Utilising African mahogany bark for pharmaceutical applications

July 2018

Prepared and funded by Department of Agriculture and Water Resources, Bioactive Laboratories, and The Fruit Tree Factory[1]

Key components

- **Investigating the use of bark extracts from tree harvesting to manufacture pharmaceutical products.**
- **Enhancing the commercial non-wood benefits of tree plantation activity.**
- **Identifying and isolating compounds from African mahogany (Khaya senegalensis) bark, specifically within the family of compounds known as Liminoids.**
- **Confirmation of the first step to discover new pharmaceutical applications from tree harvest residues and suggests an innovative approach to a potentially high value new export opportunity.**
- **Providing encouragement of new and novel pharmaceutical uses for tree harvest residues throughout the plantation-based industry.**

Context

This project was directed at investigating the use of bark extracts from tree harvesting to manufacture pharmaceutical products. Enhancing the non-wood benefits of tree plantation activity has commercial benefits, as does research to identify and develop new pharmaceuticals to treat challenging medical conditions.

The tree species used was African mahogany (Khaya senegalensis), a tropical tree covering approximately 20,000 hectares of plantation and rehabilitated mine sites throughout Northern Australia.

There are many diseases and health conditions that are either untreatable or where current medicines are losing their effectiveness, for example anti-parasitic treatments and anti-biotics. Finding new compounds is the genesis of drug discovery leading to the development of new pharmaceutical applications.

In vivo studies have demonstrated that Liminoid terpenes[2] can be attributed to slowing oral cancer growth; exhibit toxicity to leukaemia cells; inhibit colon cancer cell growth; display anti-bacterial activity, and indicate strong anti-inflammatory and analgesic activity.

Societal health and welfare profiling suggests that the community would benefit from the discovery of more effective plant-based pharmaceutical products. Improving society health outcomes has knock-on effects, such as reducing hospital bed numbers and lowering employment sick days.

Objectives

This project sought to identify and isolate compounds from African mahogany bark, specifically within the family of compounds known as Liminoids. These compounds are associated with some of the world's most used pharmaceutical applications, such as anti-cancer treatments, anti-inflammatories, anti-microbials and pain relieving treatments.

The project aimed at:

1. Creating a process and a set of guidelines by which any tree species can be adapted from tree to laboratory in order to create a library of fractions and compounds.
2. Creating additional employment in the tree plantation-based industry, plus employment opportunities within the plant-based pharmaceutical medicines supply chain.

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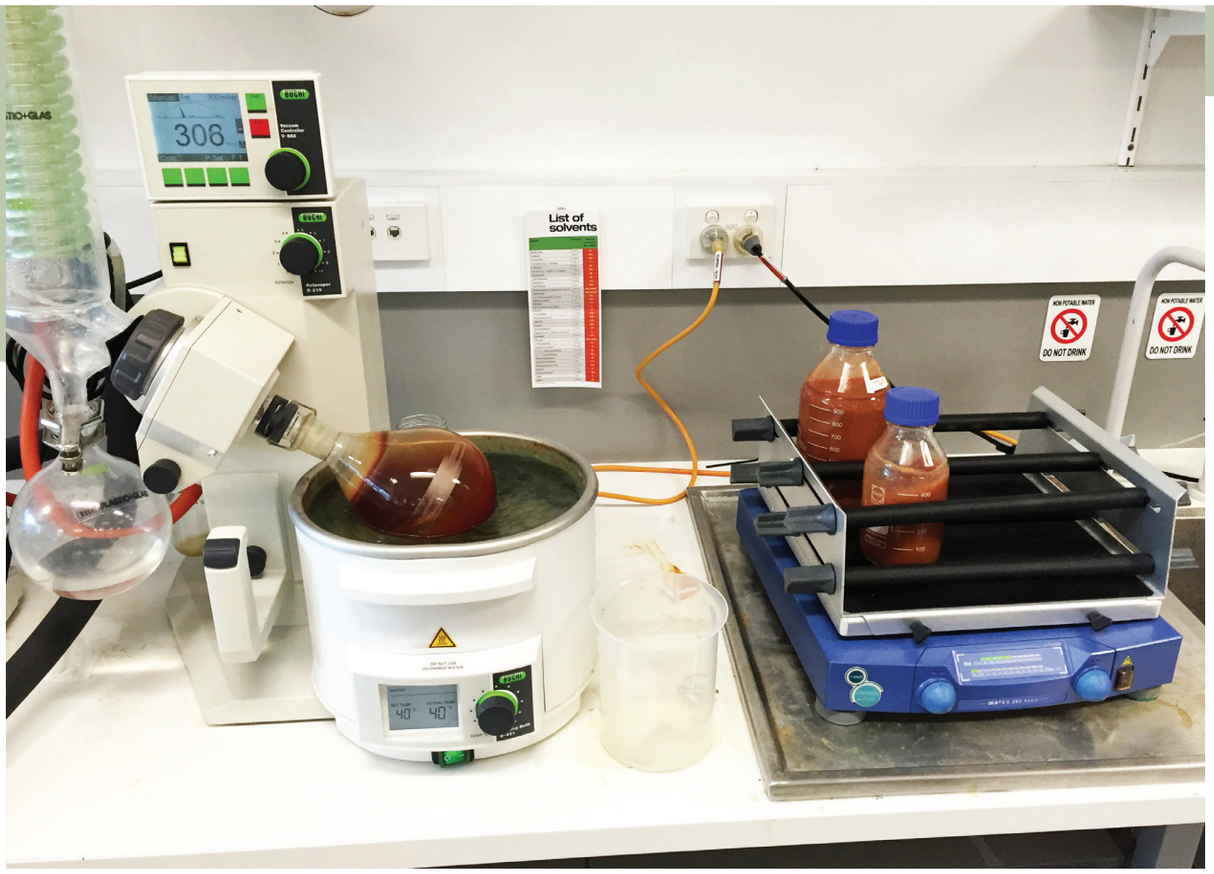
1. Project collaborators: 1) Bioactive Laboratories uses advanced botanical chemistry to identified new medicines within organic compounds. 2) The Fruit Tree Factory operates nurseries for many plantation tree species and using new and innovative methods has been supplying African mahogany seedlings to the industry for over ten years.
2. Terpenes are a large and diverse class of organic compounds, produced by a variety of plants.



Laboratory research directed at identifying and isolating compounds from African mahogany bark, specifically Liminod compounds.

3. Reducing net costs at tree harvest due to resource sharing and increased revenue.
4. Creating a new export opportunity with new and improved plant-based pharmaceutical medicines.
5. Introducing new investment into the plantation-based industry. Improved profitability is expected to assist with investment risk mitigation and in raising investment confidence.

Method and deliverables

The project prepared material from tree bark to enable fractions and Liminoid compounds responsible for medicinal effects to be isolated and identified. The purpose of this was to better target complementary medicines using optimised plant extracts and to develop more targeted future drug candidates.

The results of the project confirm the first and vital step to discovering new pharmaceutical applications from tree harvest residues. The project also suggests an innovative approach to a potentially high value new export opportunity.

The knowledge gained through the process of this research is expected to be transferable to other tree species and to encourage new and novel uses for plantation harvest residues.

The direct outcome of the project will be that a library of isolated fractions and compounds extracted from African mahogany bark will be created. Beyond the project the intention is to make the library available to follow-on researchers to screen for a wide variety of human health conditions.

The wider industry outcome of this research will be to take the knowledge gained through the creation of this process and transfer it to other tree species to screen for human health conditions. In creating a new streamlined process researchers are hopeful that this project will encourage new and novel pharmaceutical uses for tree harvest residues.

Discussion and findings

Identifying individual compounds of the Liminoid family of compounds in African mahogany bark that have the potential for pharmaceutical applications marks the success of this project. More specifically, progress made has demonstrated that bark is a major source of Liminoid terpenes. The project demonstrated that these compounds can be purified, and their structures determined.

Griffith University's School of Environment Professor Tony Carroll confirmed that the project demonstrated the potential of tree harvest residues as sources of compounds that can be used for a variety of applications, including pharmaceutical, veterinary, cosmetic, pest control and as a source of 'rare' fine chemicals for biotechnological research and development.

He said the lack of a sustainable supply of complex naturally derived compounds can stifle their development into pharmaceuticals, but harvesting them from plantation sources provides certainty that can aid in positive decision-making in the drug development pipeline. The project has shown that tree harvest waste material can be converted in to high value products.

FWPA Project: VNB393-1516 | **Project completed**: in December 2017
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