AN #: 19_007_05_002
Market: Wine
Subcategory: Specific Ion Analysis
Product: HI5522, HI4101, HI1131B, HI76312

Ammonia in Wine

Description

Nitrogen is one of the primary building blocks of living organisms. In plants, nitrogen is taken up in the form of nitrate (NO_3^-), urea (CH_4N_2O), or ammonia in the form of ammonium (NH_4^+). The majority of these nitrogen compounds are then converted to amino acids and proteins that make up the structure and provide function to the plant. Some of the nitrogenous compounds are also stored in the plant for later use. In grapevines, these compounds accumulate in the berries of the plants. Nitrogen is stored in plants most commonly as ammonia, with its concentration in grape juice ranging from 24-209 mg/L.

Nitrogenous compounds such as ammonia are essential to the winemaking process. A sufficient concentration of nitrogen must be present in the grape juice for healthy yeast metabolism and an efficient fermentation. Low nitrogen levels can result in slow or incomplete fermentations. Further, when nitrogen availability is too low in must, yeast may undergo less efficient, undesirable fermentation pathways that can produce hydrogen sulfide, a compound known for its 'rotten egg' odor. Typically nitrogen levels in grape must should be between 140-500 mg/L. Nitrogen can be supplemented with the use of diammonium phosphate (DAP), an Alcohol and Tobacco Tax and Trade Bureau (TTB) approved ammonium-based wine additive. Total nitrogen (present in the form of ammonia and amino acids) is commonly measured in must before fermentation to ensure an adequate concentration of yeast available nitrogen (YAN) for efficient fermentation. Any ammonia not consumed by the yeast during fermentation remains in the finished wine. Ammonia in wine can impact flavor and microbial stability in the finished product. Typical concentrations for ammonia in finished wine range between 3-50 mg/L.

Ammonia in wine is commonly measured with an ion-selective electrode (ISE). First, an ionic strength adjuster (ISA) is added to the wine. This ISA fixes the sample so that ion concentration, not just activity, can be measured. Additionally, the ammonia ISA contains a pH adjuster to buffer the sample above pH 10. Below pH 10, ammonia is present as the ammonium ion. Above pH 10, all ammonium in the wine is converted to ammonia gas (NH_3). Ammonia ISEs use a gas permeable membrane, which selectively permits the passage of ammonia gas across. As ammonia diffuses across the membrane, it changes the pH of an internal electrolyte. A pH electrode housed inside the body of the ammonia ISE detects the pH change. The change in pH is directly proportional to the ammonia concentration.

Application

A contract wine laboratory contacted Hanna for a method for measuring ammonia in grape must and finished wine. It was important that the instrument performed in accordance with their written procedure for ammonia direct measurement with an ISE. Upon discussion with the customer, the sales representative learned that the wine laboratory also performed pH tests, manual titrations for acidity, and tartrate stability determinations. Hanna Instruments offered the **HI5522** Research Grade pH/ORP/ISE and EC/TDS/Salinity/Resistivity Meter with the HI4101 ammonia combination ion selective electrode. Although it is generally recommended to calibrate using standards with ten times different in concentration from each other, the customer appreciated being able to calibrate to both 50ppm and 100ppm on the HI5522 to comply with their written SOP. The data storage capability was especially valuable to the customer. They appreciated being able to create up to 100 lots to accommodate their high sample throughput. The HI5522 includes both a HI1131B pH electrode and HI76312 conductivity probe. The lab manager valued the flexibility of the meter to be used for pH, tartrate stability, and manual titrations in addition to their ammonia testing. Between the versatility, ease-of-use, and accuracy of the meter, the customer agreed that the HI5522 was a powerful addition to their laboratory.