Perfluorooctanoic acid (PFOA) and Its Salts and Transformation and Degradation Precursors

Perfluorooctanoic acid (PFOA, C8) and its salts are perfluorinated organic compounds with surfactant properties. PFOA can be released from several fluorochemicals, such as fluorinated telomere alcohols and other precursor compounds of fluorinated polymers by biotic and/or metabolic decomposition. PFOA and its salts are used in a variety of industrial applications, such as plasticizers, lubricants, wetting agents, and emulsifiers. They are used in the manufacture of fluoroelastomers and fluoropolymers, such as polytetrafluoroethylene (Teflon) and polyvinylidene fluoride. These are used as protective finishes to make non-stick cookware and water and stain repelling treatments for carpets, furniture upholstery and textiles. Fluoroelastomers and fluoropolymers are also used in the automotive, mechanical, aerospace, chemicals, electrical, medical, and building/construction industries. Uses in consumer products include coatings on paper, textiles, and carpet, personal care products, and nonstick coatings on cookware.

Biomonitoring studies indicate widespread exposure of the population to PFOA. PFOA can cross the placenta and accumulate in amniotic fluid. It has also been measured in cord blood from newborns. PFOA is persistent in the environment. The general population is exposed through the use of products containing PFOA and its salts and transformation and degradation precursors, and through environmental exposures, and occupational exposures occur in workplaces where these chemicals are manufactured and used.

PFOA and its salts and transformation and degradation precursors passed the animal data screen, underwent a preliminary toxicological evaluation, and are being brought to the Carcinogen Identification Committee for consultation. This is a compilation of the relevant studies identified during the preliminary toxicological evaluation.

Epidemiological data

- Retrospective occupational cohort mortality studies
  - Workers at a perfluorooctanesulphonyl fluoride-based fluorochemicals production facility, with likely exposure to multiple fluorochemicals, including PFOA: Alexander et al. (2003), Alexander and Olsen (2007)
Animal carcinogenicity data

- Long-term diet studies in rats
  - Two year study in male Sprague-Dawley rats: Cook et al. (1994) as fully described in Biegel et al. (2001); described in U.S. EPA (2005, p. 58)

- Tumor promotion studies
  - Male Wistar rats (initiation-selection-PFOA promotion protocol, seven month study duration): Abdellatif et al. (1990); Nilsson et al. (1991)
  - Rainbow trout: Tilton et al. (2008)

Other relevant data

- Genotoxicity
  - Micronuclei in the human hepatoma cell line HepG2: Yao and Zhong (2005)
  - DNA strand breaks in the human hepatoma cell line HepG2: Yao and Zhong (2005)
  - 8-hydroxydeoxyguanosine in the human hepatoma cell line HepG2: Yao and Zhong (2005)

- Hormonal effects
  - Studies in Saccharomyces cervisiae: Ishibashi et al. (2007)
  - Studies in freshwater male tilapia hepatocyte cultures: Liu et al. (2007)
  - Studies in MCF-7 breast cancer cells: Maras et al. (2006)
  - Studies in male CD rats: Cook et al. (1992); Liu et al. (1996)
  - Studies in peripubertal mice: Yang et al. (2008)

- Immune system effects
  - Studies in mice: DeWitt et al. (2008); Son et al. (2008); Yang et al. (2000)

- Inhibition of gap junctional intercellular communication
  - Studies in WB-rat liver epithelial cells: Upham et al. (1998)

- Toxicogenomic studies
  - Studies in rare minnow liver: Wei et al. (2008a, b)
  - Studies in rainbow trout liver: Tilton et al. (2008)
• Studies in wild-type and PPARα-mull mouse liver: Rosen et al. (2008a, b)
• Studies in male Sprague-Dawley rat liver: Martin et al. (2007)

• Mechanisms
  o Peroxisome proliferator-activated receptor α (PPARα) agonism: Wolf et al. (2008), Ito et al. (2007), Takashima et al. (2008), Yang et al. (2007),
  o Disruption of the hypothalamic-pituitary-gonad axis: Cook et al. (1992)
  o Review: U.S. EPA (2005, pp. 75-84)

Reviews

• U.S EPA (2005)
• Lau et al. (2007)

References


1 Copies of these listed references, as either the abstract, the relevant sections of the publication, or the complete publication, have been provided to members of the Carcinogen Identification Committee. These references have been provided in the order in which they are discussed in this document.

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