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# Synthesis and characterization of new PNNP-type chiral ligands

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## SHORT COMMUNICATION

## Synthesis and characterization of new PNNP-type chiral ligands

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#### ABSTRACT

Polydentate ligands having both soft and hard centers are very effective ligands for the preparation of transition metal complexes. PNNP-type tetradentate diaminodiphosphine ligands are most preferred ligand types cause of their good efficiency for the asymmetric reactions. In this study, three different iminophosphine derivative PNNP-type chiral ligands were synthesized using (R)-(+)-1,1'-Binaphthyl-2,2'-diamine (R-BINAM) and diphenylphosphino benzaldehyde derivatives.

#### **GRAPHICAL ABSTRACT**



PNNP-type tetradentate diaminodiphosphine ligands are generally synthesized by the condensation of phosphinoaldehydes and imine groups. In this study, firstly, three different phosphinobenzaldehydes (**1a-c**) were prepared starting from aryl bromides (Scheme 1).<sup>[1]</sup> Then all of three air-stable phosphinobenzaldehydes were reacted with R-BINAM in toluene at reflux temperature using a Dean-Stark apparatus. The resulted iminophosphines (**2a-c**) which are PNNP type chiral ligands were characterized by spectroscopic methods.

From <sup>1</sup>H and <sup>31</sup>P NMR spectra of compounds (**1a-c**), the typical aldehyde group protons can be found at around 10.60 ppm and the peaks belong to phosphorous atoms can be found at around -13 ppm as singlet. After the condensation,

in <sup>1</sup>H NMR spectra characteristic peaks of the imine protons were shifted from 10.50 ppm to 10.44 ppm range. In addition, in <sup>31</sup>P NMR spectra, shifts from -13 ppm to -15 ppm confirm the imine bonds on the molecule structures.<sup>[2]</sup> The bands around 1610 cm<sup>-1</sup> in FT-IR spectra represent C = N stretching frequencies which are in agreement with the literature.<sup>[3]</sup>

All reactions were carried out under dry pure  $N_2$  in standard Schlenk apparatus. All the reagents were obtained from commercial suppliers. All solvents were distilled from sodium/benzophenone and stored under nitrogen. The NMR spectra were recorded on Bruker 400 MHz spectrometer operating at room temperature. Infrared spectra were recorded on Thermo FT-IR spectrometer and Smart ITR diamond attenuated total reflection (ATR).

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#### **KEYWORDS**

PNNP type ligand; iminophosphine; R-BINAM; chirality



## **Disclosure statement**

No potential conflict of interest was reported by the authors.

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