A SMALL DOSE OF SOLVENTS

Solvents: Quick Facts
Use: varied - recreational (alcohol) to industrial (gasoline, degreasers)
Source: synthetic chemistry, petroleum products; plant oils
Recommended daily intake: none (not essential)
Absorption: intestine, inhalation (major), skin
Sensitive individuals: fetus, children
Toxicity/symptoms: nervous system, reproductive system, and death
General facts: long history of use (alcohol), high volatility of solvent results in inhalation exposure of vapors
Environmental concerns: volatile organic compounds react with sunlight to produce smog; solvents may contaminate groundwater
Recommendations: avoid, use proper workplace protection

Also see our page, Solvents - Chemical Profiles and External Links

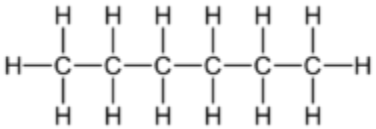
Case Studies

Anesthetics

"I also attended on two occasions the operating theatre in the hospital at Edinburgh, and saw two very bad operations, one on a child, but I rushed away before they were completed. Nor did I ever attend again, for hardly any inducement would have been strong enough to make me do so; this being long before the blessed days of chloroform. The two cases fairly haunted me for many a long year." - Charles Darwin, Autobiography (1993)

An effective anesthetic agent must be easy to use, quickly render the patient unconscious, and not produce any toxicity. Dr. William T.G. Morton first publicly demonstrated the use of ether as an effective anesthetic agent at the Massachusetts General Hospital on October 16, 1846 before a crowd of skeptical physicians. Ether (CH3CH2)2O was first discovered in 1275 by Raymundus Lullius, a Spanish chemist. Its hypnotic effects were soon appreciated (and enjoyed by some), but for many decades ether was only used occasionally to treat medical ailments. The success of surgical procedures did not improve until the introduction of antiseptic procedure and infection control some 20 years later. Ether was replaced by cyclopropane in 1929, which in turn was replaced by halothane in1956. While anesthetic agents are desirable for the patient, exposure to hospital staff is highly undesirable and an important occupational consideration.

n-Hexane



n-Hexane is a simple and common hydrocarbon found in solvents, degreasing agents, glues, spray paints, gasoline, silicones, and other common substances. A common workplace exposure to n-hexane is from degreasing agents, which usually contain a mixture of solvents. In 1997 a 24-year-old male automotive technician went to his doctor complaining of numbness and tingling of the toes and fingers. Further neurological evaluation revealed reduced sensation in the forearms and diminished reflexes. For the previous 22 months this worker had used, on a daily basis, aerosol cans of brake cleaner that contained 50-60% hexane (composed of 20%-80% n-hexane), 20-30% toluene, and 1-10% methyl ethyl ketone. He used this degreasing agent to clean brakes, small tools, and even car engines, commonly using latex gloves while at work. His condition improved when exposure to the cleaning agent was stopped. 2,5-hexanedione, a urinary metabolite of n-hexane that is thought to be the toxic agent responsible for the nervous system effects, can be measured and used to estimate exposure to n-hexane. A subsequent study found that automotive technicians were indeed exposed to n-hexane. Degreasing products typically contain a mixture of solvents that are readily absorbed when inhaled or allowed to pass through the skin. The latex gloves used by this worker offered little protection. More information on this case study can be found at MMWR (2001).

Introduction and History

Solvents are a broad class of compounds that we are commonly exposed to when we pump gas at the gas station, change the car oil, paint the house, glue something back together, drink alcohol, or use anesthetic when we undergo surgery. Solvents are highly volatile in air and are readily absorbed by the lungs when the vapors are inhaled. The small molecular weight of most solvents and their high fat solubility means they are easily absorbed across the skin. Occupational exposure to solvents is common, with an estimated 10 million workers in the United States exposed either though inhalation or skin contact. Acute exposure can result in loss of coordination, reduced speed of response, and a general feeling of drunkenness. Long-term exposure can result in decreased learning and memory, reduced ability to concentrate, changes in personality, and even structural changes in the nervous system.

Some people find the effects of solvents on the nervous system desirable and purposely inhale (sniff) solvents to induce a form of intoxication. In the United States approximately 15% of high school students have tried solvent inhalation at least once. Solvents available for inhalation and abuse are common in the home. Home products that may contain solvents included paints, paint remover, varnishes, adhesives, glues, degreasing and cleaning agents, dyes, marker pens, printer inks, floor and shoe polishes, waxes, pesticides, drugs, cosmetics, and fuels, just to name a few.

In general there are few benefits to solvent exposure and it should be avoided. The one important exception is the use of solvents to induce unconsciousness prior to surgery. As mentioned above, the solvent ether was discovered centuries ago but not used in surgery until the 1840s. Some physicians and dentists first became aware of the effects of ether during "ether

frolics" while attending school. Nitrous oxide was also experimented with around the same time but was not widely adopted by dentists and surgeons until the 1860s. Despite its liver toxicity, chloroform was also used as an anesthetic particularly in England and Scotland starting in the late 1840s. Anesthetic agents changed little until the accidental discovery of cyclopropane in 1929. With the increased use of electronic equipment in the surgery area, the flammability of the anesthetic agents became an important issue. In 1956, halothane was discovered by researchers in England, ushering in a new era in anesthesiology.

The use of solvents greatly expanded with the Industrial Revolution, which resulted in solvents' widespread release into the environment. Solvents such as volatile organic compounds (VOCs) readily evaporate into air, for example, when oil-based paint dries. Industrial release also occurs during manufacture or spills.

Solvent contamination of drinking water is not uncommon and is a public health issue. VOCs that enter groundwater become trapped until released during use. Human exposure occurs from drinking contaminated water or from bathing. Solvents such as benzene and trichloroethylene are commonly found at hazardous waste sites and may endanger nearby groundwater.

Source : http://www.toxipedia.org/display/toxipedia/A+Small+Dose+of+Solvents