Indenyl Rhodium Complexes; New Efficient Coal Tar Catalyst

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General theme of the project is exploration of indenyl rhodium complexes. The relevance of this study is that organometallic complexes are widely used in organic synthesis as catalysts. For example, they play important role in obtaining isocoumarins, benzolactams, CF3-substituted compounds. But currently used pentamethylcyclopentadienyl (Cp*) rhodium complexes have strong disadvantage - high price. So, our main goal was to synthesize efficient and cheap analogue of Cp* complexes. Our solution to this problem have become unknown IndRhHal2 complexes. We've developed and optimized 2-stage synthesis in mild conditions for these compounds. First step is synthesis of IndRh(C2H4)2: "one pot" reactions of BuLi with indene and (C2H4)2RhCl. Final step is reaction of IndRh(C2H4)2 with halogen. Yields of the reactions varies from 71-90% depending on halogen. Next part of our work was exploration of chemical activity IndRhHal2. We obtained compounds with different carboranes, arene and Cp as ligands. Also we've compared chemical activity of Ind and Cp* complexes through the arene exchange reaction. The experiments showed superiority of Ind complexes. Final part of our project was testing gained compounds as catalysts. We tested them in different reactions of getting heterocycles. IndRhI2 was also tested in reaction of reductive amination where CO used as reductive agent. The best conditions were H2O as a solvent with catalyst load 1 mol%. We obtained different amines with 83 – 99% yield. Due to our catalyst, this reaction can be an industrial synthesis: usage of H2O & CO utilization makes the process cheap and ecological, amines are widely used in plenty spheres of life.

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