Research Brief

January 2024

WHAT KILLED THE PAA?
Topic 2: Chemical Formulation & Water Quality Effects

Problem Statement

Peracetic Acid (PAA) is a strong oxidizer and serves as an antimicrobial agent in poultry processing. PAA stock comes chemically stabilized. Once PAA is diluted with water or dosed into chillers, the chemical begins to decompose into acetic acid and water. PAA decomposition rates are reported as chemical half-life and measured in minutes. The chemical half-life is the time required for a quantity of PAA to reduce to half of its starting value. PAA decays rapidly in the presence of high organic loading common in immersion chillers. Organics in the chiller are found in the form of Total Suspended Solids (TSS), Fats, Oils, Grease (FOG), and Total Dissolved Solids (TDS), such as proteins, lipids, and salts.

This research brief presents results of the impact of PAA chemical formulations and incoming water quality on the chemical decomposition of the PAA.

Objectives

- Determine the decomposition rates of different PAA formulations, which vary in the percentage of peracetic acid and hydrogen peroxide.
- Examine incoming potable water quality effects on the stability of PAA within immersion chillers.

Key Takeaways

- Typical municipal water contains 25-55 ppm of TDS.
- The higher the TDS in the source water, the faster the rate of PAA decomposition.
- The combination of chiller organics with TDS in source water further accelerates the PAA decay.
- The formulation of the stock PAA does have an effect on overall PAA stability.
- When high levels of hydrogen peroxide (≥20%) are present, PAA lasts longer under chiller conditions.
- PAA is most stable at pH 4.0. PAA stability decreases as pH is raised to the levels used in poultry processing (typically, 7.0-9.0).

Continued on back

Technical Contacts: Daniel Sabo, Ph.D., Senior Research Scientist | daniel.sabo@gtri.gatech.edu | 404.407.6730
Stephanie Richter, Research Scientist II | stephanie.richter@gtri.gatech.edu | 404.407.6075

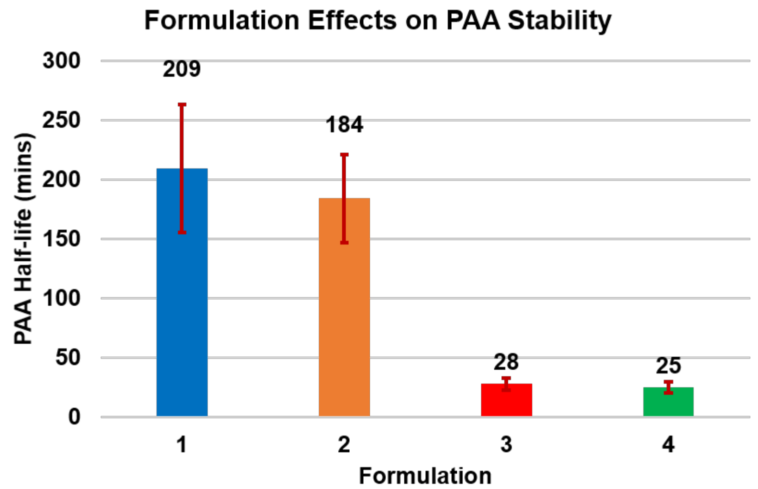
Research Methodology and Results

PAA Formulation on Its Overall Stability Under Chiller Conditions

Four formulations of PAA were tested:

- Formulation 1: 6% PAA + 26% H_2O_2
- Formulation 2: 15% PAA + 22% H_2O_2
- Formulation 3: 22% PAA + 5% H_2O_2
- Formulation 4: 15% PAA + 5% H_2O_2

All four formulations were stabilized and from the same manufacturer. Each one was subjected to the same simulated chiller media: TDS (cations including magnesium and calcium) at 250 ppm, protein (Bovine Serum Albumin) at 1800 ppm, and a starting pH of 9.0. The starting PAA concentration target was 160 ppm, and concentrations were measured at 1, 5, 15, 30, 60, and 90 minutes post PAA addition. From this data, the half-life was calculated.



Initial Water Quality Effects on PAA Stability Under Immersion Chiller Conditions

Formulation 3 was utilized for the study, as it is commonly used in the poultry processing industry. Starting water quality was varied through the addition of TDS (cations including magnesium and calcium). The test parameters were as follows: TDS ranged from 0 to 500 ppm with and without protein at 1800 ppm. The figure below shows the exact ratios of TDS to BSA (Bovine Serum Albumin). Each solution was held at pH 9.0, and 160 ppm of PAA was added. PAA concentrations were monitored at 1, 5, 15, 30, 60, and 90 minutes post PAA addition. From this data, the half-life was calculated.