

Elimination of Perfluorooctanoic Acid in PTFE Micropowders

Abstract:

PTFE Micropowders are produced by irradiating high molecular weight PTFE. This process is known to generate per- and polyfluoro alkyl substances ("PFAS"), including perfluorooctanoic acid ("PFOA"). While techniques to remove PFOA (and related species) have been devised, such processes may leave significant residual PFOA in the final product, and change particle morphology, impacting product performance. Further, such thermal processes can generate waste in the form of the various extracted PFAS species. Inhance Technologies' Fixpure process eliminates PFAS, including PFOA, from irradiated micronized PTFE Micropowders to less than 100 parts per trillion through selective fluorination. This process does not affect particle morphology, thereby maintaining the performance of the original product.

Introduction

Fluoropolymers have desirable properties that make them virtually indispensable for numerous consumer and industrial applications. In recent years, the presence of per- and polyfluoroalkyl substances ("PFAS") within fluoropolymers and fluoroelastomers have come under significant scrutiny.

A special class of PTFE, PTFE Micropowders or Waxes, are produced by irradiating PTFE to reduce molecular weight. Such products are used in specialty inks, coatings, lubricants and other applications. During the irradiation process, multiple PFAS species can be generated, including perfluorooctanoic acid ("PFOA")

PFOA, commonly referred to as 'C8', has been described as a persistent organic pollutant ("POP") that does not readily degrade and tends to accumulate in ecosystem food chains and within living organisms, leading to potential cancers and birth abnormalities in animals and humans. PFOA is a very stable substance that will persist within the environment and has been reported to be found in the blood of more than 98% of the general US population.¹

The Stockholm Convention and regional regulatory authorities, such as the US EPA, are considering regulations to eliminate or restrict the use of PFOA and substances that may degrade to PFOA.^{2,3}

There are active regulations in place in the European Union which limits PFOA presence in articles.⁴

Fixpure PFAS Elimination Technology

Inhance Technologies' Fixpure process eliminates PFAS species, including PFOA, from irradiated PTFE Micropowders to less than 100 parts per trillion through selective fluorination, without impacting material characteristics, such as particle size or shape, maintaining critical performance features in product formulations. This technology is effective for virtually all PFAS species. Fixpure is effective on fluoropolymer materials from submicron powders to pellets, waxes, regrind and recycled grades.

Fixpure's performance in defined parameters has been tested and certified by independent test laboratories. Separately, Inhance Technologies has collaborated with third-party product & environmental stewardship resources to review and analyze potential regulatory considerations impacting the commercial use of the technology. The results of these reviews have provided favorable conclusions.⁵

Technology Demonstration & Results

Commercially available, irradiated PTFE Micropowders were procured and analyzed for initial PFOA concentration. The materials were then treated using the Fixpure process and analyzed for residual PFOA. The results are shown in Table 1.


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PFOA content was analyzed using EPA method 3452A **Pressurized Fluid Extraction (PFE)** and EPA method 8321B **Solvent Extractable Nonvolatile Compounds by High Performance Liquid Chromatography/ Thermospray/Mass Spectroscopy (HPLC/TS/MS)** standards. These tests were performed by Applied Technical Services, located at 1049 Triad Court, Marietta, GA 30062, a certified (CPSC Accredited, ISO9001:2015 certified, EN71 European Toy Safety Testing, NADCAP Accreditations) laboratory.

Table 1: Results for initial and final PFOA concentrations of commercial PTFE Micropowders, treated using Fixpure process

PTFE Type	Particle size	Initial [PFOA]	Final [PFOA]
Commercial Sample A (regrind)	Coarse	9.26 ppb	Non-Detectable
Commercial Sample B (micropowder)	35 micron	127 ppb	Non-Detectable
Commercial Sample C (micropowder)	10 micron	557 ppb	Non-Detectable

Non-Detectable denotes <100 ppt (parts per trillion)

Fixpure technology should be considered for PTFE Micropowders when formulating systems for various applications, including, but not limited to:

- Coatings
- Inks
- Additives for Plastics
- Lubricants and Greases
- Cosmetics

Inhance Technologies has commercial scale Fixpure capacity in Houston, TX. As an ACC Responsible Care® RC14001:2015 and ISO9001:2015 registrant, Inhance Technologies is committed to exceed the most stringent compliance standards.

Table 2: Fixpure process capabilities

Particle size	Submicron powders to pellets
Resin Form	Powders, pellets, regrind, waxes
Initial PFAS concentration	No limit
Final PFAS concentration after Fixpure	To < 1ppb

References

1. Antonia M. Calafat, Lee-Yang Wong, Zsuzsanna Kuklenyik, John A. Reidy, and Larry L. Needham; Polyfluoroalkyl Chemicals in the U.S. Population: Data from the National Health and Nutrition Examination Survey (NHANES) 2003–2004 and Comparisons with NHANES 1999–2000, Environmental Health Perspectives; 2007 Nov; 115(11): 1596–1602
2. UNEP/POPS/POPRC.14/6/Add.2; Addendum to the risk management evaluation on perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds
3. EPA Docket EPA-HQ-OPPT-2013-0225; Long-Chain Perfluoroalkyl Carboxylate and Perfluoroalkyl Sulfonate Chemical Substances; Significant New Use Rule; Supplemental Proposal
4. ECHA REACH Annex XVII entry 68; <https://echa.europa.eu/documents/10162/7a04b630-e00a-a9c5-bc85-0de793f6643c>
5. Inhance Technologies Confidential Information, available for discussion

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