

Peracetic Acid (PAA) Fact Sheet

Peracetic acid (PAA) is a highly corrosive chemical often used in the healthcare industry for instrument disinfection and also for aseptic processing and packaging in the food & beverage industry. Know the facts for worker safety and process management.

Uses of PAA

Biocide: Healthcare, aseptic packaging, food processing including fruits and vegetables, meat production, water treatment, and cooling water

Bleach: pulp & paper

Oxidizer: Epoxidation reagent,¹ etching circuit boards.²

Chemical Properties

- PAA also known as peroxyacetic ($\text{CH}_3\text{C}(\text{O})\text{OOH}$), is an organic peroxyacid that forms an equilibrium mixture with hydrogen peroxide and acetic acid.
- PAA is a strong oxidizing agent, and primary irritant but a weak acid ($\text{pK}_a = 8.2$).
- Acrid odor similar to acetic acid, odor threshold 50 ppb.³
- Mol. Wt 76.05g/mol, CAS 79-21-0, EC No. 201-186-8, BP 105-110 °C, (explodes violently on heating to 110°C⁴) MP -0.2 °C, FP 40.6 °C (open cup), Vapour pressure, kPa at 20°C: 2.6.⁵
- Its oxidation potential makes it a very efficient biocide, and bleaching agent. This high reactivity also means that it rapidly breaks down in the environment to benign oxygen, water and acetic acid making it environmentally friendly but hazardous to anyone exposed to it.

Microbiocidal Activity

- Bacteria: PAA will inactivate gram-positive and gram-negative bacteria, fungi, and yeasts in <5 minutes at <100 ppm. In the presence of organic matter, 200-500 ppm is required.
- For viruses, the dosage range is wide (12-2250 ppm), with poliovirus inactivated in yeast extract in 15 minutes with 1500 to 2250 ppm.
- Bacterial spores in suspension are inactivated in 15 seconds to 30 minutes with 500 to 10,000 ppm (0.05 to 1%).⁶

Hazard Summary⁷

- PAA can affect you when inhaled
- PAA is a HIGHLY CORROSIVE CHEMICAL and contact can severely irritate and burn the skin and eyes leading to eye damage.
- Breathing PAA can irritate the nose and throat.
- Breathing PAA can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- High or repeated exposure may affect the liver and kidneys.

Note: A detailed summary of health effects of PAA exposure is available from the National Library of Medicine⁸ and the ECHA.⁹

HMIS¹⁰ (U.S.A.):

Health Hazard: 3, Fire Hazard: 2, Reactivity: 4
Personal Protection: h¹¹

Exposure Limits

- ACGIH STEL TLV 0.4 ppm, (15 min TWA)¹²
- US OSHA, => no occupation exposure limit set, there is a PEL for hydrogen peroxide (1 ppm 8 hr TWA) and acetic acid (10 ppm 8 hr TWA).¹³

Note: PAA is more hazardous than either hydrogen peroxide or acetic acid and so the concentration of PAA and the hazard presented cannot be assessed based on measurements of hydrogen peroxide and acetic acid only.

- UK HSE => no occupation exposure limit set, there is a WEL for hydrogen peroxide (1ppm 8 hr TWA, 2ppm STEL 15 min TWA)¹⁴

Note: Review on current OELs for PAA¹⁵

Acute Exposure Guidelines (US-EPA)¹⁶

AEGL 1 - 0.52 mg/m³, 0.17ppm

AEGL 2 - 1.6 mg/m³, 0.51ppm

AEGL 3 - 10 min: 60 mg/m³, 19 ppm; 30 min: 30 mg/m³, 9.7ppm; 60 min: 15 mg/m³, 4.8ppm; 4 hrs: 6.3 mg/m³, 2.0ppm; 8 hrs: 4.1 mg/m³, 1.3ppm

See Reverse for more valuable information.

¹ E.g. Epoxidised from polybutadiene latex and peracetic acid is used as an epoxy resin comonomer in sealants and electronics.

² http://echa.europa.eu/documents/10162/6434698/orats_final_rar_but-1_3-diene_en.pdf

³ Hydrogen Peroxide, Summary Risk Assessment Report Final report, 2003.

⁴ http://echa.europa.eu/documents/10162/6434698/orats_summary_hydrogenperoxide_en.pdf

⁵ http://www.solvaychemicals.us/EN/News/Documents/newsletters/20101201_PAA-Solutions.pdf

⁶ Merck Index, 12th Edition, Merck & co Inc. (1996)

⁷ PubChem Open Chemistry Database, US National Library of Medicine;

⁸ http://pubchem.ncbi.nlm.nih.gov/compound/peracetic_acid#section=Metabolism-Metabolites

⁹ CDC, Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008.

¹⁰ http://www.cdc.gov/hicpac/Disinfection_Sterilization/13_06PeraceticAcidSterilization.html

¹¹ New Jersey's Department of Health and Human Services Hazardous Substance Fact Sheet. <http://nj.gov/health/eoh/rtkweb/documents/fs/1482.pdf>

¹² Toxnet, <http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+1106>

¹³ http://apps.echa.europa.eu/registered/data/dossiers/DISS-9d928d34-d05a-47c7-e044-00144f67d249/AGGR-9d9e4871-4a5a-4230-aa44-053a73d3ec91_DISS-9d928d34-d05a-47c7-e044-00144f67d249.html#L-24eb8c99-7251-40c6-aF9-ba0430fc8b09

¹⁴ http://en.wikipedia.org/wiki/Hazardous_Materials_Identification_System

¹⁵ http://www.paint.org/images/HMIS_PPElist.jpg

¹⁶ 2014 Guide to Occupational Exposure Values, ACGIH

¹⁷ 29 CFR 1910.1000 Tbl. Z-1

¹⁸ EH40/2005 Workplace exposure limits (publ. 2011)

¹⁹ "Evaluation of the toxicity data for peracetic acid in deriving occupational exposure limits: A minireview" N. Pechacek, M. Osorio, J.Caudill, B. Peterson, *Toxicology Letters* (2015), 233, 45-57

²⁰ <http://www.epa.gov/opptintr/aegl/pubs/results80.htm>



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Detection Methods

- ChemDAQ Steri-Trac® continuous monitor for PAA.¹⁷
- SKC absorption tube.¹⁸
- No standard OSHA or NIOSH method is available.

Note: The concentration of PAA exposure cannot readily be assessed by measurement of the hydrogen peroxide and acetic acid concentrations, nor can it be reliably measured by most general methods for acids due to its low acidity.

Spill Control

Small Spill: Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill: Flammable liquid, Oxidizing material, Organic peroxide. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not use metal tools or equipment. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV.¹⁹

¹⁷ <http://www.chemdaq.com/products/steri-trac-area-monitors/steri-trac-peracetic-acid-area-monitor/>

¹⁸ <http://www.skcin.com/catalog/infopage.php?id=6019>

¹⁹ <http://www.sciencelab.com/msds.php?msdsId=9926439>

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Regulatory Environment

United States

OSHA

- Duties: Employers have a duty to provide a safe work environment and employees have a duty to work safely.²⁰
- Hazard Communication Regulation²¹, suppliers (labels, safety data sheets), Employers (facilities, work practices, training and personal protective equipment) to enable the safe use of the chemicals.

EPA

- PAA is a registered pesticide under FIFRA. Reports for various products & manufacturers are available.²²
- Approved for anthrax spore decontamination²³
- PAA has been tested as a green disinfectant,²⁴

FDA/USDA: PAA is exempt from food residual requirements;²⁵ and may be used in organic food production.²⁶

DOT – Class 5.2, organic peroxide.

European Union

Article 1.6. MAINTENANCE - annex 1 of machinery directive 2006/42/EC

²⁰ Occupational Safety and Health Act 1970, §5

²¹ 29 CFR 1910.1200

²² <http://www.epa.gov/pesticides/chemicalsearch/chemical/foia/cleared-reviews/reviews/063201/063201.htm>

²³

http://www.epa.gov/pesticides/factsheets/chemicals/hydrogenperoxide_peroxyaceticacid_factsheet.htm

²⁴ <http://www.epa.gov/pesticides/chemicalsearch/chemical/foia/cleared-reviews/reviews/063201/063201.htm>

²⁵ 40 CFR 180.1196 - Peroxyacetic acid; exemption from the requirement of a tolerance; <https://www.law.cornell.edu/cfr/text/40/180.1196>

²⁶ USDA National Organic Program Rule Summary, Prepared by Jim Riddle, and Miles McEvoy, Updated by Jim Riddle 12/20/06; <http://agr.wa.gov/FoodAnimal/Organic/Certificate/2006/NOPSummary2006.pdf>

§243 Cleaning of internal parts. ... Where it is not possible to avoid entering such parts, the necessary protective measures must be taken, such as, for example, the fitting of an adequate ventilation system, the monitoring of the concentration of hazardous substances or of the lack of oxygen in the air and provisions for the surveillance and safe rescue of operators.²⁷

ER Regulation (EU) No 528/2012 concerning the making available on the market and use of biocidal products.²⁸

Full registration under REACH, & list of registered suppliers²⁹

United Kingdom

COSHH Regulations. (Employers have a duty to assess the workplace, identify chemical health hazards, take necessary measures to protect health, provide information & training to employees, and plan for emergencies).³⁰

CHIP regulations concern hazardous information and packaging (implementing the Dangerous Substances Directive (No. 67/548/EEC), and the Dangerous Preparations Directive (No. 99/45/EC).³¹ CHIP is being replaced by the European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP Regs.)³²

²⁷ Guide to the Application of the Machine Directive 2006/42/EC

http://ec.europa.eu/enterprise/sectors/mechanical/files/machinery/guide-appl-2006-42-ec-2nd-201006_en.pdf

²⁸ <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32012R0528>

²⁹ http://apps.echa.europa.eu/registered/data/dossiers/DISS-9d928d34-d05a-47c7-e044-00144f67d249/DISS-9d928d34-d05a-47c7-e044-00144f67d249.html#REGISTRANTS_SUPPLIERS

³⁰ <http://www.hse.gov.uk/coshh/basics.htm>

³¹ <http://www.hse.gov.uk/chemical-classification/legal/chip-regulations.htm>

³² <http://www.hse.gov.uk/chemical-classification/legal/clp-regulation.htm>