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Effects of Pulsed Electric Field (PEF) Preprocessing During Maceration for Red Wine Processing of Idaho Wines: Analysis of Polyphenol Content in Sangiovese Red Wine

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This research was funded by the 2021 Idaho State Department of Agriculture Specialty Crop Block Grant.

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Abstract

- The wine industry has created around 70 wineries in Idaho and has had a $209.6 million impact on its economy.
- The cool climate has made white wines its top-produced wine, however, Idaho has recently been focusing on increasing production of red wines.
- Sangiovese grapes are a light red color, so producers are interested in increasing the strength of the color pigment.
- Red wine is produced through the maceration of grapes.
- Maceration is the process where grapes soak in their juice after being crushed to extract color and flavor from their skins.
- The maceration time is around 7 days, and producers hope to decrease that time to increase wine production.

Comments

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Analysis of Polyphenol Content in Sangiovese Red Wine

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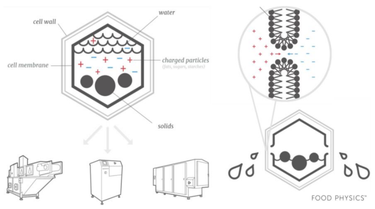
Introduction

- Pulsed Electric Field (PEF) is a treatment that pulses a high-strength electric field through a material that is between two electrodes.
- For the wine industry, PEF shows promising results in expediting the aging process while maintaining or improving the quality of the wine.
- Polyphenols are part of a large group of aromatic phenol-containing groups that affect the wine's color, taste, and aging properties.[2]
- PEF can help release polyphenols from the grapes at a quicker rate, which reduces maceration times and increases the wine's color and taste.

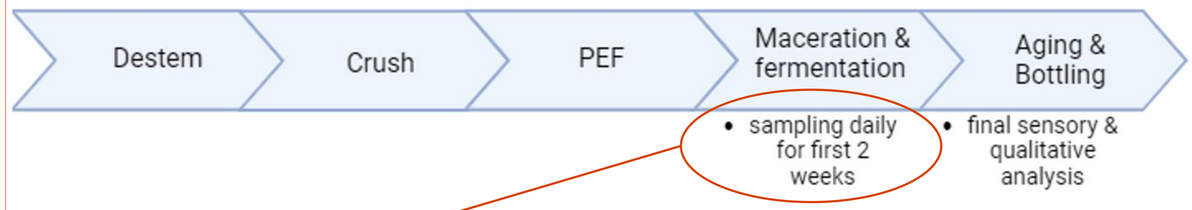


Hypothesis

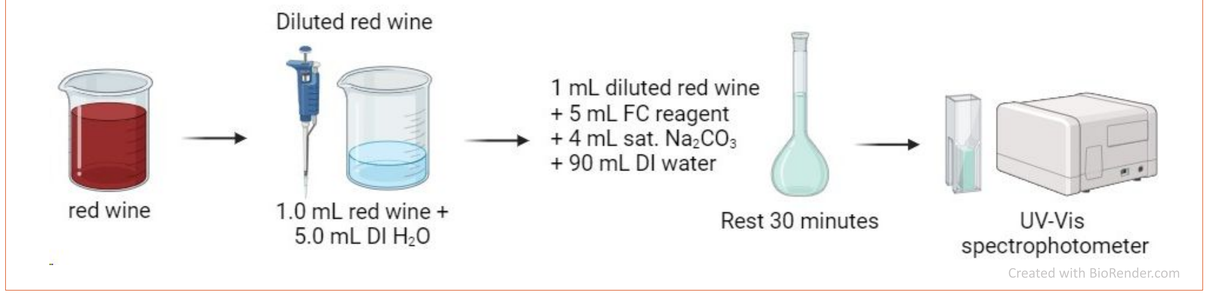
We hypothesize that Pulse Electric Field application will improve extraction efficiency from Sangiovese grapes to generate red wine that will be more fragrant with deeper, more appealing color.

Methodology

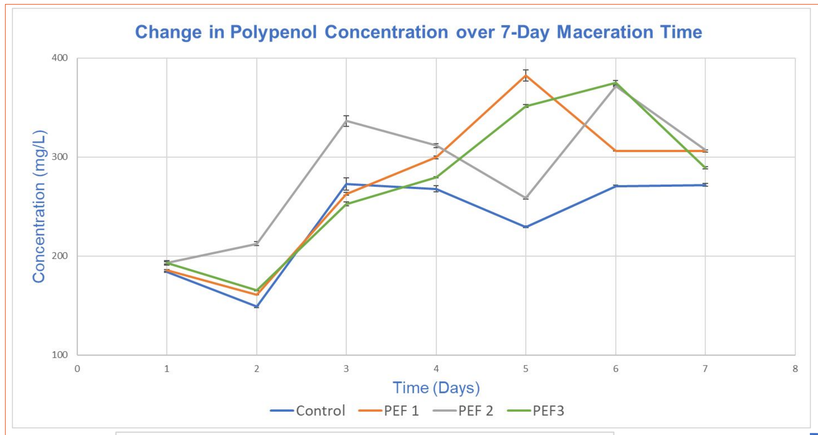
Wine Process from Grape to Bottle:

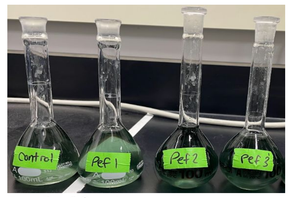


Folin-Ciocalteu Method:



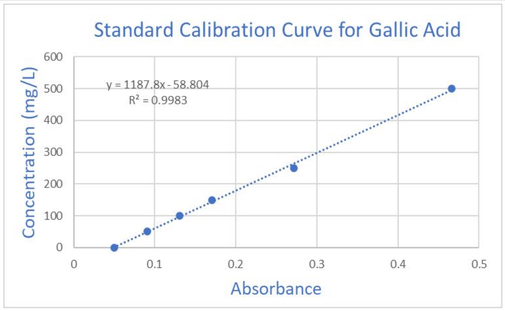
Results





From Day 6 Sample

- Folin-Ciocalteu (FC) reagent releases a blue color when it reacts with phenols.
- The darker the blue color is, the higher the concentration of polyphenols is in the solution.
- This color change allows UV-Spectroscopy to be used to determine the absorbance values.



PEF System Parameters

Sample	Specific Energy	Field Strength
Control	–	–
PEF 1 (Low)	15 kJ/L	5 kV
PEF 2 (Medium)	10 kJ/L	20 kV
PEF 3 (High)	20 kJ/L	24 kV

This is the 2nd year working with Cinder Wines so PEF Parameters were increased significantly

Discussion

- The control reaches a max polyphenol concentration of 273 mg/L around Day 3 and then remains fairly constant.
- All PEF treatments showed an increased in polyphenol concentrations in comparison to the control.
- PEF 1 exceeded the control maximum on Day 4 at 300 mg/L and hit a max concentration of 382 mg/L on Day 5.
- PEF 2 exceeded the control maximum on Day 3 at 336 mg/L and hit a max concentration of 372 mg/L on Day 6.
- PEF 3 exceeded the control maximum on Day 4 at 279 mg/L and hit a max concentration of 375 mg/L on Day 6.
- PEF 2 showed the most improvement on maceration time with higher concentration rates on Days 2-4 compared to the other samples
- Therefore, the most effective PEF parameter had a specific energy of 10 kJ/L and a field strength of 20 kV.
- Results show PEF should decrease maceration time, and increase the polyphenol concentration which will strengthen the color, taste, and fragrance of the wine.

Future Work

- Collect monthly sampling until aging is done to observe if red color has also been benefited.
- Sensory analysis at the end of aging by Cinder to evaluate the impact on the aroma and quality of the wine.

Acknowledgements

- This research was funded by the 2021 Idaho State Department of Agriculture Specialty Crop Block Grant.

CINDER FOOD PHYSICS™ BOISE STATE UNIVERSITY IDAHO STATE DEPARTMENT OF AGRICULTURE

Citations

(1) Ripe for Growth IDAHO'S WINE INDUSTRY; **2020**.

(2) Saldaña, G.; Cebrián, G.; Abenoza, M.; Sánchez-Gimeno, C.; Álvarez, I.; Raso, J. Assessing the efficacy of PEF treatments for improving polyphenol extraction during red wine vinifications. Innovative Food Science and Emerging Technologies **2017**, 39, 179-187, https://doi.org/10.1016/j.ifset.2016.12.008