High-throughput parallel evaporation system for grape berry phenolics determination

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Grape berry phenolic composition is likely of greater importance as a marker of crop quality compared to berry juice composition. Furthermore, it is relatively easy to manipulate grape juice/must sugar and acid concentration in the winery compared to that of anthocyanin and tannin concentration. Because phenolic composition is highly responsive to viticultural practices, the need to be able to quantify berry phenolic composition in response to experimental treatments in the vineyard is critical.

While final phenolic composition (i.e. at harvest) is the most important variable to measure, it is only through the monitoring of phenolic development over time that we gain the most insight into how viticultural practices influence grapevine physiology, fruit development, and ultimately wine quality. This monitoring requires repeated sampling, and the ability to process those samples efficiently with high degrees of accuracy and precision.

The Harbertson-Adams phenolics assay is a well-established, colorimetric assay that was developed for grapes and wine. Initially the assay utilized standard 1-cm pathlength spectrophotometers that could read one to five samples at a time. The rationale was to develop a simple way to measure phenolics using relatively inexpensive and common laboratory equipment (as opposed to more advanced chromatographic methods, such as HPLC or GC-MS). It has since been downsized for high-throughput microplate spectrophotometers that can read 96 samples at a time. Another advantage of this assay is that it uses the exact same procedure to measure phenolics in grapes and in wine, allowing for a direct analytical link between the two products. However, preparation for grape samples is tedious, and requires an improved high-throughput system that can improve data production.

The Büchi Syncore® Analyst system[1] used in the Levin Lab has revolutionized data production with respect to phenolics analyses (Fig. 1). This high-throughput system allows for the simultaneous concentration of up to 12 laboratory samples (a required step in the preparation process), thus has greatly reduced production time. It is computer controlled, and therefore requires very little technical skill to operate with a high degree of accuracy and precision. Also, there are few moving parts to the system that eases troubleshooting when problems arise (in stark contrast to the advanced systems referenced above).

Thus far, this system has allowed us to produce large amounts of high quality data that have given us insight into how grape berry phenolic development occurs in response to experimental treatments (Fig. 2). This type of work is fundamental to the research program in the Levin Lab, and would not have been possible without the support of the Erath Family Foundation. The data generated by this system has allow us to pursue larger funding opportunities with grants of $180,000 and $300,000 from the Oregon Department of Agriculture and the United States Department of Agriculture. Finally, several students that trained in our lab have gone on to work in the wine industry or to graduate school or both. In this way, the Foundation's support of this equipment purchase has catalyzed innovative research that will continue to advance Oregon's wine industry well into future.

[1] https://www.buchi.com/us-en/products/parallel-evaporation/syncore-analyst

Figure 1. The Büchi Syncore® Analyst system located in the Levin Lab at the Southern Oregon Research and Extension Center.

Figure 2. Anthocyanin accumulation over time in Pinot noir berries as a function of irrigation treatment and Red Blotch virus status in 2017. Data points are means ± one standard error.