# Understanding the Impact of 4-Ethylphenol and 2-Isopropyl-3-methoxypyrazine on the Acceptability for Sale of Ontario Riesling Wines

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## INTRODUCTION

Faulty wines in the retail space can have a detrimental impact on the brand, retailer and consumer confidence. Identifying faulty products before they reach the consumer mitigates the potential impact on reputation and financial costs. (Ridgway *et al.*, 2010). Contamination due to micro-organisms and/or insects during the wine making process can evolve into wine sensory faults, and if undetected, reach the consumer. For this study, two chemical markers, which in sufficient concentrations can render a wine faulty, were considered: 4-Ethylphenol (4-EP) and 2-Isopropyl-3-methoxypyrazine (IPMP). These two chemical markers are associated with Brettanomyces and multicolour Asian lady beetle wine faults, respectively (Romano *et al.*, 2009, Pickering *et al.*, 2006).

## OBJECTIVES

The purpose of this research was to determine aromatic sensory Detection Threshold (DT) and Rejection Threshold (RT) levels that winemakers can employ to assist in evaluating an Ontario Riesling.

## METHODS AND MATERIALS

### Chemical Reagents

The chemical standards 4-ethylphenol and 2-Isopropyl-3-methoxypyrazine were purchased from Sigma-Aldrich (Oakville, Canada).

### Wine

The wine used for this study was a commercially available 2012 Ontario Riesling.

### Sensory Analysis

The DT and RT were determined using a modified same-different methodology. A total of 365 samples were presented to a panel comprised of 73 experienced and trained wine assessors. Using a randomized block design each assessor was presented a reference sample together with wine samples spiked with a single fault in ascending concentrations. Assessors were asked to: 1) nose each spiked sample and compare it with the reference "unspiked" sample, 2) determine if the samples were different, if so, identify the specific wine fault and 3) if the identified spiked sample was acceptable for sale.

## RESULTS 4-EP

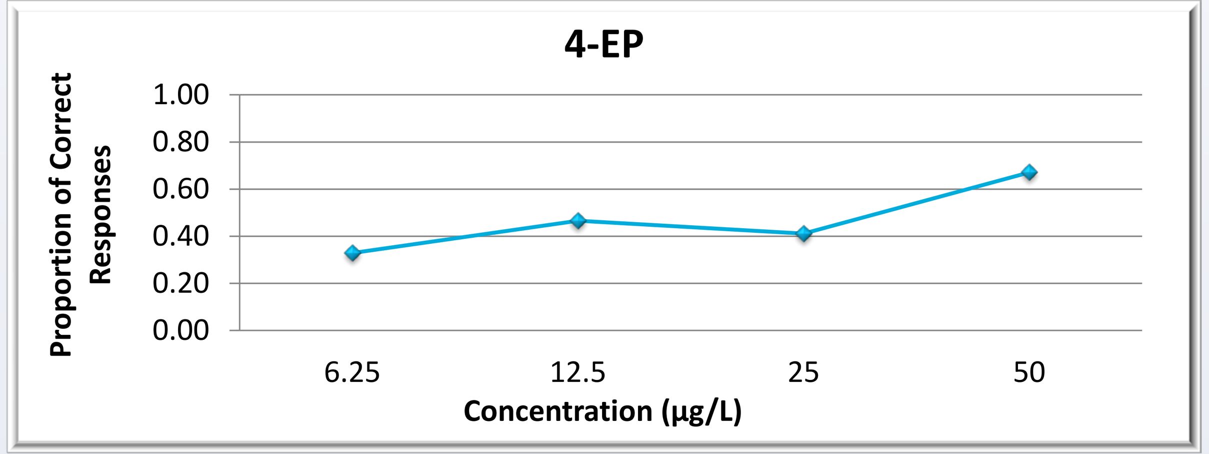


Fig.1 Proportion of assessors (N=73) that correctly identified a difference for wines spiked with increasing concentrations of 4-EP.

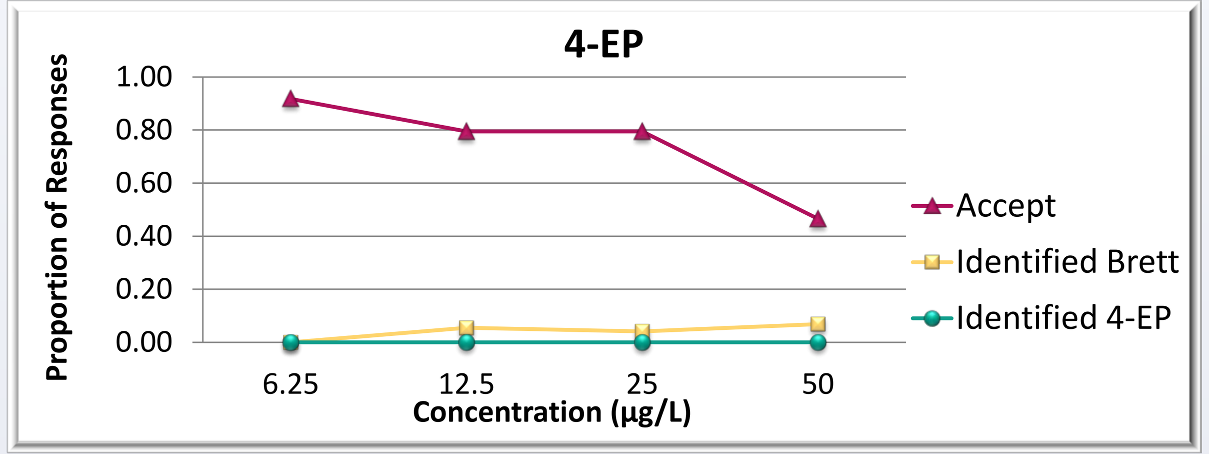


Fig.2 Proportion of assessors (N=73) that accepted wines with increasing concentrations of 4-EP compared with those that were able to correctly identify the fault as 4-EP or Brett.

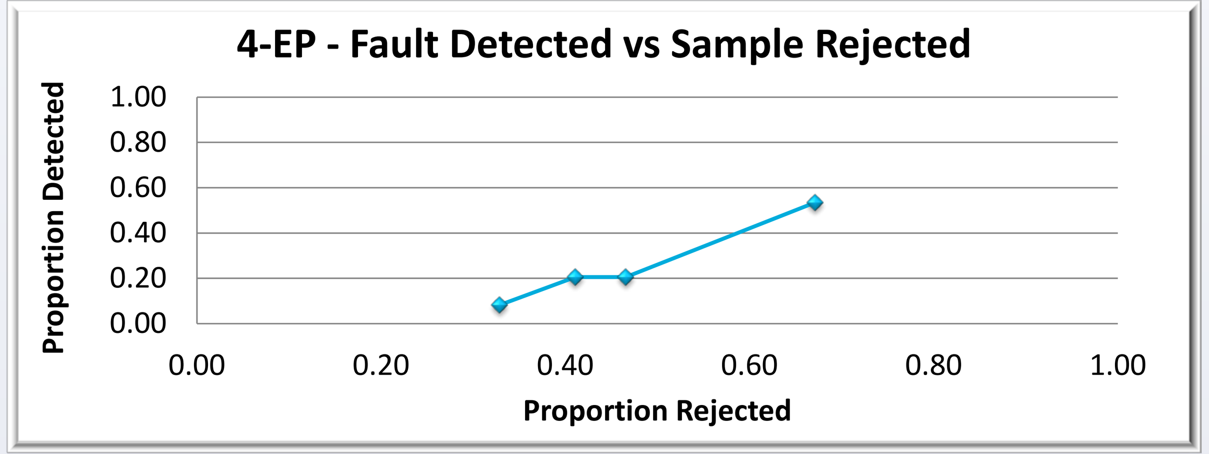


Fig.3 Comparison of the proportion (N=73) of assessors that correctly identified a difference versus the proportion of assessors that rejected the wine containing 4-EP.

Table 1. The proportion of assessors that identified 4-EP at four different concentrations, with groupings from a Marascuilo procedure following a significant chi-squared test (α=0.05).

| Sample | Proportion | Groups | |
|---|---|---|---|
| 6.25µg/L | 0.329 | A | |
| 12.5µg/L | 0.411 | A | |
| 25µg/L | 0.466 | A | B |
| 50µg/L | 0.671 | | B |

Table 2. The proportion of assessors that accepted 4-EP at four different concentrations, with groupings from a Marascuilo procedure following a significant chi-squared test (α=0.05).

| Sample | Proportion | Groups | |
|---|---|---|---|
| 6.25ug/L | 0.918 | A | |
| 12.5ug/L | 0.795 | A | |
| 25ug/L | 0.795 | A | |
| 50ug/L | 0.466 | | B |

### 4-EP Summary

Table 3. The DT and RT of 4-EP in an Ontario Riesling wine.

| Number of Assessors | Compound | Detection Threshold | Rejection Threshold |
|---|---|---|---|
| 73 | 4-EP | 28µg/L | 48µg/L |

## RESULTS IPMP

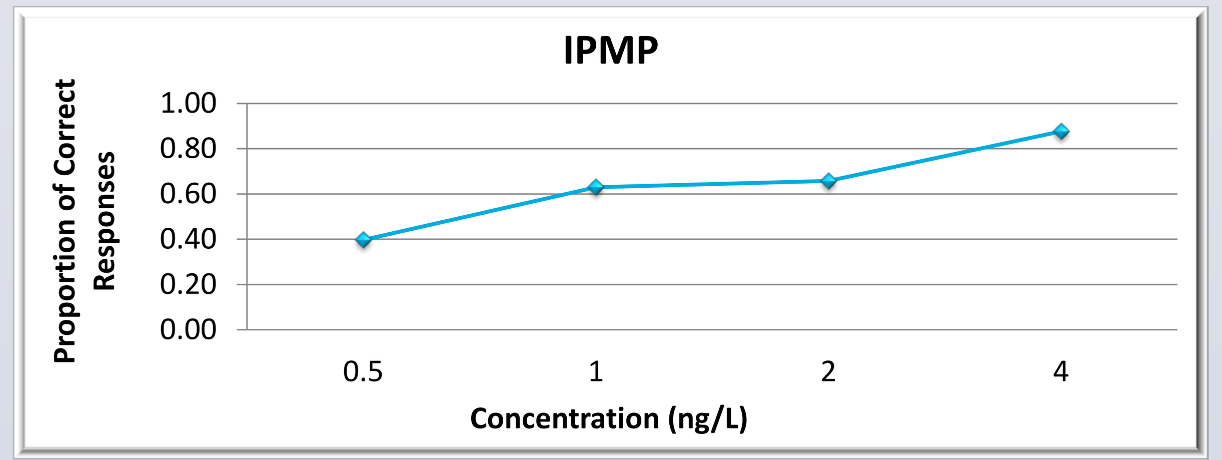


Fig.4 Proportion of assessors (N=73) that correctly identified a difference for wines spiked with increasing concentrations of IPMP.

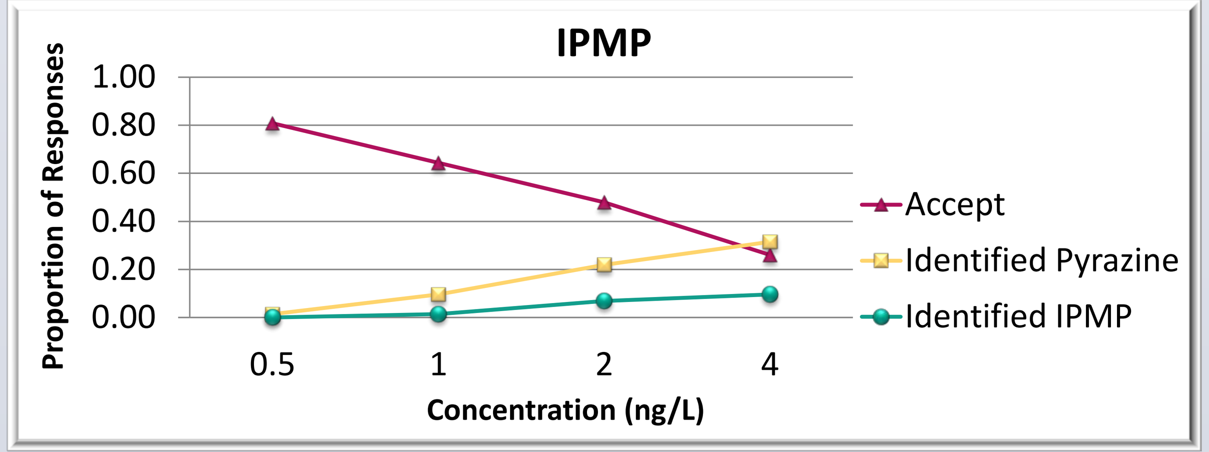


Fig.5 Proportion of assessors (N=73) that accepted wines with increasing concentrations of IPMP compared with those that were able to correctly identify the fault as IPMP or pyrazine.

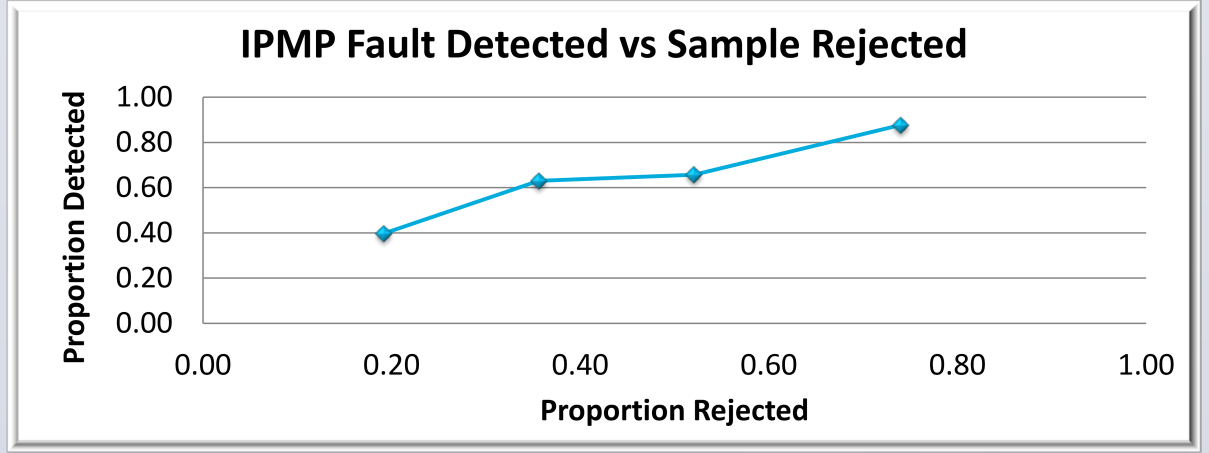


Fig.6 Comparison of the proportion (N=73) of assessors that correctly identified a difference versus the proportion of assessors that rejected the wine containing IPMP.

Table 4. . The proportion of assessors that identified IPMP at four different concentrations, with groupings from a Marascuilo procedure following a significant chi-squared test (α=0.05).

| Sample | Proportion | Groups | | |
|---|---|---|---|---|
| 0.5ng/L | 0.397 | A | | |
| 1ng/L | 0.630 | | B | |
| 2ng/L | 0.658 | | B | |
| 4ng/L | 0.877 | | | C |

Table 5. The proportion of assessors that accepted IPMP at four different concentrations, with groupings from a Marascuilo procedure following a significant chi-squared test (α=0.05).

| Sample | Proportion | Groups | | |
|---|---|---|---|---|
| 0.5ng/L | 0.808 | A | | |
| 1ng/L | 0.644 | A | B | |
| 2ng/L | 0.479 | | B | |
| 4ng/L | 0.260 | | | C |

### IPMP Summary

Table 6. The DT and RT of IPMP in an Ontario Riesling wine.

| Number of Assessors | Compound | Detection Threshold | Rejection Threshold |
|---|---|---|---|
| 73 | IPMP | 0.8ng/L | 2.2ng/L |

## CONCLUSIONS

The results will assist in determining the RT levels of 4-EP and IPMP in Ontario Riesling wines. Although the specific faults could not be clearly identified by the assessors at the RT, they were in sufficient concentrations to render it unacceptable for sale.

Further research will be needed to determine if the DT and RT of these faults are significantly different in other wine styles and grape varieties. Thereby assisting winemakers in establishing guidelines to determine if their wines are acceptable for sale.

## REFERENCES

1. Lawless, H. T., & Heymann, H. (2010). Sensory Evaluation of Food: Principles and Practices (Vol. 5999): Springer.
2. O'Mahony, M., & Rousseau, B. (2003). Discrimination testing: A few ideas, old and new. Food Quality and Preference, 14(2), 157-164.
3. Pickering, G., Lin, J., Reynolds, A., Soleas, G., & Riesen, R. (2006). The Evaluation of Remedial Treatments For Wine Affected By Harmonia Axyridis. International Journal of Food Science & Technology, 41(1), 77-86.
4. Prescott, J., Norris, L., Kunst, M. & Kim, S. (2005). Estimating a "Consumer Rejection Threshold" for Cork Taint in White Wine. Food Quality and Preference 16, 345-349.
5. Ridgway, K., Lallije, S., & Smith, R. (2010). "Analysis of Food Taints and Off-Flavours: A Review". Food Additives & Contaminants: Part A, 27(2), 146-168.
6. Romano, A., Perello, M. C., Lonvaud-Funel, A., Sicard, G. & de Revel, G. (2009). Sensory and Analytical Re-Evaluation of "Brett Character". Journal of Food Chemistry 114, 15-19.
7. Standard Practice for Determination of Odor and Taste Thresholds By a Forced-Choice Ascending Concentration Series Method of Limits, ASTM E679, ASTM.
8. Standard Test Method for Same-Difference Test, ASTM E2139,ASTM.

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