



PROJECT SUMMARY

'NUTRACEUTICAL EXTRACTION FROM AUSTRALIAN WINE INDUSTRY WASTE'

COLLABORATION BETWEEN VIRIDI INNOVATIONS, SWINBURNE UNIVERSITY & SWISSE WELLNESS

KEY POINTS

- Engineering technology and an ethanol-water chemical extraction process capable of processing up to around 900 kg of spent grape marc per hour to produce over 300 kg of grape seeds.
- Enhanced extraction and purification technology to produce high purity, high total phenol content, bulk quantity, and commercial ready materials.
- Validation of analytical techniques for quantifying the purity and type of polyphenols in grape seed extracts.

THE CHALLENGE

The overall objective of this research was to develop an engineering process to extract biologically important and commercially useful compounds from waste streams that would otherwise go to landfill. Specifically, the research team identified and isolated high purity polyphenol antioxidants from grape seeds which includes relatively high proportions of proanthocyanins, which are among the most powerful polyphenol antioxidants in the plant world.

This is a key progression for the industry partner Swisse Wellness to source and produce polyphenols derived from grape seeds as a substitute for imported material. Furthermore, the potential harnessing of increasing global demand for high quality polyphenols is an important step forward and an opportunity to demand a premium on local Australian product which is considered "green" and sustainable.

THE OPPORTUNITY

The key commercialisation opportunity is for the industry partner who has now identified a new and inexpensive source of raw material for which an efficient extraction, isolation and purification template has been established. Several new raw materials are available for input into an existing range of nutraceutical products or, if they choose to, they can develop a new range of antioxidant nutraceuticals based on grape seed extracts.

THE RESEARCH

KEY RESULTS

- The research team developed and optimised plant designed specifically for separating seed from marc (Figure 1). This equipment can be implemented across the sector with appropriate modifications, resulting in reduced waste, and employment and growth opportunities.

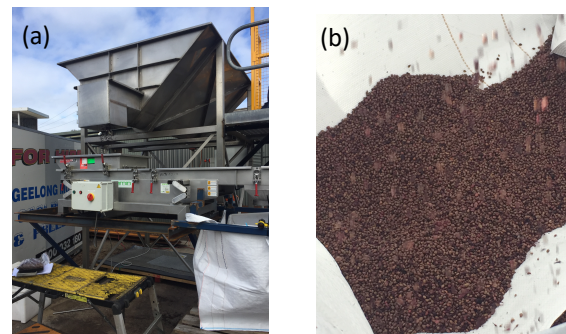


Figure 1. Prototype seed collection assembly. (a) Overview of seed separation machinery (b) Separated and collected seed

- The research team developed and manufactured a small-scale pilot plant providing a low cost, low waste, reduced solvent chemical extraction process of polyphenols from grape seeds. This involved a six-step process of seed separation, grinding, polyphenol extraction, purification using resin columns, elution and spray drying. This reduces processing complexity and increases economic returns which make the uptake more likely.
- The research team demonstrated production of high polyphenol content material, most of which is among the most powerful polyphenol antioxidants in the plant world. Thus, the waste has become an important resource.
- The antioxidant extracts were able to be powderised in high purity (Figure 2), making the material more readily accessible, easily packaged and transported.

OUTCOMES

The research in this project resulted in the development of processes and chemistry to extract biologically important and commercially useful compounds from waste streams that would otherwise go to landfill.

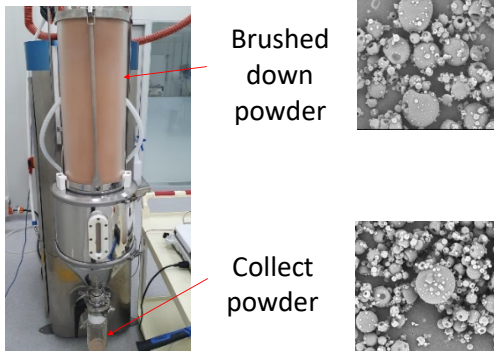


Figure 2. Spray dryer assembly showing final collected grape seed extract powders and scanning electron micrographs (5000 X magnification) of collected materials showing powder particle morphology

The research team successfully produced high purity polyphenol antioxidants which are rich in proanthocyanins – these compounds are highly sought-after nutraceutical ingredients with several reported health benefits.

The project was severely hampered by movement restrictions caused by COVID-19 lockdowns in Victoria and, as such, it was decided to modify the ambitious goal of producing 500 kg of >95% polyphenol grape seed extract to a more achievable 4-5 kg of product for the product launch. The latter was successfully delivered.

Swisse Wellness has plans to incorporate this product in their Swisse Earth range in the first half of next year.

IMPACT

Implementation of this research will see the reduction of grape marc waste from horticulture reduced by around 35-40% per annum, and that waste converted to high value nutraceutical products, noting that other partners will need to be identified to ensure the whole waste stream is utilised.

The exact dollar return will depend on the target market and the degree of purity required because the market is relatively diverse and large. However, an example is the sale of green tea extract with 50% polyphenols powder which sells for around US\$30 per kg. These translates to around US\$20,000 per tonne of grape marc, depending on the mark-up and costs of production.

Ultimately, the return depends on the demand for polyphenols and the cost of production, hence the need for a detailed economic study. The total return can be evaluated based on the total marc generated each vintage.

A new horticulture industry business could be developed, which focusses solely on grape marc extraction. This could involve a business model where mobile plant and equipment visit wine-making facilities and treat the marc onsite or establish a substantial plant which processes all the marc within a region.

NEXT STEPS FOR VIRIDI INNOVATIONS

- Given the new knowledge of the plant and process parameters, undertake a business case/economic study to evaluate:
 - the size of the local and global market and price point maintainable for local provenance; and
 - the best way for the plant to be optimised and scaled up to produce commercial quantities
- Building on the new knowledge of extracting, isolating and purifying polyphenols from marc, carry out laboratory-based trials to further improve extraction and polyphenol recovery
- Utilise the developed engineering and processing parameters to evaluate their suitability to different grape varieties
- Identify additional commercially valuable waste feedstocks

Relevant to this discussion is whether the plant should be located centrally within wine regions or developed into a mobile unit for localised use in the different wine regions; co-operation with other industry partners who can utilise the waste product generated by this process is desirable

PROJECT TEAM

Enzo Palombo (Swinburne University of Technology)
Nick Terziovski (Viridi Innovations)
Lyn George (Viridi Innovations/Austeng)
Russell Brown (Austeng)
Ross George (Viridi Innovations/Austeng)
Carl Tomczak (Austeng)
Sean Jahnecke (Austeng)

PARTICIPANTS



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