Ask the AWRI – The power of pH

SEPTEMBER'S 'Ask the AWRI' column looked at acidity and answered the most common questions received about this parameter. This month's column considers the other equally if not more important partner – wine pH. Some winemakers believe this is the single most important analytical parameter to measure when making wine (closely followed by SO_2).

What is pH?

The pH of juice or wine is a measure of the strength and concentration of the dissociated acids present in that medium. It is calculated using the concentration of hydrogen ions in the formula pH = $-\log_{10}[H+]$ and can be adjusted through the addition of acid or base.

Why is pH important?

The pH of juice or wine is important to know as it plays a critical role in many aspects of winemaking, in particular wine stability. Boulton et al. (1996) writes that pH influences microbiological stability, affects the equilibrium of tartrate salts, determines the effectiveness of sulfur dioxide and enzyme additions, influences the solubility of proteins and effectiveness of bentonite and affects red wine colour and oxidative and browning reactions.

How does pH influence the effectiveness of sulfur dioxide?

Understanding the relationship between pH and sulfur dioxide (SO_2) is critical. SO_2 has both antioxidant and antimicrobial properties, making it an extremely effective preservative for wine. However, the amount of SO_2 that is present in the free and molecular forms that have antioxidant and antimicrobial properties is dependent on the pH of the wine. The higher the pH, the less SO_2 will be in the useful free form AND the less effective this free SO_2 will be. Therefore, all other things being equal, at a higher pH not only will more SO_2 need to be added to achieve the desired level of free SO_2, but the concentration of free SO_2 required to have the desired antioxidant and antimicrobial properties will in itself also be greater. So if the vintage delivers higher than typical pH values, it's important to think about adjusting SO_2 levels during storage.

Why am I having trouble getting consistent pH results from my pH meter?

Calibration of pH meters before use is very important, and during vintage this should be done at the beginning of every day. Analysing a standard to ensure the pH meter is giving the right results is also important. A simple solution of saturated potassium bitartrate should always give a pH of 3.55 plus or minus the error of the measurement. Common sources of errors include protein build-up from analysing juice samples or switching from juice to wine without cleaning the electrode. At the AWRI, the pH electrode is stored in a soultion of 10 g/L potassium chloride in pH 4.0 buffer when not in use, and a cleaning solution is also used at regular intervals for removal of protein from the electrode tip.

Do pH meters correct for temperature?

Questions about temperature and pH measurement are often raised. Most instruments do not correct for the temperature of the sample being analysed. This means that if a sample of juice or wine is at 10C, and the pH meter was calibrated using solutions at 20C, then there will be an error in this measurement. Samples must be the same temperature as the calibration solutions.

MEASUREMENT: A pH meter in action at the AWRI.

What is the magic pH number?

It's not necessarily magic, but there is a figure to be aware of to ensure that pH does not shift in the wrong direction after cold stabilisation. Precipitation of potassium bitartrate is both influenced by, and has an influence on, the pH and titratable acidity of a wine. When wines with pH values below 3.65 are cold stabilised, the pH lowers as potassium bitartrate drops out and the titratable acidity (TA) decreases. This occurs because for every molecule of potassium bitartrate that forms and precipitates, one free hydrogen ion is formed (that had been attached to the tartrate in KHT). However, when wines with pH values above 3.65 are cold stabilised, the pH level increases (whilst the TA still decreases), as one free hydrogen ion is removed. The magnitude of the pH shift will vary depending on the amount of KHT that is removed during both fermentation and cold stabilisation.

For more information about pH, contact the AWRI helpdesk team on winemakingservices@awri.com.au or 08 8313 6600.

References

Boulton, R.B.; Singleton, V.L.; Bisson, L.F.; Kunkee, R.E. 1996. Principles and practices of winemaking. New York: Chapman & Hall.

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