Novel Iron-Catalyzed Hetero Diels-Alder Reaction directed towards Natural Product Synthesis

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With an increased desire to access medically important compounds, chemists are pursuing many alternative synthetic methodologies. The purpose of this research was to investigate the potential use of an in situ generated ortho-quinone methide intermediate as a diene partner in an iron-catalyzed hetero Diels-Alder reaction directed towards natural product synthesis. The goal of the investigation was to establish a practical and cost-effective synthetic route to allow access to the hexahydro-6H-benzo[c] chromene core and to synthesize marine meroterpene (+)-conicol. The research was conducted in three individual phases in order to completely assess the utility of the iron-catalyzed reaction methodology. The first phase (optimization) was accomplished through a series of preliminary reactions, manipulating individual parameters including stoichiometric ratios of reagents, catalyst concentration, buffers, and duration. The reactions were monitored by silica-gel thin layer chromatography (TLC) and the products were isolated using flash column chromatography. The Diels-Alder adducts were then validated with 1H nuclear magnetic resonance (NMR) spectroscopy. Once the optimal reaction conditions were determined, a series of electron-rich dienophiles were substituted into the parent reaction (Phase 2). In the third phase, optimal conditions of the parent reaction were then extended to the synthesis of (+)- conicol. The implementation of the selected reaction methodology directed towards the synthesis of (+)- conicol revealed a practical and cost-effective synthetic route. TLC and 1H NMR assessments revealed a mixture of (+)- conicol and an impurity. Future studies will need to be completed in order to optimize the reaction.

Awards Won:

Fourth Award of $500