

## Chiral Diphosphine Ligands and Their Transition Metal Diphosphine Complexes in Asymmetric Catalysis

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**Abstract :** (R)-(4,4',6,6'-tetramethoxybiphenyl-2,2'-diyl)bis(diphenylphosphine) (R-Ph-Garphos), and (S)-(4,4',6,6'-tetramethoxybiphenyl-2,2'-diyl)bis(diphenylphosphine) (S-Ph-Garphos) are novel, nucleophilic, chiral atropisomeric ligands. The research explored the synthesis of chiral transition metal complexes containing these ligands and their applications in various asymmetric catalytic transformations. Herein, the transition metal complexes having ruthenium(II), rhodium(I) and iridium(I) metal centres will be discussed. These are air stable complexes and were characterized by CHN analysis, <sup>1</sup>H, <sup>13</sup>C, and <sup>31</sup>P NMR spectroscopy, and polarimetry. Currently, there is an emphasis on 'greener' catalysts and the need for 'green' solvents in asymmetric catalysis. As such, the Ph-Garphos ligands were demethylated thereby introducing hydroxyl moieties unto the ligand scaffold. The facile tunability of the biaryl diphosphines led to the preparation of the (R)-(4,4',6,6'-tetrahydroxybiphenyl-2,2'-diyl)bis(diphenylphosphine) (R-Ph-Garphos-OH), and (S)-(4,4',6,6'-tetrahydroxybiphenyl-2,2'-diyl)bis(diphenylphosphine) (S-Ph-Garphos-OH) ligands. These were successfully characterized by CHN analysis, <sup>1</sup>H, <sup>13</sup>C, and <sup>31</sup>P NMR spectroscopy, and polarimetry. The use of the Ph-Garphos and Ph-Garphos-OH ligands and their transition metal complexes in asymmetric hydrogenations will be reported. Additionally, the scope of the research will highlight the applicability of the Ph-Garphos-OH ligand and its transitional metal complexes as 'green' catalysts.

**Keywords :** catalysis, asymmetric hydrogenation, diphosphine transition metal complexes, Ph-Garphos ligands

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