Qvevri use in Winemaking

Yanmei Zhang, **Kyle Johnston**, and Brent Trela*
Tech University, Dept. of Plant and Soil Science, Lubbock, Texas, 79409
*Corresponding author E-mail: **trelab@alertaesthetics.com**

Introduction

Qvevri are earthenware vessels resembling amphora without handles that originated in the Caucuses around 6,000 BCE. Qvevri, usually buried below ground, were the primary vessels used for the fermentation and storage of wine. Qvevri range in size from a few liters to more than 3,000 liters. Despite their continued widespread use in traditional Georgian winemaking, modern winemaking equipment render the use of qvevri inefficient. Nevertheless new recognition and appreciation of Georgian wine, wine history and winemaking techniques are causing newfound interest in Georgian winemaking traditions and technology beyond its borders. Qvevri and the wines made in them are unique and a potential consumer attraction to a qvevri equipped winery or tasting room. There are few reports on the effects, if any, to a wine's composition after fermentation or storage in qvevri as opposed to similar vessels, such as concrete, or stainless steel. This study evaluated 1) the porosity of qvevri lined with beeswax as a sealant and 2) the influences of clay and beeswax on specific wine volatile compounds.

Materials & Methods

Materials: Four handcrafted qvevri fired to cone 02, approx. 1102 °C (Sleeping Dog Studio); four 4-L glass jars with lids; beeswax (Walker Honey Farms); model wine (pH 3.3, ethanol 12.0%v/v, potassium bitartrate 5 g/L in de-ionized water); commercial red wine (Barbara, Ruby Cabernet, Dolcetto blend, non-vintage, Llano Estacado Winery)

Method:

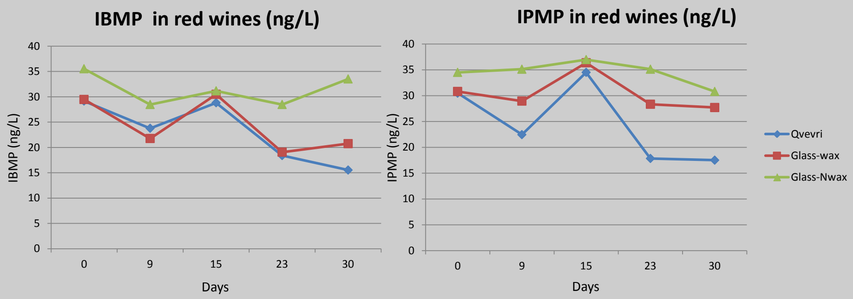
1) Qvevri porosity was measured by the average weight change before and after soaking with water for 24 hours. All qvevri were coated with beeswax because a previous test with the same qvevri before beeswax coating resulted in liquid leakage.
2) Concentrations of 3-isobutyl-2-methoxypyarzine (IBMP), 3-isopropyl-2-methoxypyrazine (IPMP), ethyl acetate, β-Linalool and geraniol were added to the model wine. The wine was stored in four qvevri glazed with beeswax, two glass jars glazed with beeswax (G1), and two glass jars without bees wax (G0, control lots). The 8 containers were stored at 20°C in the dark for 30 days. Qvevri openings were sealed with polyethylene wrap. 45 mL of wine was collected from each container every week until the experiment was completed. IBMP, IPMP, ethyl acetate, β-Linalool, and geraniol were quantified by Stir Bar Sorptive Extraction-Gas Chromatogram-Mass Spectroscopy (SBSE GC-MS). The experiment was repeated using red wine following the same procedure.

Results & Discussion

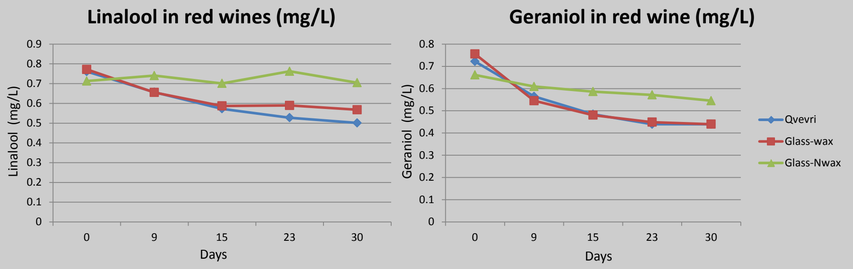
Table 1. Result of porosity test

ID		Volume(L)	Dry Weight (kg)	Weight after soaking 24hr (kg)	Weight change (kg)	Percentage of weight change
Qvevri #1		6.00	4.67	4.73	0.06	1.3%
Qvevri #2		6.75	5.39	5.44	0.05	0.9%
Qvevri #3		7.00	4.92	4.96	0.04	0.8%
Qvevri #4		7.75	5.44	5.51	0.07	1.3%
Glass #5	with wax	4.00	1.11	1.11	0.00	0.0%
Glass #6	with wax	4.00	1.13	1.14	0.01	0.9%
Glass #7	w/o wax	4.00	1.04	1.04	0.00	0.0%
Glass #8	w/o wax	4.00	1.04	1.04	0.00	0.0%

The volume and the dry weight of qvevri vary because of their hand-made nature. After soaking with water for 24 hours, qvevri gained about 1.1% weight on average compared to their dry weight (Table 1). The qvevri absorbed liquid and this porosity may cause volume loss and liquid-air exchange in and out of qvevri.

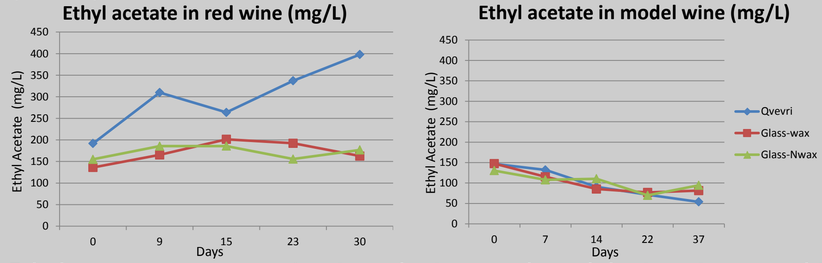


The concentrations of IBMP and IPMP, the volatile compounds possessing distinctive vegetative aroma, in qvevri and G1 declined in 30-day aging trials, while they did not decline significantly in G0.



The concentrations of β-Linalool and geraniol, volatile terpenes that can contribute fruity and floral respectively aromas in wines, in qvevri and G1 also declined during the 30-day aging trials, while they did not decline significantly in G0.

Similar volatile depletion trends in IBMP, IPMP, linalool and geraniol concentrations were found in model wine experiments. These results indicate that beeswax on clay jars and glass jars can absorb the volatiles and possibly alter wine flavor. Selected volatiles tended to have lower concentrations in qvevri than in glass jar with beeswax. This might relate to the property of different materials, such as porosity and polarity etc.



Ethyl acetate concentration in red wines and model wines increased in qvevri. Extremely high conc. of ethyl acetate and high volatile acidy (VA) in the red wine in qvevri was indicative of oxidation. In the model wine trial, ethyl acetate concentrations in qvevri was comparable to both G1 and G0 and tended to decrease with increased aging time. Some reports and popular journals have indicated that qvevri wines tend to have higher VA indicative of oxidation conditions, compared to conventionally made wines. The porosity of the clay-beeswax combined with the large surface area to volume ratio in the small trial containers combined with the oxygen permeable polyethylene seal are likely responsible for the oxidation.

Conclusions

Results: The qvevri absorbed liquid, averaging about a 1% increase in total weight after 24 hours. Significantly higher concentrations of IBMP and IPMP were measured in the model wines after storage in the qvevri (data not shown). The clay material of the qvevri, which has higher porosity than glass, is likely responsible for liquid volume loss, concentrating pyrazine compounds in the wines that may result in higher vegetal flavor intensity. Ethyl acetate, β-linalool, and geraniol concentrations in the model wines stored in qvevri were unchanged (data not shown). Beeswax glaze absorbed β-linalool, geraniol, IBMP and IPMP, but did not affect ethyl acetate concentration in both model wine and red wine.

Acknowledgements:
Thanks to Sleeping Dog Studio, San Marcos, TX for the donation of the qvevri; Walker Honey Farms, Rogers, TX for the donation of the bees wax, Llano Estacado Winery, Lubbock, TX for the donation of wine, and Tom Vincent for his efforts.