Application Note AN-PAN-1029

Monitoring peracetic acid (PAA) in a beverage bottling facility

The food and beverage industry is built on strict rules that govern hygiene. All surfaces of materials that contact foods or beverages must be disinfected to ensure their bacteriological purity. Peracetic acid (PAA) is often used for rapid disinfection of polyethylene terephthalate (PET) bottles. Proper dosing of the acid must be observed while doing so: excess PAA affects taste and increases costs. Insufficient concentration, in turn, cannot ensure that surfaces are sufficiently clean.

The PAA concentration can be precisely determined by using an online process analyzer configured specifically for photometric analyses. The analyzer sends an alarm signal to the control system if the peracetic acid concentration deviates from the specifications.

This Process Application Note details the online monitoring of peracetic acid levels in a beverage bottling facility using the Metrohm Process Analytics stainless-steel process analyzer, which ensures optimal disinfection efficacy and cost efficiency while adhering to stringent quality control standards.

INTRODUCTION

Sanitary practices play a crucial role in the processing and handling of food and beverages, as fully hygienic conditions support longer shelf lives and food safety [1]. Unsanitary conditions in a beverage bottling facility can result in several undesirable outcomes. Contamination of a batch not only leads to product loss – it can potentially create a critical public health situation if not contained and resolved quickly. The company's image and sales can be damaged if the product is perceived as untrustworthy or tainted [2].

There are various methods for disinfecting a process line. These include high-heat treatments, specialized agents like electrolyzed water or ozone, and chemical sanitizers. Peracetic acid is favored over most other chemical sanitizers in the food and beverage industry for sanitizing new and recycled PET bottles [3]. The U.S. Food and Drug Administration (FDA) approves PAA as sufficiently harmless to allow direct contact with meat, vegetables, and fruits [4].

Peracetic acid (CH_3CO_3H) is formed by the reaction between acetic acid (CH_3COOH) and hydrogen peroxide (H_2O_2) [3]. It is highly reactive and decomposes into harmless byproducts like water, oxygen, and acetic acid, which can be recycled. To stabilize PAA, it is typically maintained in a solution with an excess concentration of H_2O_2. At proper concentrations, PAA can sanitize bottles in less than 10 seconds at temperatures between 15–65 °C.

Dosing of the disinfectant is controlled by regularly checking PAA concentration. Low PAA levels risk microbial contamination, while high levels increase chemical and rinse water usage, which may affect product taste.

While laboratory methods are time-consuming and require skilled technicians, online monitoring with process analyzers offers rapid results with minimal personnel oversight. Furthermore, positioning the analyzer within clean rooms minimizes contamination risks, which ensures greater reliability and efficiency. Metrohm process analyzers can handle peracetic acid samples with or without the presence of surfactants. They also degas samples before analysis to prevent bubble formation from H_2O_2 that directly interferes with the measurement.

In this industry, preventing cross-contamination is essential; therefore, a stainless-steel process analyzer (Figure 2) is recommended to maintain a sanitary environment and ensure reliable monitoring of PAA in cleaning solutions.

Figure 2. A 2060 TI Ex Proof Process Analyzer, one of the Metrohm Process Analytics stainless-steel process analyzers.

APPLICATION

A stainless-steel process analyzer, configured for photometric analyses at 470 nm, accurately measures the intensity of the color formed by reactions between reagents and PAA.

Table 1. Parameter to monitor in a beverage bottling facility.

Parameter	Concentration [mg/L]
Peracetic acid (PAA)	0–3000

REMARKS

Other online applications are available for the food and beverage industry. These include alkalinity, salt (NaCl), chlorine (Cl_2), hydrogen peroxide, iron, phosphate, and many more.

CONCLUSION

Monitoring peracetic acid prior to beverage bottling ensures hygienic standards, product safety, and cost efficiency. Online stainless-steel process analyzer enable precise, real-time control, minimizing contamination risks and optimizing disinfection in beverage production environments.

RELATED APPLICATION NOTES

AN-PAN-1036 Online determination of alkalinity and hardness in process and make up water for beer production

AN-PAN-1049 Online determination of bromate and other disinfection byproducts in drinking & bottled water with IC

AN-T-076 Conductivity, pH value, alkalinity, hardness, and chloride in tap water

BENEFITS FOR ONLINE ANALYSIS IN PROCESS

- Improved product quality and manufacturing efficiency.
- Ensure regulatory compliances for process and make-up water.
- Detect process upsets via automated analysis.

REFERENCES

1. Proquimia. Peracetic Acid Disinfection in the Food Industry. *Proquimia*, 2022.
2. *Food contamination: Understanding and preventing risks | Arthur D. Little.* https://www.adlittle.com/en/insights/viewpoints/food-contamination-understanding-and-preventing-risks (accessed 2025-08-28).
3. *Peracetic Acid in the Fresh Food Industry | Food Safety*. https://www.food-safety.com/articles/2451-peracetic-acid-in-the-fresh-food-industry (accessed 2025-08-28).
4. Morell, J. Industrial Applications for Chlorination Systems. *Hydro Instruments*, 2025.

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CONFIGURATION

2060 TI Ex Proof Process Analyzer

The **2060 TI Ex Proof Process Analyzer** is an intrinsically safe wet chemistry process analyzer for process monitoring in gas or dust zoned hazardous environments rated as zone 0, 1 and 2, or 20, 21, and 22. It complies with EU Directives 94/9/EC (ATEX95) and is certified for Zone 1 and Zone 2 areas. Its design combines a purge and pressurization system with intrinsically safe electronic devices. The air purging phase and permanent overpressure prevent potentially explosive atmospheres from entering the analyzer enclosure.

The analyzer's design eliminates the need for purging large analyzer shelters, allowing for direct installation at the production line within hazardous zones. It supports various kinds of techniques, including titration, Karl Fischer titration, photometry, ion-selective electrode measurements, and direct measurements.