Extracting value from grape marc

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Grape marc is one of the major waste products of the winemaking process. After pressing is carried out, grape marc contains around 50% w/w of wine or grape juice. The wine or grape juice is entrained in the marc and cannot be removed by applying pressure. The wine and grape juice leaves the winery with the marc.

In addition to the wine and grape juice that is present, it is clearly apparent that marc contains residual materials important to wine quality that are not extracted during conventional winemaking processes. For example, red grape marc can contain significant quantities of red pigment compounds such as anthocyanins.

Traditionally, grape marc was treated by steam distillation to remove alcohol for use in fortified wine and brandy. The alcohol-free marc was then composted and returned to the soil as organic matter. The downturn in the market for fortified wines and brandy has reduced demand for marc alcohol. Disposal of marc is now more difficult. The high levels of soluble organic compounds such as ethanol and sugar in untreated grape marc introduce environmental impact concerns and make it unsuitable for other applications.

Natural Extraction Technology (NET) is a process that treats standard grape marc to remove grape juice, wine and soluble compounds such as colouring pigments to produce extra product. The treated marc contains less moisture and less soluble material, reducing environmental risk and making it suitable for other uses such as stock feed. Once in operation, the only feed material to the process is grape marc. No additives, process aids or other materials are used.

The NET process includes several technologies that are relatively new to the wine industry, such as counter-current diffusion, crossflow microfiltration, reverse osmosis and solids drying.

The objectives of the NET process are:

1. To extract extra wine volume from each tonne of grapes.
2. To produce wine of a suitable quality standard for use in commercial wine blends.
3. To produce a skin and seed material with lower environmental impact and higher value than conventional grape marc.

The basic steps of the NET process are:

1. Counter-Current Extraction – grape marc is passed through a counter-current extractor (CCE). Soluble materials in the marc are extracted by contact with a dilute liquid that is produced further on in the process and recycled back to the CCE. Wet solids leave the CCE for treatment by Drying (see below).
2. Clarification – the raw extract is clarified.
3. Concentration – the clarified extract is concentrated by reverse osmosis treatment. The concentrate is taken off as product, while permeate is returned to the CCE as part of the dilute extraction liquid.
4. Drying – solids leaving the CCE are dried to remove liquid. The liquid vapour is condensed and returned to the CCE as part of the extraction liquid.

The final products of the process are a wine or grape juice made up of most of the liquid and soluble organic materials in the feed marc, and skin and seed solid containing less than 5% moisture.

The wine produced from the NET process complies with the requirements for Australian wine in the Australian and New Zealand Food Standards Code. In addition, when operating on marc of known origin, variety and vintage, the resulting wine can retain these characteristics under the Australian Wine and Brandy Corporation label integrity program.

A commercial scale NET plant has now been operating for three vintages at Tandou Wines, located at Monash in the South Australian Riverland. The process design has been altered over these three vintages to give enhanced performance and process reliability.

During the 2006 vintage, the plant gave the following results¹:

White: Processed 437 tonnes of marc for a yield of 46 litres/fresh tonne of grapes
Red: Processed 2310 tonnes of marc for a yield of 38–55 litres/fresh tonne of grapes

Yield is influenced by the liquid content of the incoming marc and the degree of concentration carried out by reverse osmosis.

Product quality has improved over the three years that the plant has been operating. Samples of the 2006 red wine have been shown to a number of winemakers, who have given encouraging feedback. The products have deep red colours, varietal aromas and rich, full palates with low levels of bitterness and astringency. The white product, however, is high in extracted phenolic material, which presents challenges to obtaining wine suitable for commercial blending.

The dried seeds and skins from the NET process are suitable for stock feed. Consideration has also been given to using the dried residues for boiler fuel, providing the energy required for the process. Extraction of the seeds from the marc prior to the NET process is also under way. This gives high quality seeds for oil extraction and improved CCE capacity. Little material is extracted from the seeds under CCE conditions.

Over the last three years, a small-scale counter-current diffusion unit has been operated by Provisor following protocols developed by Scorpex Wine Services to gain more fundamental knowledge of the impact of operating parameters, raw marc condition and other factors on plant efficiency and product quality. This study has been funded by a Food Innovation Grant. Outcomes from the Provisor work have been used to make significant enhancements to the commercial NET process.

The NET process can only generate enhanced efficiency if it is cheaper to make more product from the same quantity of raw materials rather than buy more raw material, and if the total value of the extracted material exceeds the cost of extraction. Current

¹ All yield data assumes production of 15% marc weight per weight of fresh grapes.
grape pricing makes it challenging to justify the costs of increased extraction from the same amount of raw material. The total value of the wine produced is increased by enhanced quality and volume. Over and above the economic appraisal, the benefit given by the improved environmental performance of the outputs of the process should be considered.

**Conclusion**
Improved production efficiency can be gained by extracting more product per unit of raw material input, but only if:

1. The cost of extraction is lower than the cost of buying and processing more raw material to produce the same quantity of product.
2. The total value (value times volume) of the incremental volume of product exceeds the costs of extraction.
3. Extraction of more product from raw materials leads to less waste and environmental impact.