

Telomer Research Program



Clariant



8-2 Telomer B Alcohol Biodegradation Research

Scope and Rationale

The Telomer Research Program (TRP)¹ is investigating the biodegradation potential and pathway(s) of 8-2 Telomer B Alcohol ($C_8F_{17}CH_2CH_2OH$; CAS #678-39-7), a primary fluorotelomer intermediate. The 8-2 Telomer B Alcohol is a key raw material used in the manufacture of sales products and was selected as a starting point for identifying environmental fate pathways for telomer-based products. The TRP began this work by first developing fundamental physical-chemical property data for the substance including water solubility, sorption properties, UV-Visible absorption spectrum and vapor pressure. These properties are essential to determine and understand in order to develop rigorous sampling and analysis methods in advance of conducting biodegradation studies. The 8-2 Telomer B Alcohol was found to have a water solubility of approximately 150 ppb at 25°C, 3 Pa vapor pressure at ambient temperature (20°C), and significant sorption to a number of types of surfaces. As a result of its low water solubility, hydrophobicity, volatility, and a propensity to partition from water to air when a sorptive medium is not present, the 8-2 Telomer B Alcohol has proven itself to be a "difficult to test substance." Furthermore, the study material lacks structural characteristics that would enable it or any of its potential transformation products to be identified and quantified at parts-per-billion levels in complex matrices by sensitive spectroscopic, spectrophotometric, or fluorescence detection techniques. Thus, a parallel research effort defined, developed and prepared [3-¹⁴C]-radiolabeled 8-2 Telomer B Alcohol to be used for quantitative biodegradation studies to facilitate the best opportunity for developing a compound mass balance and both quantitation and chemical identification of transformation products.

In advance of the successful preparation of the radiolabeled 8-2 Telomer B Alcohol, pilot studies were initiated to develop sampling and analysis methods in relevant test matrices using

¹ The companies participating in the TRP include Asahi Glass, Clariant GmbH, Daikin Industries and E.I. duPont de Nemours & Company. These companies produce fluorotelomer-based products, which are used as fluorosurfactants and surface protection chemicals.

“cold” 8-2 Telomer B Alcohol. This work included extraction-recovery methods to identify appropriate solvents, conditions, and procedures for recovery of the parent 8-2 Telomer B Alcohol and potential transformation products as well as the preparation or purchase of high purity samples of the potential transformation products such as $C_8F_{17}CH_2COOH$, $C_7F_{15}CF=CHCOOH$, $C_7F_{15}COOH$ and $C_5F_{11}COOH$. The final report from the biodegradation screening work was submitted to EPA in mid-March 2003.

With the radiolabeled test material in hand, safe handling, sampling and analysis methods are being verified at this time. Procedural review, evaluation and training in the safe handling of the radiolabeled 8-2 Telomer B Alcohol was conducted to ensure the safety of all personnel working with this material. The first biodegradation study to be conducted by the TRP is a 28-Day OECD 301D, Closed-bottle, Ready Biodegradation study (under Good Laboratory Practices) utilizing unacclimated municipal sludge with radiolabeled $[3-^{14}C]$ 8-2 Telomer B Alcohol. This study follows earlier screening studies conducted by DuPont. Meanwhile, a study to determine the adsorption-desorption behavior of radiolabeled 8-2 Telomer B Alcohol for a range of soils and sediments is underway. These two studies will provide essential data for design and protocol development for a long-term, higher tier studies on 8-2 Telomer B Alcohol. Currently, the TRP has a study protocol in development to define a sediment or soil biodegradation study that would emulate long-term, more environmentally relevant conditions.

Biodegradation Studies Timeline Summary

- DuPont ready and accelerated biodegradation screening studies reports. Submitted 21 March 2003.
- Results from the ^{14}C -labeled 28-Day OECD 301D biodegradation study will be available in June / July 2003.
- The adsorption-desorption study (soil, sediment, sludge) is expected to be completed in July / August 2003 with a study report following.
- The timeline for study protocol definition and development for a longer-term study of sediment or soil biodegradation is contingent on the results of ongoing studies described above.