Photolysis of Polychlorinated Dibenzo-p-Dioxins (PCDD) in Vapors and Aerosols

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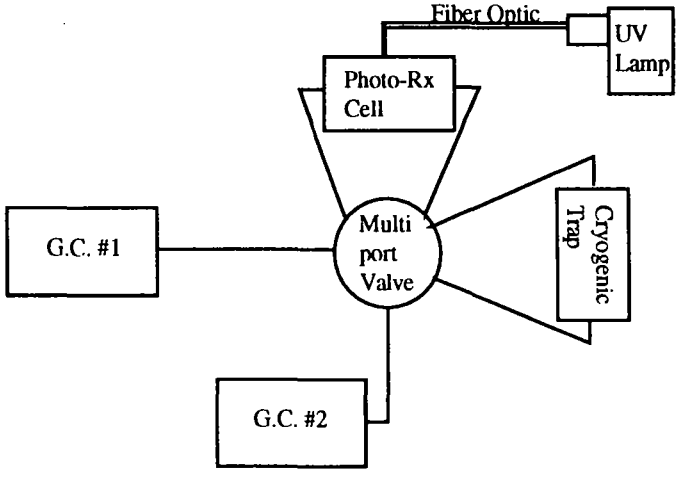
Photodegradation is generally believed to be the most significant natural mechanism for removal of polychlorinated dibenzo-p-dioxins (PCDD's) and related polychlorinated dibenzo furans (PCDFs). The kinetics of the process have been studied in detail in various solutions and on surfaces. A photolytic degradation process has also been successfully used for destruction 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD). However, little data is available on vapor and condensed (aerosol) phase photochemistry of these toxic molecules. Results of a vapor phase study showed a quantum yield of 0.33 ± 0.04 at 95% confidence level. No photoproducts or dependence of photoloss on radiation energy was reported (1). A number of products such as 2,3,7 trichlorodibenzo-p-dioxin (TrCDD); tetrachloro dihydroxy biphenyl and chlorodimethoxy biphenyl in solution have been reported by Miller and co-workers (2). A detailed study on photochemical behavior of PCDD in vapor and aerosol forms has been initiated in our laboratory. The study is being carried out in a closed system comprised of a two dimensional chromatographic set-up which is interfaced to a photoreactor. Photolysis experiments are being carried out with irradiation assembly consisting of a xenon arc lamp monochromator and a light pipe. A schematic of the system is shown in the figure below.



The arrangement permits on-line monitoring of residual parent contaminants and neutral photoproducts. Determination of neutral products is important to assess health risks since

toxicities of PCDD congeners depends both on the position and the degree of chlorine substitution.

REFERENCES

[1]R. S. Orth, C. Ritchie, and F. Hileman, *Chemosphere*, 18 (1-6), 1275-1282 (1989)
[2]S. Kieatiwong, L.V. Nguyen, V.R. Herbert, M. Hackett, G.C. Miller, M.J. Miller, and R. Mitzel, *Environ. Science Technol.*, 24, 1575-1580 (1990).