Poster 11

Determination of 4-Ethyl Catechol in Faulted Wine using Sensory Evaluation and the Electronic Tongue

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ABSTRACT

When the wild yeast *Brettanomyces* grows in wine, it produces several compounds that can alter the sensory properties of a wine. At low levels, some winemakers feel that these compounds exert a positive effect on wine but at high concentrations, these *brettanomyces*-related compounds may exert a negative effect. While several of these *brettanomyces*-related compounds have received research attention to determine aroma thresholds, one of these compounds, 4-ethyl catechol (4-EC) has received less study. Thus, the objective of this study was to determine the sensory impact of 4-EC on the sensory profile of *brettanomyces*-contaminated wine. Different concentrations of 4-EC (493, 714, 1035 and 1500 µg/L) were added to a WA State Merlot wine. Both the consumer detection threshold (DT) and the consumer rejection threshold (CRT) of 4-EC were determined. The electronic tongue (e-tongue) was also used to distinguish among the different concentrations of 4-EC. The threshold value of 4-EC in the WA State Merlot was determined to be 823 µg/L. No differences in consumer preference were found between the control wine (no 4-EC) added and the wine containing the highest concentration of 4-EC (1500 µg/L). The electronic tongue was able to discriminate (DI=82%) among the samples of 4-EC (base wine and four concentrations of 4-EC). The lowest concentration distinguished by the e-tongue was 493 µg/L, which was lower than the sensory threshold determined in this study. These findings suggest that for the detection of 4-EC in Merlot wine, the e-tongue may be more sensitive than many consumers. These results show great promise as they demonstrate the e-tongue as a methodology for the detection of sub-threshold concentrations of chemical compounds in wine. The results also further illustrate the many applications of the e-tongue in wine research, including early detection of wine faults.

INTRODUCTION

Brettanomyces spp is a wine spoilage microorganism which finds it way into a winery through importation of infected wine, fruit flies, old barrels and poor equipment sanitation. Brettanomyces-tainted wines have been described as having "barnyard", "mousy", "horsey" odors (1). Brettanomyces-taint is controversial as some experts and consumers feel that Brettanomyces taint lends complexity to the wine. Brettanomyces aromas and flavors are due to the presence of the volatile phenols, including 4-ethyl catechol (4-EC), among other compounds (2). As previous research has found the concentration of the metabolic precursor to 4-EC (caffeic acid) is in higher amounts compared to other precursors in WA State red wines (3), the sensory impact of 4-EC was an important question to answer for the WA Wine Industry.

To answer this question of the sensory impact of 4-EC in red wine, we ran a series of studies employing both analytical and sensory methods. In sensory evaluation, detection threshold (DT) indicates the concentration of a compound that needs to be present for a difference to be detected in a wine while consumer rejection threshold (CRT) panels determine the rejection point of a particular sample by consumers. The present study determined both the DT and CRT of 4-EC in wine, while also employing the electronic tongue (e-tongue) to discriminate among the same concentrations of 4-EC that the consumers were evaluating. The e-tongue, a novel piece of analytical equipment, which operates on the principles of the neurophysiology of the sense of taste would provide insight into changes in taste profiles with different concentrations of 4-EC

METHODS

Sensory evaluation was done using untrained but experienced red wine consumers. Taste attributes (sourness, sweetness, umami, metallic, bitterness and spiciness) were analyzed using the Astree Electronic Tongue (Alpha MOS)

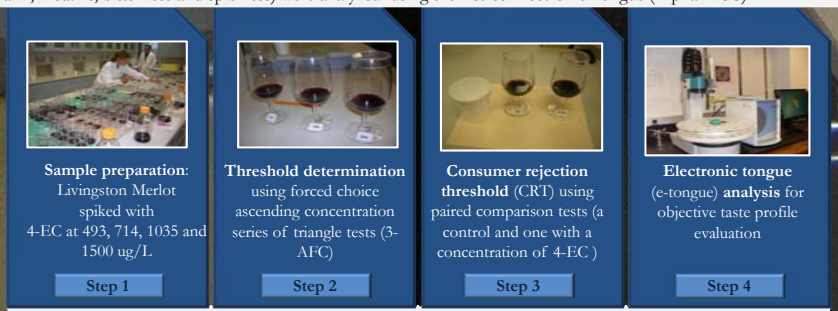

Figure 1. Sensory testing and electronic tongue analysis for of 4-ethyl catechol containing red wine.

REFERENCES
1) Fugelsang and Edwards (2007). Wine microbiology. Springer. 2) Moreno-Arribas and Polo (2009). Wine chemistry and biochemistry. Springer. 3) Schopp et al. (2014). J. Agric. Fd. Chem (online). 4) Curtin et al. (2008). Proc. 13th Australian Wine Tech. Conference:207-211. 5) Botha, J. (2010). Thesis: Stellenbosch University

RESULTS AND DISCUSSION

The threshold value of 4-EC as determined by the panelists was 823 ug/L (Figure 2). This threshold value compares to a previously reported value of 774 µg /L, which was determined in in Cabernet Sauvignon (4). A lower value of 442 ug/L was reported in Pinotage (5). No significant differences were found in consumer acceptance of 4-EC containing wines (Figure 3). This may be due to the relatively low number of consumers used in the study (n=36). However, these results may also be attributed to differences among consumers in sensitivity to 4-EC, as apparent in the threshold determination, or differences among consumers in their acceptance of 4-EC in wine.

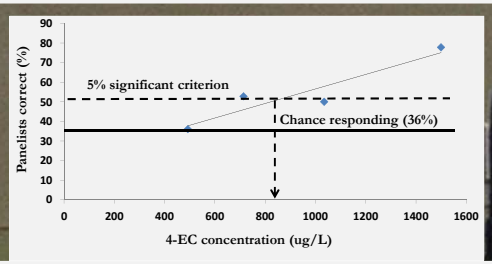

Figure 2. Percentage of consumers correctly identifying the wine with added 4-EC (n=36).

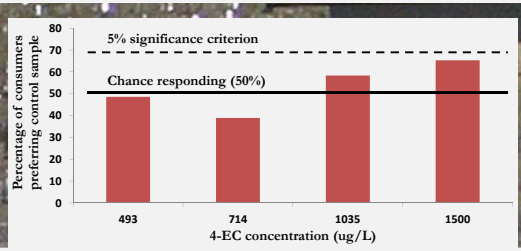

Figure 3. Percentage of consumers preferring a wine without added 4-EC on two separate days of testing (n=36).

Figure 4 shows the results from the e-tongue analysis. A high discrimination index of 82% indicated that the e-tongue detected differences among red wines containing different concentrations of 4-EC. High concentrations of 4-EC (1500 and 1035 ug/L) were associated with low response of the e-tongue to the different taste attributes. The control wine with no added 4-EC was defined as being higher in the attributes assessed by the e-tongue, including sweetness and sourness.

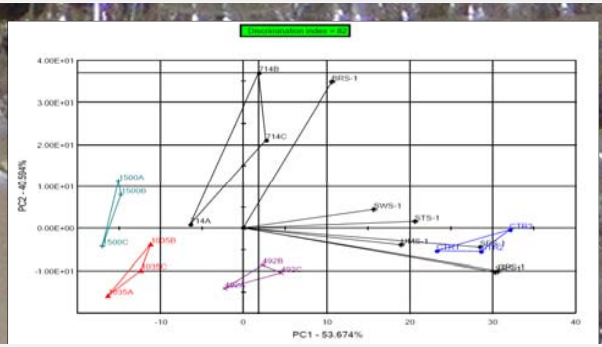

Figure 4. Electronic tongue discrimination of 4-EC solutions. The 4-EC concentrations examined were 493, 714, 1035 and 1500 µg/L.

CONCLUSION

The lowest concentration detected by the e-tongue was 493ug/L which was lower than the threshold determined in this study (823 ug/L). These results demonstrate that the e-tongue is as a promising tool in the detection of sub-threshold concentrations of compounds contributing to faulted wines.