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Introduction



Copper is routinely present in wines at appreciable concentrations and it is known to mediate oxidative and reductive processes during wine aging. The presence of copper can stem from the use of copper-containing sprays on grapes in the vineyard and/or the use of copper(II) sulfate as an additive during wine production for the remediation of sulfidic off-aromas. In any case, the measurement of total Cu concentrations in wine has typically been conducted with high-end expensive scientific equipment (e.g., ICPOES) not generally found in small to medium wineries. As a consequence, the concentration of copper in wine is often not determined by winemakers.

A novel colorimetric technique for the determination of total Cu in red and white wines was developed that required a single wavelength spectrophotometer commonly found in small to medium wineries.

Method

The method utilises the colorimetric reagent 2,2'-biquinoline-4,4'-dicarboxylic (BCA, 0.05% v/w for white wines and 0.5% for red wines), ascorbic acid (80 g/l) and silver nitrate (1 g/l silver) according to Table 1. In the case of white wines, samples were incubated at room temperature for 30 min., filtered and analysed with a spectrophotometer at 563 nm with the use of a 40 mm cuvette. In the case of red wines, samples were digested (10 ml + 1 ml 1M NaOH + 1ml H₂O₂) at 60°C for 2 h and after cooling samples, they were measured without any incubation time.

Results

- Total Cu concentrations in wines were determined by both colorimetric and ICPOES methods. Ideal agreement would be represented by a trend-line equation of $y = 1.00x + 0$, and an

R^2 value of 1.00.

- Total Cu concentration determined in white wines without pH adjustment by the colorimetric results compared well to results obtained by ICPOES (see grey circles, Figure 1).

- Improved agreement was obtained by adjusted white wines to pH 4 (see yellow circles, Figure 1) prior to colorimetric analysis rather than leaving them unadjusted (i.e., the R^2 value increased from 0.89 to 0.95).

- For total Cu concentration in red wine, the two methods agreed best at concentrations below 0.3 mg/L, but above this concentration the colorimetric method had some tendency towards underestimating compared to ICPOES.

Conclusions

Total Cu levels in red and white wines can be determined using a simple and cheap colorimetric method.

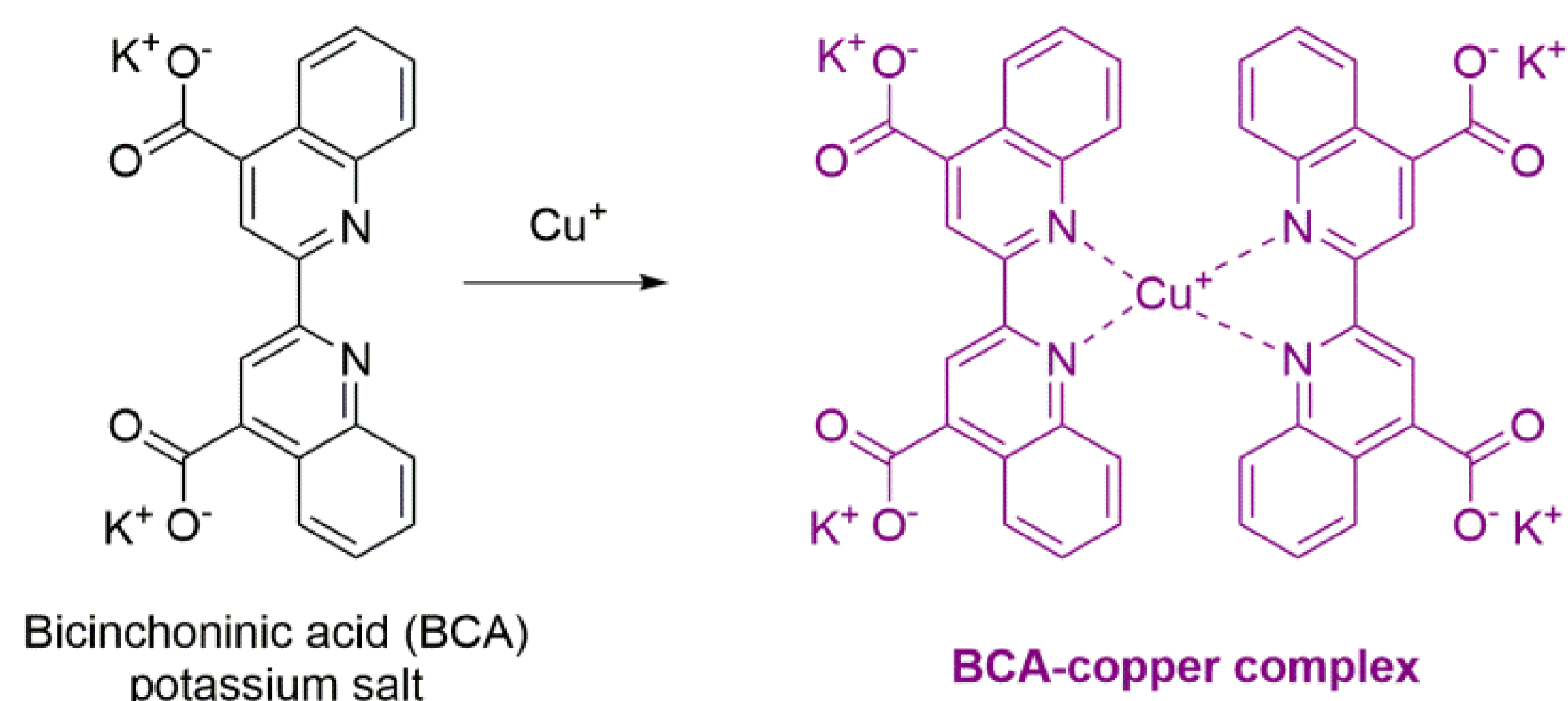


Table 1. Addition volumes (mL) in wine standard addition samples.

Solution to add	Wine blank	Wine non-blank	Wine + 0.1 mg/L Cu	Wine + 0.3 mg/L Cu
Sample	10	10	10	10
Ascorbic acid	0.05	0.05	0.05	0.05
Silver(I)	0.1	0.1	0.1	0.1
BCA	---	0.5	0.5	0.5
Copper	---	---	0.05	0.15
Water	0.65	0.15	0.10	---

Figure 1. The total concentration for white wines.

