1**, **3** (CH₂Cl₂, 4.75 mL) or **4**-**6** (MeOH, 4.75 mL)]. This small glass tube was placed in a semi-automated autoclave with eight reactors (EndeavorTM) that was purged twice with nitrogen and once with hydrogen. Then, the autoclave was pressurized with 2 bar of H₂ and the reaction was monitored by the hydrogen consumption while stirred at room temperature. After 3 h, the resulting mixture was filtered over a short silica column and subjected to conversion (¹H-NMR) and ee determination (capillary GC). Full conversion was observed in all cases. The configuration of the product (**8**) was *R* (**1**-**4**, **6**) and *S* (**5**), determined by comparing the sign of optical rotations with that of the reported ones.^{1b}

¹ MonoPhosTM was prepared from bis-2-naphthol and HMPT with excellent yields: (a) Hulst, R.; de Vries, N. K.; Feringa, B. L. *Tetrahedron: Asymmetry* **1994**, 5, 699. (b) van den Berg, M.; Minnaard, A. J.; Haak, R. M.; Leeman, M.; Schudde, E. P.; Meetsma, A.; Feringa, B. L.; de Vries, A. H. M.; Maljaars, C. E. P.; Willans, C. E.; Hyett, D.; Boogers, J. A. F.; Henderickx, H. J. W.; de Vries, J. G. *Adv. Synth. Catal.* **2003**, 345, 1.

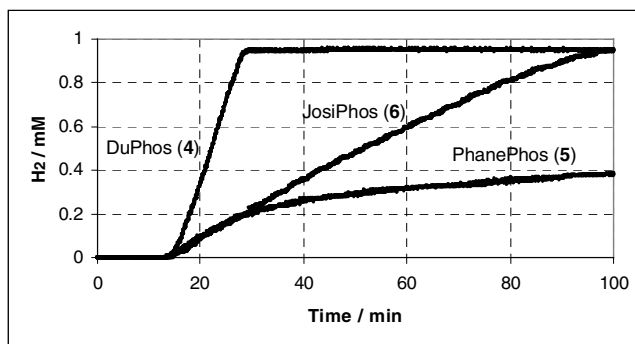
² Peña, D.; Minnaard, A.; de Vries, J. G.; Feringa, B. L. *J. Am. Chem. Soc.* **2002**, 124, 14552.

³ Reetz, M. T.; Mehler, G. *Angew. Chem., Int. Ed.* **2000**, 39, 3889.

⁴ Schmidt, U.; Lieberknecht, A.; Wild, J. *Synthesis* **1988**, 159.



Preliminary run comparing bidentate phosphines 4-6 in the hydrogenation of **7**.



General procedure for the hydrogenation of (Z)-ethyl 3-acetamido 2-butenate (9**).**

In a Schlenk tube equipped with septum and stirring bar, a mixture of $\text{Rh}(\text{COD})_2\text{BF}_4$ (16.2 mg, 40 μmol) and the appropriate ligand [(*S*)-**1** (28.8 mg, 80 μmol), (*S,R*)-**2** (34.8 mg, 80 μmol), (*S,R*)-**3** (34.9 mg, 80 μmol), (*R,R*)-**4** (12.3 mg, 40 μmol), (*S*)-**5** (23.1 mg, 40 μmol) or (*R*)-(*S*)-**6** (23.8 mg, 40 μmol)] was dissolved in CH_2Cl_2 (2 mL). After stirring under argon at room temperature for 15 min, volatiles were removed under vacuum and the appropriate solvent was added [**1-3** (CH_2Cl_2 , 2 mL, 20 mM) or **4-6** (MeOH, 2 mL, 20 mM)]. In a glass tube, an aliquot of this solution (1 mL, 20 μmol of complex) was added over a mixture of **9** (171 mg, 1 mmol) in the appropriate solvent [**1-3** (*i*-PrOH, 4 mL) or **4-6** (MeOH, 4 mL)]. This small glass tube was placed in a semi-automated autoclave with eight reactors (Endeavor™) that was purged twice with nitrogen and once with hydrogen. Then, the autoclave was pressurized with 10 bar of H_2 and the reaction was monitored by the hydrogen consumption while stirred at room temperature. After 3 h, the resulting mixture was filtered over a short silica column and subjected to conversion (^1H -NMR) and ee determination (capillary GC). Full conversion was observed in all cases. The configuration of the product (**10**) was *R* (**1-4**, **6**) or *S* (**5**), determined by comparing the sign of optical rotations with that of the reported ones.²

