Georgia Tech Research Institute
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Research Program

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Research Brief

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WHAT KILLED THE PAA?
Topic 5: Temperature 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 effect of water temperature on the chemical decomposition of PAA.

Objectives

- Determine the effect that water temperature has on the stability of PAA.
- Compare temperature's effect on PAA half-life in both potable water and water containing an organic load comparable to that of an immersion chiller.

Key Takeaways

- Water temperature alone has a noticeable effect on PAA stability.
- There is a combined effect of water temperature and organic load on PAA decay.
- At room temperature, the half-life of PAA was 170 minutes in potable water
- PAA stability decreased by 57% in simulated chiller water at room temperature.
- Decreasing water temperature to near freezing will extend PAA's half-life by 150% to 254 minutes in potable water.
- When measured in chilled simulated chiller water, PAA stability dropped by 42% to 148 minutes.
- Increasing water temperature to 95 °F decreases PAA's half-life by 18% to 139 minutes in potable water.
- When measured in warmed simulated chiller water, PAA stability dropped by 66% to 47 minutes.

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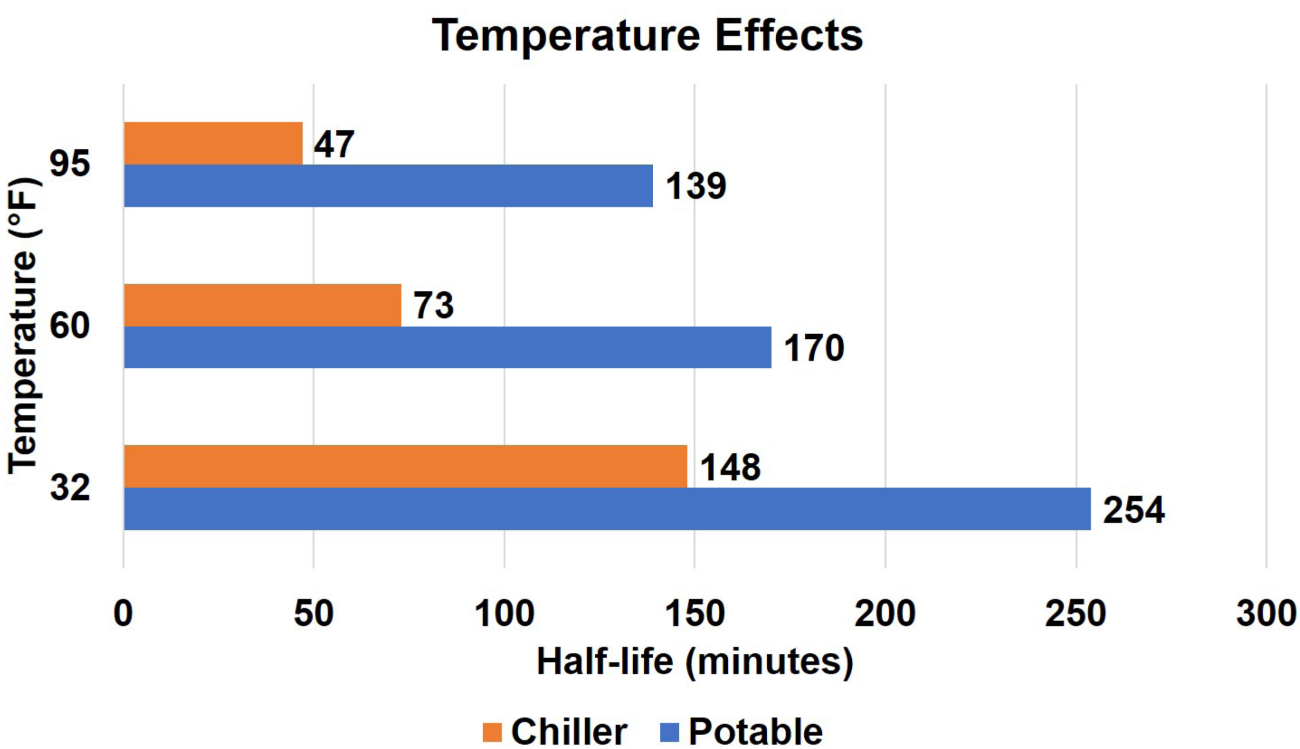
Research Methodology and Results

Temperature Effects on PAA Stability

Two types of water (potable and simulated chiller water) at three different temperatures (32 °F, 60 °F, and 95 °F) were tested for PAA decay. The simulated chiller water contained 1,000 ppm of TDS composed of cations (sodium, calcium, magnesium, and potassium) and 1,800 ppm of Bovine serum albumin (BSA). Each solution was characterized before testing. pH was adjusted to 9.0. The starting concentration of PAA was 160 ppm, and concentrations were measured at discrete time points until PAA was no longer detectable. Using this time and concentration data, the half-life was calculated. The half-lives are reported and compared as can be seen in the graph below.



The blue bars show the effect of temperature alone on PAA decay. It can be seen that at room temperature (60 °F) the half-life of PAA was calculated to be 170 minutes. When the temperature was decreased to freezing, stability of PAA increased 150%. Conversely, when the temperature was increased to 95 °F, PAA's stability decreased by 65%.

The orange bars show the combined effect of temperature and organic load on PAA decay. PAA added to simulated chiller water at room temperature (60 °F) showed a half-life of 73 minutes, a decrease of 57% in stability compared to potable water alone. When the temperature was decreased to freezing, PAA only lost 42% stability compared to potable water. Finally, when the temperature was increased to 95 °F, PAA's stability decreased by 66%.