

# tech talk

Issue 1 2020

## Condensed Natural Smoke: pH vs. titratable acidity

Ron Crawford, Red Arrow Products Global Technical Services Director

*Many processors that shower, spray or dip meat products with solutions of water-soluble Condensed Natural Smokes wonder why they cannot simply take pH readings of the solution to determine the concentration of smoke in that solution. The following information is meant to eliminate confusion and explain the differences between pH and titratable acidity, as used as tools for proper process and finished product quality controls.*

### pH Readings:

pH and titratable acidity are both measurements for acids. However, the methods are measuring different things. Consequently, one scale cannot be directly converted or correlated to the other.

pH essentially measures the presence or absence of acids (or bases) in a solution. When mixed with water, acid molecules ionize into free, positively charged ions ( $H^+$ ) and corresponding negatively charged ions. In the case of acetic acid in Condensed Natural Smoke, this would be a negatively charged acetate ion. A pH in the acidic range is telling us there are free  $H^+$  ions able to ionize or go into the solution and available to react with other compounds.

Solutions with a pH of less than 7.0 are acidic, meaning there are some  $H^+$  ions free in solution. Solutions with a pH greater than 7.0 are considered basic, meaning, instead of  $H^+$  ions, negatively charged hydroxide ions ( $OH^-$ ) are present. A pH of 7.0 is considered perfectly neutral, not acidic or basic.

pH readings are relative numbers, meaning they tell us if one solution is more acidic (or basic) than another but not exactly how much acid is actually present. Two important things to know about pH readings; first they are inverse. That is to say that pH 3.0 is higher in  $H^+$  ion concentration than pH 4.0, indicating the solution is more acidic. Secondly, the scale is not linear, rather logarithmic by a factor of -10, meaning that a smoke solution with a pH of 3.0 has 10 times as much  $H^+$  than a solution with a pH of 4.0. It is possible to have a smoke with a pH of 2.4 but contains only 3.0% acetic acid. Likewise, a smoke can have a pH of 5.0 but can contain 7.25% acetic acid.

There are many factors that affect the amount of  $H^+$  ions that are able to go into solution. The strength of the specific acid, temperature of the solution, amount of water in the solution and saturation or degree of other compounds that have also ionized (salt, phosphates, proteins, etc.) are just a few. Now let's take a look at titratable acidity.



### Titrateable Acidity Readings:

Titrateable acidity, expressed as a percentage (%TA), is the measurement of the actual amount of acid present in a solution. Acid-base titration is the chemical procedure used. The amount of acid in the smoke solution is the “unknown”. By using several “known” factors and using pH as a guide or marker, the %TA can be determined simply, quickly, and accurately making it an effective, real-time process control tool for drenching meat products with solutions of Condensed Natural Smoke to ensure and maintain target color, flavor and texture.

The “knowns” in this case are: 1) we are looking for acetic acid (molecular weight of 60) 2) we use a known volume of solution being titrated and 3) we use a known base or reagent (sodium hydroxide) with a known or standardized strength (normality) to conduct the procedure.

pH measurement is then used as a guide while sodium hydroxide (NaOH) is slowly added to a smoke solution that is constantly stirred. When the pH of the solution reaches 7.0, we know that there is no more acid (or base) present and the titration is stopped. The volume of NaOH required to reach pH 7.0 is then recorded and plugged into an established chemical formula (Potentiometric Method) to calculate the %TA of the smoke solution.

.....

Red Arrow can provide additional tools to streamline and standardize your titration procedures, including: a recommended titration station supplies list, titrateable acidity procedure (Potentiometric Method) and customized quick reference titration charts (specific for Condensed Natural Smoke, application and customer process).

*For additional product or technical questions, or to schedule a visit, contact your Regional Red Arrow Technical Manager.*

## get to know your technical team

.....



**Ron Crawford** is responsible for the technical direction of smoke, grill and cooking method flavors. He supports the domestic sales force with product and application technology knowledge and is responsible for direction of the field technical service group of six, product testing and troubleshooting, as well as new product development and implementation. He will be directing technical services globally along with Dr. Joseph Yates and a yet to be named manager in Europe.

(815)-954-9375

[r.crawford@redarrowusa.com](mailto:r.crawford@redarrowusa.com)

Contact us today with product questions, technical questions or to schedule a visit.

