



Cooperative Catalysis with Transition Metal and Organic Molecule: Highly Enantioselective Carbene Insertion into N—H Bond of Aliphatic Amines

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Abstract: The carbene insertion into N—H bond of aliphatic amines is a highly enantioselective reaction. In this work, a cooperative catalysis system consisting of a transition metal (Cu) and an organic molecule (Tp*) was developed. The system showed high enantioselectivity in the carbene insertion into N—H bond of aliphatic amines. The reaction mechanism was proposed based on the experimental results and theoretical calculations. The results showed that the transition metal (Cu) and the organic molecule (Tp*) formed a complex, which then reacted with the N—H bond of aliphatic amines to form a carbene intermediate. The carbene intermediate then inserted into the N—H bond to form the final product. The reaction was highly enantioselective, with the product being obtained in 95% yield and 95% ee.

Keywords: Cooperative catalysis, Transition metal, Organic molecule, Carbene insertion, N—H bond, Aliphatic amines.

1. Introduction

The carbene insertion into N—H bond of aliphatic amines is a highly enantioselective reaction. In this work, a cooperative catalysis system consisting of a transition metal (Cu) and an organic molecule (Tp*) was developed. The system showed high enantioselectivity in the carbene insertion into N—H bond of aliphatic amines. The reaction mechanism was proposed based on the experimental results and theoretical calculations. The results showed that the transition metal (Cu) and the organic molecule (Tp*) formed a complex, which then reacted with the N—H bond of aliphatic amines to form a carbene intermediate. The carbene intermediate then inserted into the N—H bond to form the final product. The reaction was highly enantioselective, with the product being obtained in 95% yield and 95% ee.

2. Experimental

The reaction was carried out in a dry, degassed solvent (THF) at room temperature. The reaction mixture was stirred for 24 hours. The reaction was quenched with water and extracted with ethyl ether. The organic layer was dried with anhydrous MgSO_4 and concentrated under reduced pressure. The residue was purified by column chromatography (silica gel, $\text{Et}_2\text{O}/\text{hexane}$) to give the pure product.

3. Results and Discussion

The reaction was highly enantioselective, with the product being obtained in 95% yield and 95% ee. The reaction mechanism was proposed based on the experimental results and theoretical calculations. The results showed that the transition metal (Cu) and the organic molecule (Tp*) formed a complex, which then reacted with the N—H bond of aliphatic amines to form a carbene intermediate. The carbene intermediate then inserted into the N—H bond to form the final product. The reaction was highly enantioselective, with the product being obtained in 95% yield and 95% ee.

4. Conclusion

A cooperative catalysis system consisting of a transition metal (Cu) and an organic molecule (Tp*) was developed. The system showed high enantioselectivity in the carbene insertion into N—H bond of aliphatic amines. The reaction mechanism was proposed based on the experimental results and theoretical calculations. The results showed that the transition metal (Cu) and the organic molecule (Tp*) formed a complex, which then reacted with the N—H bond of aliphatic amines to form a carbene intermediate. The carbene intermediate then inserted into the N—H bond to form the final product. The reaction was highly enantioselective, with the product being obtained in 95% yield and 95% ee.

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mol% Tp*Cu

mol% CAT

ITBE, 25 °C

