VAPOR PRESSURE

TEST SUBSTANCE

Identity: Perfluorooctanesulfonate; may also be referred to as PFOS or FC-95. (1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, potassium salt, CAS # 2795-39-3)

Remarks: The 3M production lot number was not noted. The test sample is a white powder of uncharacterized purity.

METHOD

Method: Internal. Details outlined under RESULTS section
GLP (Y/N): No
Year completed: 1993

Remarks: As described below, there are a number of methodological concerns with this study. In addition, the document submitted is a combination of two reports. The first report contained Parts I and II, and a second report contained Experiment #3. In addition, the first report contains portions of two versions. As neither of the first report versions is dated, it is unknown which is the final version.

RESULTS

Part I: Analysis before and after passing 280 liters of air through various stock solutions.

Procedure: A mixture of 10 ppm FC-95 (PFOS) and 10 ppm FC-143 (PFOA) was prepared in water or water/isopropanol solutions of the polar-organic compounds listed in the table below. Aliquots of each solution were analyzed in triplicate for fluorochemical content by LC-thermospray mass spectrometry both before and after bubbling 280 liters of air through them. The flow rate of the air passing through the stock solutions was 1 L/min. The solutions were kept in an ice bath during bubbling. The concentrations before and after bubbling were compared after adjusting for volume lost during bubbling.

Results

Solution	Original PFOS Conc., ppm	% PFOS retained
500 ppm Tetrabutylammonium	10.0	90
500 ppm Ammonium acetate	10.0	71
503 ppm Laurylpyridinium chloride	10.0	90
500 ppm N-Alkyldimethylbenzylammonium chloride	10.0	100
500 ppm Cetyltrimethylammonium bromide	10.0	95
505 ppm Tallowtrimethylammonium chloride	10.0	93
500 ppm Dicocodimethylammonium chloride	10.0	84
Water/1-Propanol (50:50)	10.0	89
Water/1-Propanol (50:50)	0	0
500 ppm Ammonium acetate in water/1-propanol (50:50)	0.10	96
500 ppm Ammonium acetate in water/1-propanol (50:50)	0.20	101
500 ppm Ammonium acetate in water/1-propanol (50:50)	0.40	90
500 ppm Ammonium acetate in water / 1-propanol (50:50)	0.80	95
500 ppm Ammonium acetate in water / 1-propanol (50:50)	2.00	96

Remarks: These findings appear to suggest a small loss of PFOS. However, in comments dated 12/7/93, Dr. Edwin Tucker of the Chemistry Department at the University of Oklahoma indicates that it is very unlikely that these fluorochemicals were removed by bubbling air through water due to their vapor pressures, which are very low. Tucker thought more likely mechanisms for loss from the solution phase were concentration of the surfactants in foam and loss from the bubbled solutions as foam or micro-droplets.

Part II: Analysis of impinger ammonium acetate solutions.

Procedure: Air was passed through an apparatus containing dry test material and then through glass wool at room temperature to a chain of impingers. A 50:50 propanol:water solution containing 500 ppm ammonium acetate was used in the impingers to catch any volatilized PFOS. All impingers were in ice water.

Results: No test material was found to be present in either the first or second impinger. This indicates that any test material transported from

the solids to air and then into the ammonium acetate solutions in the impingers is below the detection limit. The calculated maximum pressure was 8.7×10^{-8} torr.

Remarks: In the report, the maximum vapor pressure calculations section contains errors. Equation 1 should use the value 0.625 µg, not 0.625 µg/mL. In addition, the "maximum" vapor pressure calculated was inadvertently called "minimum" vapor pressure in the text below both equations 5 and 7.

Dr. Tucker stated that the experimental conditions do not provide firm evidence that the number is reasonable. There is no evidence that vapor equilibrium was attained between the solid and the flowing gas.

Experiment #3: Measuring vapor pressure at 90°C

Procedure: The same study as in Part II was conducted in duplicate at 90°C.

Results: The report concludes that PFOS has a measurable vapor pressure at this temperature. The minimum vapor pressure for the test material was purported to be 1.2×10^{-7} torr at 90°C. It was considered a minimum because the impinger trains may not have caught all of the fluorochemical that had been volatilized.

Remarks: There are reasons to consider this a questionable result. No notation was made about the sensitivity of the analytical measurements in this study, but the quantification limit in the analysis in Part II was 0.625 µg. The concentration range from impinger train 1 in Experiment #3 was 0.07 - 0.75 µg. Impinger concentrations ranged from 0 – 0.18 µg in impinger train 2. These concentrations are near or below the quantification limit reported in Part II.

CONCLUSIONS

No reliable conclusions can be made based on this study. The general observation is that this compound has very low volatility or a very low vapor pressure under ambient conditions.

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DATA QUALITY

Reliability: Klimisch ranking 3. There is no information on the validity of the test method for determining volatility of the test substance. This study lacks characterization of the purity of the test substance. There is no information on the validity of the analysis method.

REFERENCES

This study was conducted by the 3M Environmental Laboratory, St. Paul, MN, 3M Lab Request Number L3306, 1993.

OTHER

Last changed: 6/27/01