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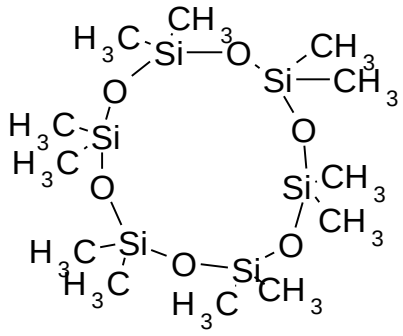
CAS No.	540-97-6
Chemical Name	Dodecamethylcyclohexasiloxane (D6)
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR

Physical-Chemical Properties

D6 is a clear, odorless liquid with a melting point of -3ºC, a boiling point of 245 ºC (at 1013 hPa) and a measured vapor pressure of 4.6 Pa at 25 ºC. The measured octanol-water partition coefficient (log K_{ow}) is 8.82 (at 23.7 ºC) and the measured water solubility is 0.00513 mg/L at 23 ºC.

Human Health

The absorption, distribution, metabolism and excretion of D6 has been studied in rats. In rats after oral exposure, the majority of ^{14}C-D6 was eliminated in the feces within 48 hours, unchanged. Approximately 12-15% was absorbed; 11-13% was excreted as volatiles; and a small amount of the substance was systemically available and distributed to the liver, brown fat and bone marrow. *In vitro* dermal absorption studies using human skin under semi-occluded conditions showed that the majority of the applied dose was found on the skin surface or volatilized from the dosing site, suggesting that D6 does not penetrate the skin.

The oral and dermal LD_{50} values for male and female rats were determined to be >2000 mg/kg-bw. No mortality or changes in clinical signs were observed. D6 does not cause skin or eye irritation in rabbits and it does not cause skin sensitisation in guinea pigs.

The repeated-dose toxicity of D6 has been investigated in two studies. In an OECD TG 422 study, rats (10/sex) were administered D6 in corn oil via oral gavage at 0, 100, 330 and 1000 mg/kg-bw daily for 29 days. Increases were observed in the relative weights of the liver and kidneys in both sexes and in the adrenal glands in females at all doses, although only the liver weight increase in females (seen at all dose levels) showed a dose-related response. Pulmonary granulomatous inflammation (focal, multifocal and/or widespread) was observed in 0, 5, 4 and 7 animals at 0, 100, 330 and 1000 mg/kg bw/day, respectively. Neither incidence nor severity increased with increasing dose levels of the test article. With the exception of the liver in females, there were no other changes in organ weights that appeared to have a dose response relationship. A LOAEL via the oral route was determined to be 100 mg/kg bw/day for systemic toxicity based on dose-responsive relative liver weight increases (14%), and periportal lipidosis in the female rat livers.

In another oral gavage repeated-dose toxicity study, rats were exposed to 1500 mg/kg bw/day D6 in distilled water for 28 days. The study revealed no treatment-related effects in either sex. Based on no effects observed, the NOAEL in this study was considered to be 1500 mg/kg bw/day.

In a bacterial reverse mutation assay with multiple strains of *Salmonella typhimurium*, and a strain of *Escherichia coli*, D6

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was negative both with and without metabolic activation. D6 tested negative in both *in vitro* chromosomal aberration assay (Chinese hamster ovary cells) and *in vivo* mouse bone marrow erythrocyte micronucleus assay. Based on these results, D6 is not genotoxic either *in vitro* or *in vivo*.

No data were available for the carcinogenicity of D6.

The reproductive toxicity of D6 was investigated in a combined reproductive/developmental screening test in rats [OECD TG 422]. D6 in corn oil was administered via gavage to 10 female rats each at 0, 100, 330 and 1000 mg/kg bw/day for 14 days prior to mating, during mating, gestation and postpartum for a total exposure duration of 45 days. Ten male rats per dose group were exposed to D6 14 days prior to mating and during mating. Based on the results of this screening study, the LOAEL for maternal toxicity of D6 via repeated oral dosing was determined to be 100 mg/kg bw/day, based on effects in the liver. The NOAEL for reproductive/developmental toxicity was 1000 mg/kg bw/day. Overall, D6 did not show evidence of reproductive/developmental toxicity based on screening level data.

D6 possesses properties indicating a hazard for human health (repeated-dose toxicity). Adequate screening-level data are available to characterize the human health hazard for the purposes of the OECD HPV Chemicals Programme.

Environment

The EPISuite program developed by the U.S. Environmental Protection Agency and Syracuse Research Corporation has not been validated for chemicals that contain siloxanes in their molecular structure (although some measured data are included in the training data set); therefore, there is uncertainty associated with the calculated values reported below and they should be used with caution.

The hydrolysis half-life for D6 at 25 °C and pH = 7 has been estimated at > 1 year based upon extrapolation of the hydrolysis rates determined at 40 °C and pH = 10, and 60 °C and pH = 9. A hydrolysis half-life of 401 days has been estimated for D6 based upon the correlation between OH and H ion catalyzed hydrolysis rates and water solubility of D3, D4 and D5.

In the atmosphere, indirect photo-oxidation by reaction with hydroxyl radicals is predicted to occur with a half-life of 5.96 days (EPISuite estimation using AOPWIN v 1.92). An OECD TG 310 study resulted in 4.47 % biodegradation after 28 days. D6 is not readily biodegradable under aerobic conditions. Level III fugacity modeling for D6 using loading rates for air, soil, and water of 1000 kg/h for each media shows environmental distributions of 0.5% in air, 1.4% in water, 28.1% in soil, and 70.0% in sediment. Due to its low water solubility, higher volatility and partitioning properties, D6 released into air or soil is expected to remain in that compartment, while D6 released into water is expected to partition primarily to the sediment (98.0%), based on the estimated log Koc value of 6.03. Measured Henry's Law constant of 2.25 x 10^6 Pa-m^3/mole (2.22 x 10^1 atm-m^3/mole) at 23.7 deg C suggests that volatilization of D6 from the water phase is expected to be high. Based on available experimental data, D6 will degrade in dry soil (with half-lives ranging from hours to several months depending on soil type)into low molecular weight linear silanols that further degrade to dimethylsilanediol. D6 will ultimately degrade to inorganic silicate (sand), water, and carbon dioxide.

Bioaccumulation studies with freshwater fish (*Pimephales promelas)* and the aquatic invertebrate, *Daphnia magna*, resulted in BCF values of 1160 and 2400 L/kg, respectively. The fish BCF is based on total radioactivity (parent compound, any retained metabolites and assimilated carbon), representing a worst case condition. A sediment bioaccumulation study with the oligochaete, *Lumbriculus variegatus*, provided BAF values of 0.66 and 0.70 mg a.i./kg (dry weight) with a depuration half-life of 4.1 – 5.2 days. In a recent field study, as yet unpublished, lower concentrations of D6 were observed at increasingly higher trophic levels in an aquatic food chain.

Chronic toxicity studies with freshwater fish (*Pimephales promelas*, 49 days) and the water flea (*Daphnia magna*, 21 days) showed no observed effects (NOEC) at the limits of water solubility (4.4 and 4.6 µg/L, respectively); based on total radioactivity using radiolabeled ^{14}C-D6. D6 also showed no adverse effects (NOEC ≥ 2 µg/L) on the yield or growth rate of the freshwater alga, *Pseudokirchneriella subcapitata* in a closed bottle study at the functional limit of water solubility (2 µg/L). Likewise, no toxicity to *Lumbriculus variegatus* was observed during the sediment BAF study at the two concentrations tested, 28 and 484 mg/kg (dry weight; measured concentrations).

D6 does not possess properties indicating a hazard to the environment based on its low hazard profile (i.e. no aquatic

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toxicity at the limit of water solubility). D6 is not readily biodegradable and has the potential to bioaccumulate. Adequate screening-level data are available to characterize the environmental hazard for the purposes of the OECD HPV Chemicals Programme.

Exposure

In 2007, the United States production volume was 7303 tonnes and accounted for 61% of global production.

D6 is widely used. It is used in the formulation of cosmetics and personal hygiene products, as an ingredient for manufacture of processing aids such as defoamers, surfactants and mold release agents, lubricants, polishes and coatings on a range of substrates including textiles, carpeting and paper, sealants, architectural coatings, mechanical, heat transfer and dielectric fluids and reprography.

The presence of D6 in the environment depends on its uses and the compartment into which it is released. The major route of entry into the environment is expected from its release into the atmosphere due to the volatility of D6 and can occur during manufacturing, via personal care products, or from atmospheric releases during wastewater treatment. Partitioning to sludge will compete with volatilization during wastewater treatment. D6 has been detected in the livers of marine fish, common mussels, flounder livers and fillets and in cod stomach contents in Europe as well as in ambient and indoor air, sludge, soil, sediment and coastal waters.

Producers, processors and formulators of personal care products may be exposed to D6 as may barbers and beauticians. Consumer exposure may occur through dermal, inhalation or oral pathways. Environmental exposure is possible. Although the majority of testing covered in the above mentioned health and environmental studies was conducted with D6 at greater than 99.5% purity, the D6 that is in commerce can contain impurities that can be up to 4% which include Octamethylcyclotetrasiloxane (D4), Decamethylcyclopentasiloxane (D5) and tetradecamethylcycloheptasiloxane (D7) and greater methylcyclosiloxanes. D4 and D5 are generally less than 2% individually in the commercial D6 product.