

Case study for Substitution of C6 Perfluorocarbon-Based Water Repellent Finishing Agent by PFC-Free Alternative

Abstract

Due to concerns about the potential environmental and human health impact of per-fluorinated compounds (PFCs), a substance known to accumulate in the environment and pose a severe risk to human health, Fast Retailing has committed to systematically eliminating all PFCs from its products by working with different stakeholders to substitute PFCs with a PFC-free water repellent alternative for textile finishes. The shift from using PFCs to a safer PFC-free alternative finishing agent, while aiming for water repellency functions, was demonstrated to result in no perceivable impact to a product's performance quality.

Substituted substance(s)

Perfluoro-n-hexanoic acid (PFHxA)

CAS No: 307-24-4

EC No.:206-196-6

Chemical group

Carboxylic acids, Fluorinated compounds

Classification

The substance is classified as Danger, and causes severe skin burns and eye damage according to Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation)

Other adverse effects

PFHxA is a persistent substance, it does not readily degrade via biotic or abiotic mechanisms in the environmental. Also, it is identified as potential teratogens and developmental toxicants.

Alternative substance(s)

Silicon-based non-fluorinated water repellent finishing agent

Chemical group

Silicon-based compounds

Classification

The substance has no harmonized classification according to Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation)

Application**Sector**

Manufacture of textiles, apparel, leather and related products

Process

Finishing (metal, wood, ceramics, textiles, etc.)

State of Implementation

In use

Availability of alternative(s)

On the market

Hazard assessment

The substituted PFCs-based product contained or released PFHxA, which is assigned by the producer with hazardous as H317 (May cause an allergic skin reaction) and H412 (Harmful to aquatic life with long lasting effects). No further details on the substituted product are known to SUBSPORT. The alternative product is classified by the producer and is free of PFCs. Silicon-based compounds are not listed on the Substance Database according to SUBSPORT Screening Criteria (SDSC).

Substitution description

Water repellent surface treated fabrics are often used for apparel and outdoor wear. PFCs are main ingredients found in Durable Water Repellent (DWR) finishing agents due to its specialty applications. They are thermally stable chemicals which provide treated fabrics with good durability during care processes such as laundering and dry-cleaning. PFCs can generally be categorized into two groups: Long-chain PFCs and short-chain PFCs. Long-chain PFCs, such as PFOA (C8) and PFOS (C8) are hard to breakdown, bio accumulative and potentially toxic. In light of the concerns around the use of long-chain PFCs, there have been shifts towards short-chain PFCs such as PFHxA (C6) and PFBS (C4). Short-chain PFCs are now promoted as having comparable repellency and other performance attributes similar to that of long-chain PFCs. Although short-chain PFCs show less environmental and human health impacts than long-chain PFCs, they may also be substances of concern. For this reason, substitution of all PFCs is driven by a precautionary principle.

One PFC-free alternative is a silicon-based, non-fluorinated water repellent finishing agent, which allows a durable surface treatment on fabrics. This alternative finishing agent was chosen out of a number of PFC-free products due to its performance results on certain fabric types (see summary of water resistance test result in table 1).

A water resistance test was conducted at an FR fabric supplier's in-house laboratory. The findings showed the PFC-free treated fabrics as having good results in water resistance tests – even on products having been laundered several times. The PFC-free alternative finishing agent has comparable repellency and other performance attributes to the C6 PFCs finishing agent.

Table 1. Summary of Water Resistance Result of Fabrics with C6 PFCs and PFC-Free Alternative Treatment.

Finishing Agent	Fabric Type	Water Resistance Result (Washing Cycle)		
		L0	L3	L10
C6 PFCs	PE	5	3	2-3
PFCs-Free	PE	5	3	2-3
C6 PFCs	Nylon	4	3-4	2
PFCs-Free	Nylon	4	2-3	2
C6 PFCs	Nylon	5	3-4	3
PFCs-Free	Nylon	4	3	2-3

Note: Test method of water resistance: JIS L1092; Test method of washing: JIS L0217 Method 103, Line dry