

## Industrial Applications of Liquid Peracetic Acid Disinfectant: A Review

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**Abstract:** Peracetic acid (PAA) serves as an excellent antimicrobial agent and hence it is widely used in the formulations of disinfectants for effective actions. It has already been known to have outstanding activity against bacteria, fungi, viruses and bacterial or fungal endospores. This unique feature of Peracetic acid makes it an important kind of disinfectant that can be used in various industries including medical, food & beverage, veterinary, agriculture and paper & pulp industries. This article primarily aims at the industrial applications of liquid Peracetic acid disinfectant in these various fields.

**Keywords:** Peracetic acid, Disinfectant, Applications.

### I. INTRODUCTION:

Peracetic acid has proven to have exceptional disinfectant properties and at the same time it can also acts as an effective antimicrobial agent, even when tested at a low concentrations. Peracetic acid is very effective against bacteria, yeasts, molds and virus. The capability of specifically penetrating through the cell membrane of microorganism is one of the key reasons to possess excellent as well as rapid antimicrobial effects of Peracetic acid. The main mode of action of Peracetic acid is disruption of the enzyme system inside the microbial cell, which ultimately results into the destruction of microorganisms. Nowadays, various types of products having Peracetic acid are commonly used as extremely useful biocides in a wide range of applications<sup>(1)</sup>.

There are various advantages of using Peracetic acid as a disinfectant including production of environmentally harmless decomposition products (i.e. acetic acid, oxygen, water & hydrogen peroxide), enhancement in the removal of organic materials with the help of breakdown of proteins. Chemical sterilization with the help of Peracetic acid exhibits the property of killing of endospores even at low temperatures<sup>(2)</sup>.

The main rationale of this review article is to summarize the different areas of applications where liquid Peracetic acid can be effectively used for the cleaning and disinfection purpose. Various products available in the market are generally used for the bleaching, disinfection and chemical synthesis purpose mostly contains Peracetic acid as an active ingredient.

#### **Medical & Pharmaceutical Industry (Disinfectant and Sterilizer):**

In medical industry, Peracetic acid can be effectively used for the sterilization of rooms in hospitals along with different medical instruments like hemodialyzer machines, surgical instruments like flexible endoscopes & various dental instruments. Medical instruments like endoscopes are manufactured from different types of materials including plastics, metals, optical and electrical components, making it impossible for the steam sterilization procedures due to possibility of damage created by high temperatures. Apart from this as these instruments are much expensive, hence it is not possible to use them once per day because of its cost effectiveness. To overcome all these problems, complete disinfection of these medical instruments with the help of disinfectants containing Peracetic acid as an active ingredient was regularly performed. This procedure also enables rapid & safe use of the medical instruments repetitively within a single working shift<sup>(3-4)</sup>.

Apart from the flexible or rigid endoscopes, other uses of Peracetic acid disinfectant include cold sterilization of dentures, syringes, and various plastic implants. Decontamination of solid and liquid medical wastes generated in hospital areas can also be performed with the effective use of Peracetic acid containing disinfectant<sup>(5)</sup>.

#### **Food and Beverage Industry (Disinfectant):**

Food and beverage industries widely use disinfectants containing Peracetic acid for efficient removal of microorganisms. Equipments functioning in food & beverage industries like pipes, processing and holding tanks along with collection bottles are usually disinfected with the help of disinfectants containing Peracetic acid as active ingredient. CIP (Cleaning in place) or SIP (Sterilization in place) installations with use of Peracetic acid are widely used as a common practice in food & beverage processing applications<sup>(6)</sup>.

Sterilization of the packaging material with Peracetic acid solutions plays a crucial role in the removal of any kind of contamination caused by microorganisms. In the rinsing step of the bottle filling line for aseptic cold filling, vapour sterilization is usually performed to protect beverages along the production chain <sup>(7)</sup>.

***Veterinary Industry (Animal Health):***

In veterinary industry, disinfectant containing Peracetic acid can be effectively used for various applications including general surface and equipment disinfection, aerial fogging and treatment of water supply systems. The procedure of surface disinfection involves the cleaning of all surfaces of poultry followed by surface disinfection with the help of mopping techniques to avoid any emergence of diseases in livestock. Instruments like pressure washer or mechanical sprayers are routinely used for chemical disinfection procedures. Since water system plays a crucial role in the veterinary industries, sanitization of water system with Peracetic acid ensures cleaning & efficient elimination of bacterial or fungal growth <sup>(8)</sup>.

The procedure of aerial fogging involves use of atomist fogging machines for the effective disinfection of buildings containing animal housings. Use of fogging machines also ensures the disinfection of critical areas which are difficult to access as far as surface disinfection is concerned <sup>(1-2)</sup>.

***Wastewater Treatment (Disinfectant):***

Peracetic acid containing disinfectant plays a vital role in the process of industrial waste water treatment. Since Peracetic acid is highly effective against not only bacteria but also fungi and viruses which makes it best suitable choice of disinfectant for the industrial wastewater effluents.

A wide range of advantages associated with the efficient use of disinfectant containing Peracetic acid includes its effective use in the secondary effluents along with broad spectrum activity even in the presence of organic matter. It also does not produce any byproducts which are environmentally undesirable.

Apart from this Peracetic acid containing disinfectants can also be used for the other applications including municipal wastewater disinfection, sludge disinfection, combined sewer overflows (CSOs) disinfection, & disinfection of ion exchangers and cooling towers <sup>(9-10)</sup>.

***Agriculture Industry (Disinfectant and Slimicides):***

In agriculture industry, solutions of disinfectants containing Peracetic acid have been proved to be extremely effective in the elimination of pathogenic microorganisms. Areas targeted for disinfection with Peracetic acid includes drip lines cleaning, disinfection of tools used for farming such as containers and tables, along with thorough washing of harvested goods used in the manufacturing and storage procedures.

Water used for washing of fruits, potatoes, and irrigation is normally disinfected with the help of Peracetic acid containing disinfectant solutions. Packaging materials used for transport from source to destinations can also be disinfected by Peracetic acid solutions with efficient removal of unwanted pathogenic microorganisms. Disinfectant products containing combination of Peracetic acid, hydrogen peroxide and acetic acid in variable concentrations as stabilized mixtures are routinely used in the agriculture industry. Since they are biodegradable in nature, hence it can be widely used for the removal of potential pathogenic bacterial or fungal contamination. These disinfectants can also play a vital role in the disinfection of fertigation solutions for control of harmful pathogens <sup>(11)</sup>.

***Paper and Pulp Industry (Slimicides):***

Peracetic acid can be effectively used as a decoloring and disinfectant agent in textile and pulp and paper industries. Brightness & whiteness of paper can be effectively increased with the help of Peracetic acid due to its bleaching action. Apart from this, yellowness of pulp can also be reduced without altering the overall viscosity with the efficient use of solutions of Peracetic acid at suitable dilutions. Peracetic acid containing disinfectants are commonly used to control microbial growth in waters of the paper mill process <sup>(12)</sup>.

## **II. CONCLUSION:**

Liquid Peracetic acid containing disinfectants are one of the most trusted and desirable disinfectant as it has a very broad spectrum of microbicidal properties. Availability and overall environmental impact of Peracetic acid makes it a widely used disinfecting and cleaning agent in various fields like medical, agricultural, wastewater treatment and veterinary establishments. Being completely biodegradable in nature, they are represented as an excellent alternative when compared with the other types of disinfectants. Since stability of the product remains the major limitation for the efficacy of liquid Peracetic acid as disinfecting agent, hence some more research needs to be done in exploring the ways to make it more stable. The current review highlighted various industrial applications of liquid Peracetic acid containing disinfectants.

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