CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34504

Project Title

Building a Library of Difluoromethyl- and Trifluoromethyl-Artemisinins: Year Two

Abstract

Objectives/Goals

In recent years fluorine has become increasingly important to the pharmaceutical industry. Coupled with already-potent drugs, fluorine has allowed common therapies to become even more effective in treating many diseases. One disease that could particularly benefit from the development of a more effective treatment method is malaria. For centuries malaria has been treated with artemisinin, but drug resistance has drastically reduced the effectiveness. Recognizing the benefits of adding fluorine to pharmaceuticals, this study focused on developing the methodology required to successfully incorporate fluorine into molecules of biological importance.

Methods/Materials

In order to improve bioavailability of artemisinin, two types of fluroalkylation were experimented with. This study focused on successfully trifluoromethylating artemisinin before branching out into the more complex difluoromethylation process. The Ruppert- Prakash Reagent was used to trifluoromethylate artemisinin. The next phase of research consisted of developing a methodology for the difluoromethylation of artemisinin. Methyl- 4- nitrobenzoate was used as a surrogate molecule to model the behavior of artemisinin in the difluoromethylation process. The difluoromethylating reagents used were TMSCF(2)H and TMSCF(2)Br and activating agents were CsF and K(2)CO3.

Results

The goal of creating a trifluoroartemisinin analog was achieved, and the difluoromethylation procedures show great promise for further research. Low yields of product are indicative of the potential for a more successful methodology to be developed.

Conclusions/Discussion

This research successfully synthesized a trifluoromethyl-artemisinin analog, one of the primary goals set for this year of research. In addition, basic difluoromethylation displayed some positive results. Overall, this work has created the necessary platform to create even more analogs of artemisinin that can supplement the existing library of drugs yielding an opportunity for biological testing.

Summary Statement

This project focused on fluoroalkylating artemisinin, an antimalarial drug, to increase its bioavailability and address the issue of drug resistance.

Help Received

Worked at USC Loker Hydrocarbon Research Institute under the supervision of Dr. Surya Prakash.