A Global Focus on the Hazards of Peracetic Acid
By Debbie Dietrich

Volunteers in the AIHA® Healthcare Working Group are among the many health and safety professionals around the world who are focused on the hazards of peracetic acid. Also known as peroxycetic acid or PAA (CAS No. 79-21-0), this chemical is being increasingly used as a chemical disinfectant in healthcare and other industries. The use of PAA has grown globally as organizations seek safer alternatives to traditional sterilants such as glutaraldehyde and ethylene oxide. For example, the U.K. Health and Safety Commission (HSC) identified glutaraldehyde as the fifth highest cause of asthma and encouraged the use of alternative disinfecting agents where practical. (HSC merged with the U.K. Health and Safety Executive, or HSE, in 2008.) Ethylene oxide has been identified by the U.S. National Toxicology Program (NTP) as a known carcinogen and a probable teratogen.

Will peracetic acid prove to be the safe alternative to traditional sterilants? How do we effectively measure PAA exposures and overcome the sampling challenges posed by this hazard? Professionals in the health and safety arena are actively seeking answers to these questions.

Exposure Guidance

PAA is formed from a reaction of acetic acid and hydrogen peroxide. Commercial solutions contain different concentrations of these three chemicals. PAA is an oxidizing agent that is corrosive and irritating to the eyes, skin, and mucous membranes of the respiratory system at lower or short-term exposures and may cause pulmonary edema and liver and kidney effects at higher exposures.

U.S. EPA has issued Acute Exposure Guideline Levels (A EGLs) for PAA. A EGLs represent threshold exposure limits for the general public and are applicable to emergency exposure periods from 10 minutes to eight hours. A EGLs -1, -2, and -3 exist for PAA and are distinguished by increasing degrees of toxic effects. Readers can reference the EPA A EGLs for PAA by searching www.epa.gov or downloading Peracetic Acid Acute Exposure Guideline Levels from the National Academies Press website at www.nap.edu/catalog/12770.html.
U.S. OSHA has not established a permissible exposure limit (PEL) for PAA in the workplace. However, ACGIH® has recently provided much needed exposure guidance. In 2014, a Threshold Limit Value (TLV®) of 0.4 ppm was adopted as a 15-minute short-term exposure limit (STEL).

**Exposure Measurements**

Sampling and analysis of PAA is a challenge because it coexists with acetic acid and hydrogen peroxide and PAA’s chemical properties are similar to these two chemicals. Unfortunately, to date, neither NIOSH nor OSHA has published sampling or analytical methods for PAA. For lack of a U.S. government agency method, health and safety professionals, laboratories, and SKC have turned to the global occupational hygiene community for exposure measurement options.

The Institut National de Recherche et de Sécurité (INRS) in France published a paper in 2004 in the *Annals of Occupational Hygiene* (Vol. 48, No. 8, pages 715–721, available at [http://annhyg.oxfordjournals.org/content/48/8/715.full](http://annhyg.oxfordjournals.org/content/48/8/715.full)) describing a sampling method for the simultaneous measurement of PAA and hydrogen peroxide. The method specifies a two-part sampling device: (1) a filter cassette containing a quartz pre-filter chemically coated with titanium oxysulfate hydrate used for the collection of hydrogen peroxide, and (2) a silica gel tube coated with methyl-p-tolyloxysulfoxide (MTSO) used for the collection of PAA.

Upon request, SKC has been producing both the chemically coated filter (225-9030) and two versions of the MTSO-coated silica gel sorbent tube. Sorbent tube 226-193 contains a single 800-mg layer of sorbent as specified in the published method. Sorbent tube 226-199 contains two sorbent layers in an 800/200-mg configuration. At the time of this publication, SKC has decided to temporarily stop production of this sample media while we collaborate with other professionals on the following key issues:

**Flow Rate**

The French method recommends a flow rate of 1 L/min. The method developers note that at flow rates lower than 1 L/min, it may not be possible to achieve accurate, simultaneous sampling and analysis of PAA and hydrogen peroxide. Alternatively, at flow rates significantly higher than 1 L/min, the pressure drop of the sample media may exceed the capabilities of personal pumps. The nature of silica gel sorbent, the thick chemical coating on the sorbent, and the coated filter combine to produce very high and variable back pressure. SKC tests indicate typical back pressures of 28 inches of water at the recommended flow rate of 1 L/min with the filter and the single-layer tube in line. Given this high pressure drop, higher-powered pumps, such as the SKC AirChek® XR5000, may be necessary to pull air through the media. SKC chemists are studying alternative flow rates and the effect on analyte collection.

**Contaminant Phase**

There may be occasions in the workplace where PAA is present as an aerosol (mist) rather than in the vapor phase. SKC chemists are working with laboratories to determine the effect of contaminant phase on collection.

**Sample Media**

Other issues currently under study include sample stability and background. SKC has designated a three-month shelf life for the unused coated filter and a one-year shelf life for the unused sorbent tubes based on the limited data available. SKC encourages readers to contact SKC or a laboratory for the latest updates on exposure measurements for PAA.
Summary

The increasing use of PAA as a chemical sterilant has sparked a focus on PAA safety and exposure measurements around the world. Direct-reading fixed systems using electrochemical sensors for PAA have emerged from equipment companies such as ChemDAQ (www.ChemDAQ.com). For sampling and analysis, the European Joint Assessment of Commodity Chemicals has issued a report with a list of available options (JACC No. 040, Brussels, 2001, available at www.ecetoc.org/jacc-reports), and a method for both PAA and hydrogen peroxide has been published by the INRS in France.

In response, SKC has been producing sample media to meet the French method requirements. Given recent feedback from the field, SKC chemists are working with laboratory partners to re-examine critical details of the method and media. SKC anticipates data availability by AIHce 2014 that will hopefully answer the question of how to overcome the sampling challenges posed by this new workplace contaminant.

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