ENDOSULFAN

Overview

Endosulfan is an organochlorine insecticide. This colorless solid has emerged as a highly controversial agrichemical due to its acute toxicity, endocrine effects, and potential for bioaccumulation. Though banned in more than 50 countries, including the European Union and several Asian and West African nations, it is still used extensively in many other countries including India, Brazil, Australia.

In June 2010, EPA (US Environmental Protection Agency) announced the termination of endosulfan, concluding that endosulfan poses unacceptable risks to agricultural workers and wildlife, and can persist in the environment (#EPA). The agency is now working with endosulfan's sole manufacturer, Makhteshim Agan of North America, a North Carolina subsidiary of an Israeli company, on a timeframe to terminate all uses yet give growers time to shift to alternatives (#Environmental Health News).

Because of endosulfan's threats to the environment, a global ban on its use and manufacture was considered under the Stockholm Convention on Persistent Organic Pollutants.

Chemical Description

Endosulfan is a solid substance, often found as crystals or flakes, that ranges from brown to cream-colored. It is a mixture of two different forms of the same chemical (alpha and beta endosulfan).This synthetic pesticide, which smells like turpentine, does not burn the skin. Common trade names include Afidan, Beosit, Endocel, Endocide, Endosol, Hildan, Insectophene, Malix, Thifor, and Thionex (#ATSDR).

Uses

Endosulfan is used as an insecticide on a variety of crops, including many food crops such as teas, grains, fruit, vegetables, and also on nonfood crops such as tobacco and cotton. It is also used as a wood preservative (#ATSDR).

Routes of Exposure and Metabolism

Endosulfan can enter the body through inhalation by breathing air contaminated with endosulfan, from eating and drinking contaminated products, or through skin. Once endosulfan

is in the body, it is broken down in the liver and kidneys into mainly water-soluble products and leaves the body through urine and feces within a few days or a few weeks. Cerrilo (2005) and his team claim: "Analyses of human adipose tissue, placenta, umbilical cord serum, and milk samples demonstrated the presence of parent compound (alpha and beta endosulfan) and metabolites endosulfan sulfate, diol, lactone, and ether, although the sulfate was the predominant degradation product".

Health Effects

Acute (Short-term) Health effects

According to the US Agency for Toxic Substances and Disease Registry (ATSDR), results from animal studies show that exposure to very large amounts of endosulfan for short periods of time can cause adverse nervous system effects (such as hyperexcitability, tremors, and convulsions) and death. Lethal or near-lethal exposures in animals have shown lung and heart failure. Other effects seen in animals include harmful effects in the stomach, blood, liver and kidneys.

According to the International Chemical Safety Card by the International Programme on Chemical Safety, people who are exposed (by inhalation, skin exposure, or ingestion) to endosulfan can have following symptoms: blue lips or fingernails, confusion, headache, weakness, dizziness, nausea, vomiting, diarrhea, convulsions, labored breathing, or unconsciousness.

Chronic (Long-term) Health Effects

According to the US Agency for Toxic Substances and Disease Registry (ATSDR), the health effects in people exposed to smaller amounts of endosulfan for longer periods are not known. Animal studies, though, have shown some negative health effects on the kidney, testes, and liver after longer-term exposure to the substance. Higher concentrations of endosulfan increase the seriousness of these effects.

According to PANNA (Pesticide Action Network North America), endosulfan is not listed by any agency as a carcinogen or reproductive or developmental toxicant. However, it is listed as a known endocrine disruptor by theIllinois EPA and is on the EU's Prioritization List for endocrine-disrupting chemicals (#PAN).

Environmental Effects

The two isomers (alpha and beta) have different degradation times in soil. Under neutral conditions, the half-life for the alpha isomer is 35 days, and it is 150 days for the beta isomer.

These two isomers will persist longer under more acidic conditions. The compound is broken down in soil by fungi and bacteria. Endosulfan does not easily dissolve in water, and has a very low solubility. It has a moderate capacity to adhere or adsorb to soils. Transport of this pesticide is most likely to occur if endosulfan is adsorbed to soil particles in surface runoff. It is not likely to be very mobile or to pose a threat to groundwater. It has, however, been detected in California well water (#Extoxnet).

In raw river water at room temperature and exposed to light, both isomers disappeared in 4 weeks. Large amounts of endosulfan can be found in surface water near areas of application. It has also been found in surface water throughout the country at very low concentrations (#Extoxnet).

In plants, endosulfan is rapidly broken down to the corresponding sulfate. On most fruits and vegetables, 50% of the parent residue is lost within 3 to 7 days. Endosulfan and its breakdown products have been detected in vegetables (0.0005-0.013 ppm), in tobacco, in various seafoods (0.2 ppt-1.7 ppb), and in milk (#Extoxnet).

Toxicity to organisms

Endosulfan is highly to moderately toxic to birds with a reported oral LD50 values in mallards ranging from 31 to 243 mg/kg and in pheasants ranging from 80 to greater than 320 mg/kg. Five-day dietary LC 50 values is 2906 ppm in Japanese quail (#Extoxnet).

Endosulfan is very highly toxic to four fish species and both of the aquatic invertebrates studied; in fish species, the reported 96-hour LC50 values were (in ug/L): rainbow trout, 1.5; fathead minnow, 1.4; channel catfish, 1.5; and bluegill sunfish, 1.2. In two aquatic invertebrates, scuds (G. lacustris) and stoneflies (Pteronarcys), the reported 96-hour LC50 values were, respectively, 5.8 ug/L and 3.3 ug/L. The bioaccumulation for the compound may be significant; in the mussel (Mytelus edulis) the compound accumulated to 600 times the ambient water concentration (#Extoxnet).

Endosulfan is moderately toxic to bees. Endosulfan was detected in adipose tissue and blood of animals in the Arctic and the Antarctic. It has also been detected in the blubber of minke whales and in the liver of northern fulmars. (#Stockholm Convention on Persistent Organic Pollutants).

Precautions

Exposure to endosulfan most commonly occurs by eating food contaminated with it. Endosulfan has been found in some food products such as oils, fats, and fruit and vegetable products. People can be also exposed to endosulfan by skin contact with contaminated soil or by smoking cigarettes made from tobacco that has endosulfan residues in it (#ATSDR Public Health Statement).

Regulation

The EPA classifies endosulfan as highly toxic, putting it in Toxicity Class I. It is a Restricted Use Pesticide, meaning that it can only be used by professional applicators (#Etoxnet).
The USFDA does not allow more than 24 parts per million (ppm) on dried tea, and no more than 0.1 to 2 ppm on other food products (#ATSDR). The EPA recommends that amount of endosulfan in rivers, lakes, and streams should not be more than 74 parts per billion (ppb) (#ATSDR).

Source : http://www.toxipedia.org/display/toxipedia/Endosulfan