

Chiral Polyols as Catalysts of Asymmetric C-C Bond Formation Reactions

Y.V. Samoilenko¹, Z.T. Gugkaeva¹, V.I. Maleev¹, M.A. Moskalenko¹, A.T. Tsaloev¹, V.N. Khrustalev¹, K.V. Hakobyan², A.S. Peregudov¹, A.S. Saghyan², Y.N. Belokon¹

1 - Institute of Russian Academy of Sciences, A.N. Nesmeyanov Institute of Organoelement Compounds, Russian Academy of Sciences, Vavilov 28, 119991 Moscow, Russia

2 - Yerevan State University, Department of Pharmaceutical Chemistry, A. Manoogian st. 1, 0025 Yerevan, Armenia

Gondzza@mail.ru

The creation of a chain of intramolecular hydrogen bonded hydroxyl groups could be expected to facilitate the proton transfer, accompanying the C-C bond formation. According to this hypothesis we have synthesized the series of polyols shown in Figure 1 to investigate their catalytic activity in corresponding reactions.

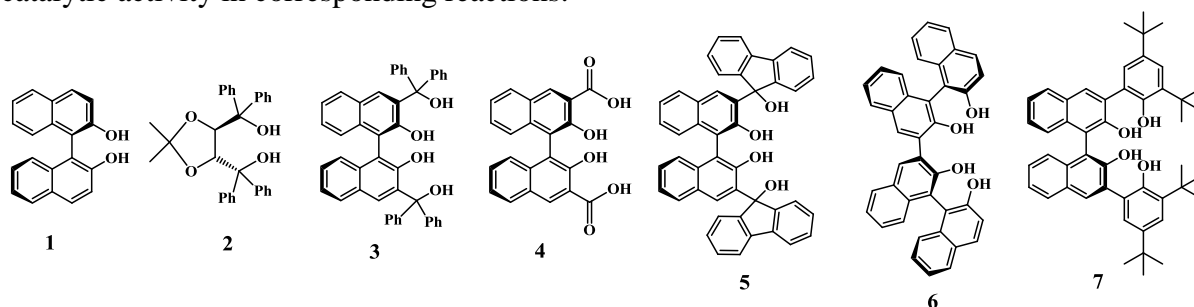


Figure 1. Series of synthesized polyols with a chain of intramolecular hydrogen bonded hydroxyl groups.

We have chosen Li, Na and K salts of (*S*)- or (*R*)-3,3'-bis[bis-(phenyl)hydroxymethyl]-2,2'-dihydroxy-dinaphthalene-1,1' (**3**) as catalysts of a model reaction of asymmetric Michael addition of malonic ester and other nucleophiles to cyclohex-2-enone.

Among other alcohols and phenols it was only BIMBOL that was an efficient catalyst of the reaction producing Michael adducts with 90% ee.

Other reactions tested with BIMBOL as a catalyst include PTC alkylations of amino acid precursors as shown in Fig. 2 and enantioselective epoxide ring opening with anilines (Fig. 3).

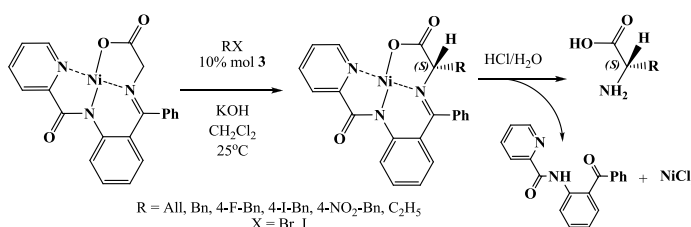


Figure 2. BIMBOL promoted asymmetric alkylation of a glycine

The asymmetric alkylation was conducted in CH_2Cl_2 in the presence of KOH and furnished different amino acids in high yield and reasonably high ee (up to 88%).

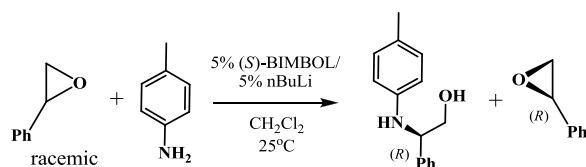


Figure 3. Styrene oxide ring opening catalyzed by mono-lithium salt of BIMBOL.

The ring opening of styrene oxide with anilines was almost not catalyzed by BIMBOL at room temperature. However, mono-lithium salt of BIMBOL showed significant catalytic activity. The reaction was stereoselective furnishing only one isomer. Kinetic resolution was observed and the asymmetric induction of the product reached 41% with 36% conversion.

The induction and catalytic activity of the system was greatly increased when $\text{Ti}(\text{O}^i\text{Pr})_4$ was added to BIMBOL in a ratio 1:1. The forming catalyst was highly active even at a ratio of substrate/catalyst 1000/1. The ee of the final product varied, depending on the conditions, but reached 90% in some cases. We are going also to test polyols **5-7** hopefully to get better results.