Iowa State University

72nd ASEV National Virtual Conference June 21–24, 2021

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Valorization of cold-hardy grape pomace using an infrared drying method

Introduction

During the wine making process, phenolic compounds including condensed tannins are extracted from grape skins and seeds and released into the wine. However, the extraction is far from being complete due to the skin size, the seed structure and the solubility of tannins in the alcoholic solution. After red wine fermentation and pressing, about 20% weight of fresh grapes as grape pomace is produced and about 50 % of tannins remain in *Vitis vinifera* grape pomace [1].

In interspecific cold-hardy (non-*Vitis vinifera*) grapes, little is known about the extraction of tannins, the concentration remaining in the pomace, and their tannin retention during red winemaking. In wines produced from interspecific hybrid grape varieties, the content of polyphenols especially tannins is much lower than in wines from Vitis vinifera grapes [2], suggesting that those compounds are not completely extracted during the alcoholic fermentation in red winemaking and therefore remain more in the pomace from cold-hardy grapes. Very few studies have focused on the effect of the drying process (temperature and length conditions) on the polyphenolic content and antioxidant capacities in grape pomace and no research has been carried out yet on this aspect on cold-hardy grape pomace.

The goal of this study was to optimize a sustainable drying method of cold-hardy grape pomace to make powder microbiologically safe and that contains polyphenols with antioxidant properties.

Material and Methods

Fresh grape pomaces after pressing from 'Edelweiss' (E) and 'Marquette' (M) grapes

Table 1. Duration of infrared (IR) heating to dry grape pomace from about 50-60% moisture content to less than 10% wet basis, using a bench-top 12" * 24" catalytic IR heater.

Sample	Drying method	Time (min)	Pomace surface temperature (°C)
'Edelweiss' pomace	IR-Low heat (E-IR-LH)	62	71
	IR-Modified (E-IR-MH)	19	124
	IR-High heat (E-IR-HH)	27	131
	Hot air drying (E-HA)	128	-
'Marquette' pomace	IR-Low heat (M-IR-LH)	22	78
	IR-Modified (M-IR-MH)	14	125
	IR-High heat (M-IR-HH)	17	141
	Hot air (M-HA)	91	-

Ground dry pomaces

Color measurement (Hunter Lab Color Flex EZ)

Extraction of phenolic compounds: dry pomace (50 g/L) in 70% acidified acetone, 24h in the dark under nitrogen

Dry pomace extracts after solvent evaporation and freeze-drying

- Iron-reactive phenolic and tannin content by UV-Vis spectrophotometry [3]
- Antioxidant activity using DPPH method [4]
- Microbiological analysis: Aerobic Plate Count; Spore-forming bacteria; Yeasts and molds

Results and Discussion

'Edelweiss' white pomace dried by IR was darker with a lower L* and b* values than dried by HA. The color of 'Marquette' pomace was not affected by the drying method (data not shown).

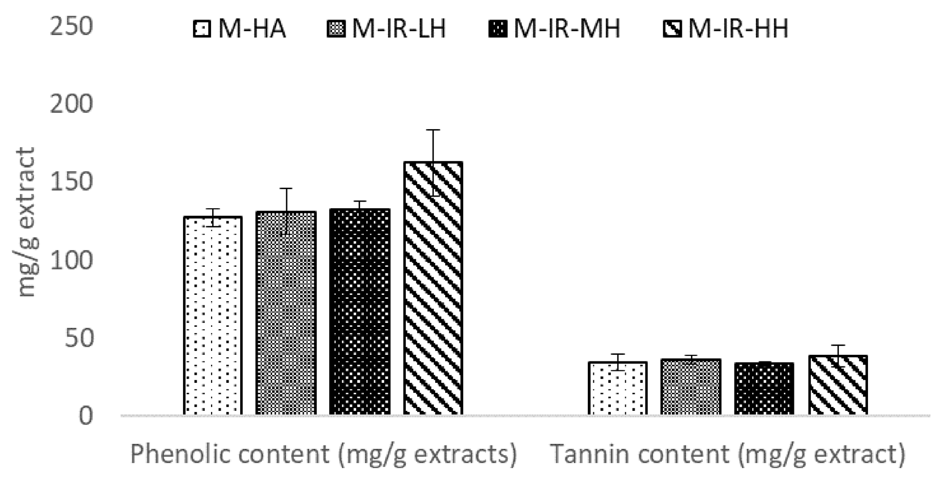

Fig 1. Phenolics and tannin content in mg/g dry extracts in 'Marquette' red pomaces.

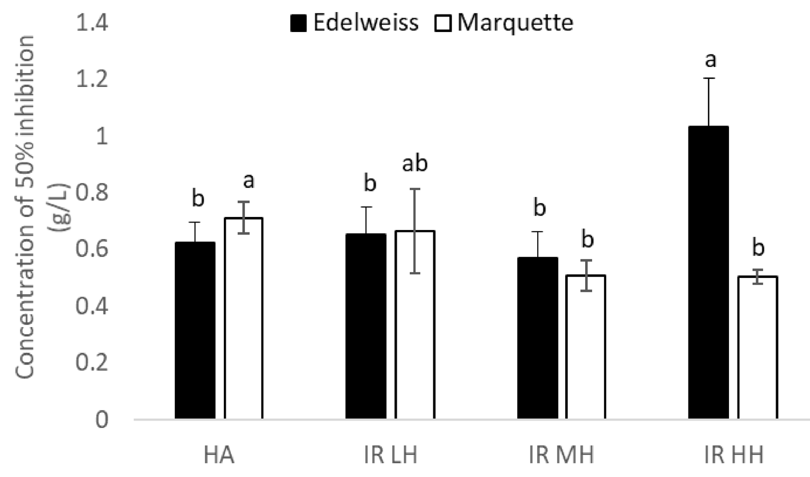

Fig 2. Antioxidant activity of pomaces as the concentration of 50 % DPPH inhibition.

The phenolics content in Marquette pomace was higher after drying under IR-HH conditions, but the tannin content was not impacted (Fig 1). The antioxidant activity was higher in Marquette pomace after IR-MH and IR-HH drying but was lower under this later condition in Edelweiss pomace (Fig 2).

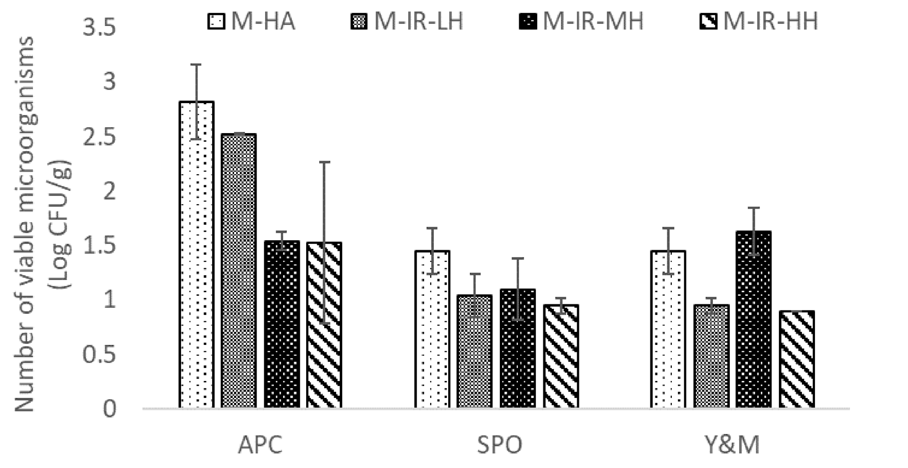

Fig 3. Number of viable microorganisms (Aerobic Plate Count (APC), Spore-forming bacteria (SPO), Yeasts and Molds (Y&M)

The HA drying method was the least effective method to reduce the bacterial population, yeast and molds of the pomaces (Fig 3). The IR-HH drying method could significantly reduce the microbial load on pomace samples.

Conclusion

The catalytic IR drying method is a more effective method to dry grape pomace in a short period of time at high temperature without reducing the phenolic compounds content and antioxidant properties. It effectively reduces the risk of microbial spoilage in cold-hardy grape varieties which can then be used in winemaking or in the food industry.

Acknowledgements. The authors would like to thank The Cellar winery at Cambridge, IA for their kind donation of grape pomaces.

Funding source: USDA-AMS Iowa Department of Agriculture and Land Stewardship Specialty Crop Block Grant Program.

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