IRGF Final Report

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Project Title: Towards Sustainable Organometallics: Synthesis of Complexes Bearing Cannabinoid Derived Ligands

1.1 Project Summary

Sustainable Organometallic Chemistry can be achieved through the use of natural products, and synthesized models of them, as starting materials to bioactive and unique organometallic complexes. This project involved an exploration of cannabinoids as a renewable source of starting materials to make novel complexes with various metal ions. These complexes are proposed to have profound bioactivity / pharmaceutical action and catalytic activity. The project was successful at increasing the validity of cannabinoids as ligands, determined using a model ligand system and developing methodologies that operate with cannabinoids.

1.2 Student Involvement

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1.3 Dissemination and Knowledge Mobilization

- Poster presentation at Research Day at MRU 2024 & 2025
- Invited panel speaker at Canadian chemistry conference (CSC2024)
- In-progress manuscript for publication in Acta Crystallographica Section E
- Currently another manuscript is being written for publication based on work conducted Spring & Summer 2025 - for Journal of Natural Products

1.4 Project Outcomes and Impacts

The development of methods that can adapt natural products, a renewable source of unique and bioactive compounds, was investigated. In order to design experimental methods that can operate with natural products, several model systems were used from commercially available, and related, chemicals. Several students committed their time as volunteers and as research assistants to explore different commercially available starting materials that mimic the chemical environment of natural products. We settled on functionalizing "phenol" and "pyrimidine" groups, generating compounds that can act as ligands to stabilize a metal ion, known as a complex. From the literature, these complexes possess a wide variety of reactivity used in pharmaceutical fields, the synthesis of designer compounds, and polymerization. With the successful

generation of a ligand system, we investigated the methods need to generate a complex.

This was successfully investigated with copper and silver, prompting further investigations into their catalytic activity. This success was the focus of a poster presentation by Kieran Mounce-McKinney for Research Day 2025. Considerable effort was focused on adapting the synthetic methods to a natural product. We operated with discarded hemp, isolating several cannabinoids to act as our starting materials (instead of the commercially available ones purchased) as they have a "phenol" group. Several synthetic strategies were explored by several volunteer students and research assistants, determining the most productive method to yield a complex, like the one Kieran disseminated and is the focus of a manuscript currently being prepared for submission. The initial work was discussed by Jarrett Hanearin-Balczer with their independent project and poster for Research Day 2024. This work continued into 2025 by Jarrett, a new student Declyn Caouette, and a Mitacs-GRI student, Edgar Gonzalez Suarez. After some considerable work, a method was developed to functionalize a cannabinoid (8THC) to be used as a ligand. The process provides several avenues for further derivatization of the cannabinoid. The methodology is being formally written for dissemination in upcoming conferences and for a manuscript in-progress. My research focuses around sustainable organometallic chemistry. The development of a natural product, 8THC, that can be functionalized for a variety of uses, including as a ligand, provides an exciting avenue to utilize the unique structure of natural products in the field of organometallic chemistry. This project promotes green chemistry principles and has created a reason to explore 8THC as a ligand and a methodology that can be adapted to other novel natural products.