IPEN Pesticide Working Group Project-2004

ENDOSULFAN

Fact sheet &
Answers to common questions

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Thanal is a voluntary public interest research, advocacy and action group working on matters of Environmental Health and Justice. It has specific areas of work in Zero Waste, Pesticides and Health, Natural History, Earth Education, and Toxics in the environment. Issues related to industrial pollution, pesticide contamination, wrong and inappropriate technologies are a major area of the work.

Thanal is a participating organization in the **International POPs Elimination Network (IPEN)** and co-chair of the Pesticide Working Group and officiates as its International Secretariat.

This fact sheet was developed after four years of interaction with experts and scientists all over the world. Harikrishnan V R, Researcher and Usha S, Coordinator of the Pesticide and Agriculture Programme of Thanal compiled the fact sheet.

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Nevertheless, Thanal wishes to acknowledge the single most driving spirit behind such a compilation - the people in the villages of Kasaragod, whose suffering is probably incomparable and their fight against the pesticide Endosulfan the only fight of this kind for survival.

Endosulfan - A Fact sheet and Answers to common questions
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ENDOSULFAN

A Fact Sheet and Answers to Common Questions

Introduction

Endosulfan is a pesticide belonging to the organochlorine group of pesticides, under the Cyclodiene subgroup. Introduced in the 1950's, it emerged as a leading chemical used against a broad spectrum of insects and mites in agriculture and allied sectors. It acts as contact and stomach poison and has a slight fumigant action[1]. It is used in vegetables, fruits, paddy, cotton, cashew, tea, coffee, tobacco and timber crops[132]. It is also used as a wood preservative and to control tse-tse flies and termites[5]. It is not recommended for household use. Intentional misuse of endosulfan for killing fish[2,57] and snails[71] has also been reported. Endosulfan was also reported as used deliberately as a method of removing unwanted fish from lakes before restoring.[132]

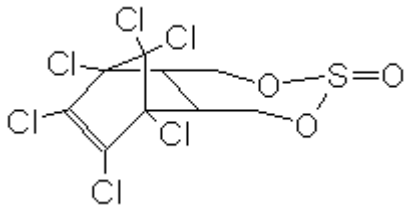
Endosulfan was introduced at a time when environmental awareness and knowledge about the environmental fate and toxicology of such chemicals were low and not mandatory as per national laws. But now it is being detected as an important cause of pesticide poisoning in many countries.

Chemical Name

6,7,8,9,10,10- hexa chloro- 1,5,5a,6,9,9a- hexahydro – 6,9- methano- 2,4,3- benzodioxathiepine-3-oxide.

Chemical Formula $C_9H_6Cl_6O_3S$

Chemical Structure: -



In pure form endosulfan exists as colourless crystals. But the technical product is brownish crystals with slight odour of sulphur dioxide[3]. Technically endosulfan is a mixture of two isomers - alpha-endosulfan and beta-endosulfan in the ratio 7:3. Technical grade endosulfan contains 94% alpha-endosulfan and beta-endosulfan and other related compounds like endosulfan alcohol, endosulfan ether and endosulfan sulfate. Endosulfan is only very slightly soluble in water, but it dissolves readily in xylene, chloroform, kerosene and most organic solvents and is a noncombustible solid. It is mixable with most fungicides and compatible with most pesticides[4].

Toxicity Classification

The U S Environmental Protection Agency (EPA) classifies endosulfan as Category Ib – Highly Hazardous. The European Union also rates it Highly Hazardous. World Health Organisation (WHO) classifies endosulfan in Category II - Moderately Hazardous. The classification of WHO was found to be inappropriate considering the classification followed in many countries and the available toxicity information. It has been alleged that the classification is based mainly on LD50 value for acute toxicity generated by the producer company[13]. The Industrial Toxicological Research Centre (ITRC) in India the nodal centre for the Regional Based Assessment of Persistent Toxic Substances (PTS) for the Indian Ocean region by the United Nations Environment Programme-Global Environment Facility(UNEP-GEF) classifies endosulfan as Extremely Hazardous[4].

Q. What do international treaties say about endosulfan ?

Endosulfan is widely considered to be a Persistent Organic Pollutant (POP) but was not included in the initial list targeted for phase out under the Stockholm Convention. Endosulfan was in the initial list of POPs being considered for world-wide elimination at the first meeting of experts in Vancouver, Canada (1994) jointly convened by governments of Canada and Philippines but was later removed from the list[13]. However, endosulfan is listed as a POP in the Convention on Long-range Transboundary Air Pollution (LRTAP). Endosulfan is recognized as a Persistent Toxic Substance (PTS) by the UNEP.[2]

Q. What is the regulatory status of endosulfan in world nations ?

Endosulfan has been in world-wide use since its introduction in the 1950's. It was considered a safer alternative to other organochlorine pesticides in many countries in all regions since the 1970's. But in the last two decades many countries have

recognized the hazards of wide application of this pesticide and have banned or restricted its use.

Countries which have banned include Singapore, Belize, Tonga, Syria, Germany, Sweden, Philippines, Netherlands, St. Lucia, Columbia, Cambodia, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Sri Lanka and Pakistan[2,73]. Restricted use is allowed in Australia, Bangladesh, Indonesia, Iran, Japan, Korea, Kazakhstan, Lithuania, Thailand, Taiwan, Denmark, Serbia & Montenegro, Norway, Finland, Russia, Venezuela, Dominican Republic, Honduras, Panama, Iceland, Canada, the United States and the United Kingdom [2,56,73,80].

It is one among the twenty one priority compounds identified by the UNEP-GEF in the Regional Based Assessment of Persistent Toxic Substances (PTS),2002. These reports have taken into account the magnitude of use, environmental levels and human and ecological effects of these compounds[2]. In the Indian Ocean Region endosulfan is banned in 8 nations. India is one of the major Indian Ocean rim nations, which has imposed no ban or restrictions on endosulfan. A ban on endosulfan exists in the South Indian state of Kerala (imposed through a Court Order) , which came as a result of a public pressure following the poisoning of many villages due to aerial spraying of the chemical[84]. Colombia and Cambodia are two countries where endosulfan is banned from use recently[80].

In the Reports of the Regional Based Assessment of PTS of the UNEP- GEF, endosulfan has been rated depending on the level of concern in the respective region countries. They are as follows-

- **Indian Ocean region** – "Regional Concern"[2]
- **North American region** – Treated as "Regionally specific PTS", receiving great attention along with HCH, chlordane, PCB, PAHs[74].
- **Mediterranean region** – "Local Concern"[70].
- **Sub Saharan Africa** – Ranked as the PTS of highest concern after DDT[69].
- **Eastern and Western South America** – "Potentially relevant PTS of emerging concern"[72].
- **European region** – "Proposed Possible Priority Hazardous Substance"[75].
- **South East Asia and Southern Pacific region** – "Regional Concern". It is identified as a major PTS which has a continuing effect on the natural ecosystem in the region and long term effect on the structure of aquatic eco system[71].
- **Central America and the Caribbean** – Considered as one of most important PTS of emerging concern[73].

Q. How much endosulfan is produced, used and stockpiled ? and Where ?

Practically very little information is available of the volumes of production of endosulfan. WHO estimated that the worldwide production of endosulfan was 10,000 MT in 1984[81]. Current estimates of worldwide production or domestic formulations could not be located[81]. Many countries that produced endosulfan in the 1970's and 80's do not produce it any more. For instance endosulfan has not been produced in the United States since 1982, but it is still used in chemical formulations[81]. In USA, annual average amount of 626 tonnes is used[132]. In European Union, Germany is the only producer of endosulfan and it is manufactured at a single site, where 5000 TPA is produced. Vast majority of this is exported to South America and South East Asia[132]. In EU, the 90% of the whole endosulfan in 1999 were used in Mediterranean area[132]. Spain, Italy, Greece and France are the major consumers. Endosulfan is produced mainly in Israel, India, China and South Korea[132].

India is one of the major producers of endosulfan. Since 1996-97 it produces an average of 8206 MTPA totaling 41033 MT between 1995-2000[2]. India exported 12180 MT during this period and consumed on an average 3599 MTPA. The UNEP-GEF report on PTS has identified some of the producing and importing countries but there is a large data gap. No information regarding stockpiles of endosulfan could be located.

Q. How might I be exposed to endosulfan ?

- By breathing air near where it has been sprayed.
- Drinking water contaminated directly or through run-offs.
- Being in contact with contaminated soil.
- Eating contaminated food.
- Smoking cigarettes made from endosulfan contaminated tobacco.
- Working at endosulfan production centers.
- Direct ingestion.

Q. How does endosulfan affect human beings ?

Worldwide use of endosulfan increased with the ban/restriction in use of the more persistent organochlorine pesticides like DDT and endrin. Endosulfan is acutely toxic and has been implicated

in many cases of poisoning and fatalities. It has been identified with a range of chronic effects, including cancer and impacts on hormonal systems, exhibiting similarities with its predecessors in the organochlorine class.

Acute effects

Endosulfan is highly toxic and can be fatal if inhaled, swallowed or absorbed through the skin. Acute toxicological data is adequately available. Acute oral toxicity is higher than dermal toxicity[30]. Absorption rate and toxicity is found to increase in the presence of solvents like alcohol and aromatic solvents[12,24,34,61].

A number of acute poisoning cases have been reported. Ingestion or breathing high levels of endosulfan may lead to convulsion and death. Endosulfan directly affects the central nervous system[24,28] and recurrent epileptic seizures are also reported[94]. It is absorbed through skin and eye irritation may also result. Symptoms of poisoning include hyper activity, excitement, dyspnea (breathing difficulty), apnea (stoppage of breathing), salivation, loss of consciousness, diarrhea, anemia, nausea, vomiting, insomnia, blurred vision, cyanosis (bluish discoloration of skin due to want of oxygen), foaming at the mouth, tremor, dry mouth, lack of appetite, irritability, head ache, decreased respiration, loss of memory, haematuria, albuminuria, confusion, dizziness, imbalance and lack of coordination[4,5,7,30]. Persons suffering from asthmatic and convulsive disorders are at high risk. Persons on protein deficient diet also possess high risk[24,30].

Autopsy examination of an intentional ingestion (suicide) case has revealed damage to liver, lung and brain[8,8a].

Chronic effects

There is experimental evidence of adverse effects of endosulfan on the male reproductive system, delaying sexual maturity and interfering with the sex-hormone synthesis[118]. Endosulfan is a proven endocrine disruptor[6,9]. It has potential to induce hypo thyroidism[66]. Long term health effects are not properly studied, experimented or documented world wide.

Endosulfan exhibits estrogenic properties[9,43], comparable to that of DDT[9]. It competes for estradiol for binding to estrogen receptors, thereby inhibiting hormonal function [107]. The estrogenic potential of endosulfan increases in the presence of other estrogenic organochlorines [110] .It induces proliferation of human breast estrogen sensitive MCF7 cells[49], (*invitro*) thereby increasing breast cancer risk[117]. It harms the reproductive system by affecting semen quality, sperm count, spermatogonial cells, sperm morphology and other defects in male sex hormones[11].Endosulfan [is having] have the capacity to alter the genetic material particularly chromosomes in mammalian cultures[119]. It is found to inhibit testicular androgen biosynthesis in lab animal experiments[30] and exhibits significant risk in renal and testicular damage. It may have adverse effects on central nervous system by inhibiting brain acetyl cholinesterase[16], causing uncontrolled discharge of acetyl choline. Endosulfan ingestion is known to affect the kidneys and liver[50.] It inhibits leucocyte and macrophage migration (this is the inhibition of the natural immune system by disrupting anti-body protection) causing adverse effects on humoral and cell-mediated immune system[30]. It is also a potential tumor promoter[67].

Many studies related to its acute and chronic toxicity in laboratory animals are available. Endosulfan is highly toxic to rats and mice[13, 30].Some studies suggests its teratogenic[28] and carcinogenic properties[21] on rats and mice. It directly affects the central nervous system, causes liver and kidney (chronic glumerulonephrosis) damage[6] in rats and mice. It also impairs the reproductory system of rats[39]. Behavioural and neurological changes have also been noticed[30.] Thyroid follicular damage in mouse has been reported[30,66]. Endosulfan is known to damage the endocrine system, nervous system, circulatory, reproductory, respiratory and excretory systems and developing foetus.[6,7,14,15,16,21,30,37]

The National Institute of Occupational Health (India) have linked the higher prevalence of neurobehavioral disorders, congenital malformations in female children and abnormalities related to male reproductive systems to the continuous exposure to endosulfan spray. The study was conducted among children in one of the villages in Kasaragod District (in the South Indian State of Kerala) where endosulfan was aerially sprayed[64]. Endosulfan is implicated in the occurrence of adverse health effects particularly in rural communities in South East Asia, Southern Pacific and Sub-Saharan Africa.[69,71]

Q. Can endosulfan cause cancer ?

Endosulfan is found to damage human red blood cells (RBC) at concentrations of 1ppb-1ppm[10]. Both alpha-endosulfan and beta- endosulfan are genotoxic to HepG2 cells[8]. Endosulfan is hepatotoxic [6], mutagenic, clastogenic and induce effects on cell cycle kinetics[13]. Endosulfan [is known] has been shown to cause chromosomal aberrations in hamster and mouse and sex linked mutations in Drosophila [13,30,58]. Endosulfan has caused mutations in bacterial and yeast cell. It is also known to cause mutations in mammals[13]

A re-analysis data from a 1978 NCI (National Cancer Institute, US) study in Osborne-Mendel rats has revealed that endosulfan induced malignant neoplasms at all sites in male and female rats and endocrine organs in male rats[21]. Both sexes

developed lymphosarcomas and female rats had neoplasms of the reproductive system[21]. Endosulfan is also carcinogenic for the liver of female mice[21].

No accurate data related to the carcinogenicity of endosulfan in human is available but from field level reports, endosulfan can be highly suspected for having carcinogenic properties in human beings, especially in cases of chronic exposure[13]. In some reports it is referred to as having possible carcinogenic effects, effects in human immune and reproductive system[68]. Studies have also shown that it induces proliferation of human breast estrogen sensitive MCF7 cells in vitro[9,49] which may lead to greater breast cancer risk. Studies also indicate the contribution of endosulfan in the combined effect of environmental estrogens in inducing breast cancer [117].

Q. What happens to endosulfan in the environment ?

The fate of endosulfan released in the environment is different for the two isomers and also depends on the medium it gets deposited.

Beta- endosulfan is more persistent than its alpha- isomer. Endosulfan sulphate is the main degradation product of both isomers, which is equally toxic[37,66] and is itself more persistent in the environment than its parent compounds[5,30]. Endosulfan can be broken down by photolysis, hydrolysis and bio degradation. Endosulfan diol, endosulfan lactone, endosulfan ether etc. are some of the other byproducts[5]. Although the isomers are fairly resistant to photolysis, the break down products are susceptible[132]. On plant surfaces endosulfan rapidly degrades to metabolites[30]. Endosulfan is fairly immobile in soil and is highly persistent[13,33]. Major products in soil are endosulfan diol, endosulfan sulfate and endosulfan lactone. Endosulfan sulfate production increases with an increase in temperature[30]. Endosulfan will persist longer under more acidic conditions[5,24]. It persists longer under submerged conditions[86]. The half life of endosulfan varies from 60 days (alpha- endosulfan) to 800 days (beta-endosulfan)[13]. It enters air by volatilization from plant and water surfaces[13,33]. Contamination by drift and particle transport also occur[33]. Ultra low volume (ULV)- application can drift several kilometers from point of application[30]. It has been detected in remote areas including the Arctic[132] in air, snow-water and lake waters, rainfall and snow samples in Californian mountains and remote European mountain lakes [5,30,33,68,75,132]. Beta-endosulfan is more stable in air. Endosulfan has been shown to be released from wood preservatives into room atmosphere over an one year period of observation[5]. In water endosulfan has a half life of 35 to 150 days[13]. It does not easily dissolve in water and may accumulate in bodies of fish and other aquatic organisms[30,69]. The break down products in water are endosulfan-diol and endosulfan sulfate. Endosulfan does not reach down much to ground water[30], but has been proven to run off after spraying. But it has been detected from ground water at deep soil layers in concentration ranging from 0.009- 0.053 micro gram per litre up to 20 days after last spraying[13]. USEPA recommends that the levels of endosulfan in rivers, lakes and streams should not be more than 74 ppb[28]. But this limit is 15 times more than the concentration required causing reproductive damage in red spotted newt[54]. Several studies of bioaccumulation have been conducted around the world and residues were found in aquatic organisms. USEPA considers endosulfan as having a high bioaccumulation potential in fish[16], but not much evidence of bioaccumulation in higher trophic levels is available.

Q. Is there any evidence of endosulfan contamination in the environment, food and human beings ?

Reports of endosulfan residue in food, soil, air, body tissues etc are available from all parts of the globe.

Residues were detected from air, water (surface and ground water)[2,59] and soil in India[2], water and sediments in Ghana[45], marine water and sediments in India[2,87], shallow ground water in Pakistan[124], river water in China[127], lagoons in Spain, surface and ground waters in Portugal[92], ground and well waters in the Philippines[133,134], coastal, estuarine and river sediments in Israel (high concentrations in Lake Kinneret)[70], water in Benin, Malawi, Nigeria[69] and from drinking, ground, surface and marine waters in South Africa[97] (alarming levels in river water 684-4843 ng/L)[69], soil in Benin, Nigeria, Sudan and Zambia, sediments in Benin and Nigeria, vegetation in Madagascar, Zambia and Ghana[69,97], Paddy fields in Mediterranean[131], water from remote mountain lakes in Europe (the Alps, Caledonian and the Pyrenees)[75] and river and sea water in South East Asia[71] etc. were found to be polluted with endosulfan. In Malaysia river sediments were found to have high levels (434micro grams/litre) of endosulfan [71]. Reports from Central America shows air and wetlands[93] in Costa Rica, shallow lakes, coastal waters, estuaries, well, surface and marine waters and sediments in Honduras, Mexico, Argentina and Jamaica are contaminated with endosulfan residues[73,96,113,130].Endosulfan is one of the most frequently reported PTS in surface and ground water in Central America and the Carribean [73]. Toxic levels of endosulfan are reported from the coastal lagoons of Mexico[105] .In Guatemala, it is found more frequently and at higher levels in river water, well water and spring water[73]. It has been detected in municipal water system in Colombia[73]. Endosulfan residues were found in high levels from the gulf of

Mexico and from many parts of the USA[104]. Residues were also found in the Greenland biota [115] and biota including mammals of Arctic region[132].

High concentrations of alpha and beta endosulfan isomers and endosulfan sulphate have been detected in tree bark samples through out the world, particularly in India and the Pacific Rim[30].

Endosulfan has been detected from food samples[20] around the world- in Australian beef at 0.36 mg/kg[32] (2 times the Australian limit and 4 times the international limit), in cows milk from tobacco farming areas in USA and food samples in USA and Canada[5]. Residues were detected in tomatoes from Brazil[20], untreated leek in Argentina[95], Spanish pepper samples from Finland, fish from India[2], Kenya and Nigeria[69], food and vegetables in Croatia[70] and vegetables in Cyprus[70]. Residues were also found from sunflower seeds of untreated areas in Spain[112] High levels of residues were found in red pepper and egg plants in Catania(Italy) [70]. High residues have also been found in diary food, meat, fish, chicken, and vegetables in Eastern and Western South America[72], cows milk in Brazil[79], vegetable diet in Kuwait, vegetables, vegetable oil and seeds from India and animal samples from slaughter houses in India[2]. Endosulfan residues were detected from cows milk in Colombia far exceeding the WHO and FAO reference levels[73]. Fish from Kenya and Nigeria were heavily contaminated with endosulfan[69]. The European Union has banned import of fish from Tanzania, Uganda and Kenya due to high levels of endosulfan residues[80]. Residues were also detected from animals samples in Benin, Nigeria, Cote d' Ivoire, Madagascar, South Africa and Kenya[69]. Presence of endosulfan in Lake trout in North America suggests a wide dispersal from areas of use to isolated lakes[74].

Endosulfan has also been detected from human tissues. It has been detected from cord blood samples obtained at the time of delivery[46], human sera[42,55] ,adipose tissue[87] and human milk samples obtained from healthy lactating women in Spain[44]. Human breast milk from Egypt[30,41], Colombia and Nicaragua[73] and from cotton pickers in Pakistan[2] were found to be contaminated. High levels of endosulfan were detected in human breast milk in Sub Saharan Africa[69] and also from India[128] . Residues were also detected in fat samples from children living nearby farms in Spain[22]. Blood, human milk and urine samples in Croatia were also found to be contaminated. Alarmingly high levels of endosulfan residues were observed in human blood and milk in a study in Kasaragod in Kerala, India[26,26a,27,31,64].

Q. How does endosulfan affect wildlife and domestic animals?

There are many reports regarding the toxicity of endosulfan on wildlife. National Wildlife Federation (USA) states that endosulfan is extremely toxic to wildlife and acutely toxic to bees[13]. It is acutely toxic to birds - mallard ducks[24], quails and pheasants[30]. The alpha isomer is more neuro-toxic and its acute toxicity against mammals is more than three times that of the beta-isomer[109]. It is genotoxic and is a known endocrine disruptor in terrestrial and aquatic species[132]

Endosulfan is highly toxic to aquatic organisms even at recommended levels of application[13,71,88,132]. It is particularly toxic to fishes[5,18,24,132] – massive fish kills are reported from many places[13]. It also causes endocrine problems, reduction of protein in tissues and other health effects. The high toxicity to fish species is evidenced through studies on *Gambusia affinis*[18], Rainbow trout, channel catfish, bluegill sunfish, minnow[24,30,36]. It affects metabolism in freshwater fishes by inhibiting transcription at some points[126]. It is known to impair the pheromonal systems leading to disrupted male choice and lowered mating success in female red spotted newts [54]. It is known to affect the germ cell population of zebrafish embryos[47]. It exhibits anti-estrogenic effects in fresh water catfish, reproductive problems in female teleostfish and opercoidfish[30]. It also bioconcentrates in aquatic organisms[33]. Reports from South East Asia and Southern Pacific proves that endosulfan has detrimental effects on aquatic biota[71]. Reports prove its high toxicity to frogs, toads, annelids, snails, aquatic insects (damsel flies, midges, beetles etc), crustaceans (crab, shrimps, prawns etc), fishes and molluscs[78, 114, 125]. Endosulfan affects the hatching rate and larval survival of common Indian Toad[82]. It also affects the larval survival, growth rate, respiration and caused limb deformities in the streamside salamander[103]. Reports from Argentina and South Africa suggests that it affects the aquatic insect and macro-invertebrate populations in streams and rivers[122,123]. Studies show that it has contributed to the adverse effects on the wetland ecosystem in the Republic of Azherbaijan[99].

Besides being toxic to crab larvae[29], it has been reported to disrupt the moulting of crabs and aquatic invertebrates[76,76a]. It is known to function as an endocrine disruptor in American alligators[65]. It has been detected from the nonviable eggs of Morelet's crocodile[19] . It is also known to be affecting the egglaying of grass shrimps[52] . It has been detected as one of the predominant organochlorine pesticides in the silverside fish in Argentina[53]. It has been related to the drastic population decline of anuran amphibians in Western USA in over the last 10 to 15 years[48]. Residues have been obtained from the liver of Eastern Box turtle[40]. It is found to accumulate 600 times the water concentration in mussels[24].

Endosulfan was found toxic to earthworms, causing a significant reduction in the growth rate and total protein content[129]. It is toxic to non target organisms[16,120], like predators of several pests[51]. Endosulfan is highly toxic to soil micro arthropods[17],

micro organisms, zooplanktons[90], phytoplanktons, soil algae, actinomycetes, bacterial colonies etc.[13,30]. It has shown to cause chromosomal aberrations in *Drosophila* fly[132]. It is also toxic to mammals like rabbits[13,30] and rats[21,108]. The disappearance of cats, frogs, bees, fresh water fishes etc. were reported form Kasaragod District in South India, where endosulfan was aerially sprayed[27].

Endosulfan is also highly poisonous to cats (LD50-2mg/kg) and dogs (LD50-76.7mg/kg). Reversible blindness and lack of muscle coordination has been reported in sheep and cattle grazing on endosulfan contaminated grass [24]. Farmers from endosulfan sprayed area report of acute effects to cattle at time of spray and after, and leading to fatalities[27]. Acute poisoning of cattle and cattle deaths, due to the direct use of endosulfan on cattle as an ecto-parasitic-control, are reported from Turkey[100]. Similar poisoning case is reported from USA also[101]. Chronic exposure to endosulfan leads to deleterious effects on metabolism and immune system of broiler chicken[111].

Endosulfan exhibits phytotoxic properties [7]. Toxic effects on plants like root growth inhibition, stunting, burning of tips and margins of leaves and affected root permeability have been reported[13]. It is a prominent contaminant in vascular plants and lichen even in remote areas like the Arctic[68,115]. It is toxic to fresh water green algae[90] and also to blue-green algae[91]. It also affects diatom abundance, chrysophytes, cryptophytes and dinoflagellates[121].

Q. Are there reports of endosulfan poisoning from around the world ?

Cases of endosulfan poisoning have been reported from many parts of the world. Accidental and intentional exposure leading to human fatalities and environmental tragedies has occurred. The following are some of the major cases of poisoning.

Human poisonings

In Sudan in1988, endosulfan barrels washed in irrigation canals caused fish kills and three people died after drinking water from the canal[13]. In the Philippines, endosulfan accounted for the largest number of deaths due to pesticide poisoning reported in 1991[13]. In Sulawesi, Indonesia, 32 cases of poisoning due to endosulfan have been reported from 1990 to 1993[56]. In Columbia, 155 cases of poisoning (in 1994) and 60 cases (1993) of poisoning due to endosulfan were reported[56]. In Northern India, 18 cases of endosulfan poisoning have been reported in 1995-97 by accidental over-exposure during spray[23]. Endosulfan caused a rise in death numbers due to poisoning in Srilanka from 1994 to 1998[98]. The misuse of endosulfan to kill snails has resulted in the largest number of poisoning cases with fatalities in Philippines in 1996 [75]. Poisoning due to consumption of endosulfan-contaminated food is also reported from Turkey (2003)[102]. Many cases of poisoning-death in Guatemala, Costa Rica and other Central American countries have also been reported [73]. In Feb 2002, two South African boys living near Ntabamhlophe, Kwa-Zulu Natal died following exposure to endosulfan. A police officer and 3 journalists were hospitalized after visiting the place several hours later[80]. In 2000, a case of 44 individuals who consumed food accidentally contaminated by endosulfan was reported in rural India. One individual died in the incident[44]. In 2004, 36 persons of all age groups in a rural area of Jabalpur, India were poisoned after consuming wheat-grains or flour contaminated with endosulfan[106].

The worst of all the cases so far reported are from three nations--- Cuba, Benin and India.

Pesticide Poisoning in Cuba : Endosulfan was responsible for the death of 15 people in the western province of Matanzas, Cuba in February 1999. A total of 63 people became ill after consuming food contaminated with endosulfan according to Cuban authorities[83].

The Benin Tragedy:- In Borgou province in Benin, endosulfan poisoning caused many deaths during 1999 - 2000 cotton season. Official records state that at least 37 deaths occurred and 36 were taken seriously ill. In the same region in1999 a boy died after eating corn contaminated with endosulfan[25].

The Kasaragod Tragedy, South India:- People in 15 villages in Kasaragod in the South Indian State of Kerala were subjected to continuous exposure to endosulfan which was aerially sprayed three times every year for 24 years. Congenital Birth defects, reproductive health problems, Cancers, loss of immunity, neurological and mental diseases were reported among the villagers. Following a public outcry a number of health based scientific studies confirmed that the health problems were directly linked to the exposure to endosulfan[27,60,64].

Poisoning of water bodies and fish kills

A wide spread fish kill was observed in 1969, when 30 kilograms of endosulfan was discharged into the Rhine river in Federal Republic of Germany[5,30]. In 1975, an accidental spill of endosulfan caused a major fish kill in North Brook a tributary of the Dunk River in Eastern Prince County of Prince Edward Island. The Brook trout population was reduced from 2227-4147 to 45-246 [30]. In 1995, run-off from cotton fields contaminated with endosulfan resulted in the death of more than 24,000 fish along a 25-kilometer stretch of a river in Alabama[13]. Investigations showed that the pesticide had been sprayed according to label instructions.

Q. What are the alternatives to endosulfan?

While there are many non-chemical alternative practices, the choice of one primarily depends on the crop and the pest for which it has been used.

One of the important crops on which endosulfan is used is cotton. Endosulfan is also used on crops like vegetables, cashew, coffee, tea etc.

There are numerous documented benefits from the adoption of Integrated Pest Management (IPM) programme for cotton from different cotton growing areas all over the world. The focus of IPM is on cultural and biological control of pests rather than depending on pesticides. A comparison in Frio county, Texas show a savings of between 131- 300 percent for alternative cotton pest management[62]. Organic farming of cotton is also gaining popularity among cotton farmers in the Asian region[62].

Similarly in vegetable cultivation many field trials have been carried out on alternative pest control methods focusing on herbal pesticides. In some studies, botanical pesticides were found more effective than endosulfan in controlling green house pests[116]. In the Asian region farmers have developed their own combinations and methods of pest control using chillies, garlic, asafoetida, cow urine and many other plant materials. FAO supported IPM programme in vegetables is well documented.

In India endosulfan was recommended for controlling tea mosquito bug in cashew and tea until 2000. Following the Kasaragod Tragedy, the National Research Centre for Cashew has withdrawn its recommendation for endosulfan use in cashew. Many cashew farmers have tried organic method and application of neem oil and pongamia leaf extract is found successful by some South Indian farmers. Some farmers have even tried 'do nothing' farming and the results are encouraging. Alternative pesticides and organic farming are encouraged in tea plantations and the use of endosulfan is being eliminated. There are tea plantations in South India which has adopted bio-dynamic farming and have completely eliminated the use of chemical pesticides including endosulfan.

In coffee, to control coffee berry borer, Integrated Pest Management is adopted instead of endosulfan[63]. This includes strict phyto-sanitary and cultural measures supplemented with bio control measures and mass trapping of the insects.

Though alternatives to endosulfan are available, support for such practices are very low. If Governments and research institutions can support such work, use of endosulfan can be totally eliminated in agriculture and other sectors.

Q. What can I do to eliminate the use of endosulfan?

- Look out for the alternative non-chemical pest control, which is available in your region and other parts of the world, and thus eliminate the use of endosulfan.
- Pressure your government to ratify the Stockholm Convention if it has not already done so (see http:/www.pops.int for a current list) and press for addition of endosulfan to the Stockholm Convention List.
- Pressure your Government to ban the production and/or use of endosulfan, if it has not already done so.
- Join one of the local and international campaigns to ban endosulfan.
- Adopt "Land and Food without Poisons" as a goal for survival and adopt organic, ecological or natural agriculture in your farm. Share this message among fellow farmers.

Trade names and formulations for endosulfan:-

Endosulfan is available in the market in a number of trade names. It is available as formulations of Emulsifiable Concentrate (EC), Wettable Powder (WP), Ultra low Volume Liquid (ULV), Granules (G), Dust(D) and Smoke Tablets.
The following list contains some of its trade names. The list is not complete and some names may now be obsolete.

Bangladesh – Thiodan

Brunei – Thiodan, Fezdion

Chile – Parmazol E, Flavylon, Galgofan, Thiodan, Thionex, Thionyl y methofan

India – Agrosulphan, Agiro Sulphan, Banej Sulphan, Cilo Sulphan, Endo Sulphan, E- Sulfan, Endo Chithin, Endocid, Endonit, Endomil, Endosol, Endostar, Endosun, Endotaf, Endostan, Endocing, Endocide, Endosulpher, Gaydan, Gilnore Endorifan, Hexa-sulfan, Hildan, Hockey Endosulfan, Hy-sulfan, Kemu Sulfan, Hilexute-Sulfan, Krushi Endosulfan, Lusu Sulfan, Marvel-Micosulfan, Mico Thansulfan, Pary Sulfan, Pesticel, Remisfan, Sico sulfan, Solesulfan, Sujadin, Sulfan, Tej Sulfan, Thiodon, Thiokill, Thionel, Thionex, Thioton, Veg-fru Thiotox, Veg-fru Thiotex, Vika sulfan.

Indonesia – Thiodan, Fanodan, Dekasulfan.

Korea – Malix, Thiolix.

Pakistan – Siagon, Thiodan, Thioluxan.

Philippines – Atlas Endosulfan, Endosulfan, Contra, Endox, Thiodan.

Sri Lanka – Thiodan, Thionex, Endomack, Endocel, Baurs Endosulfan, Harcros Harcosan, Red Star Anglo-sulfan.

Thailand – Thiodan, A. B. Fan, Aggrodan, Agridan, Bensodan, Bensocarb, Beosit, Brook, Clement, Dew Dan, Dior 35, Dori, Dumpersan, E C Sulfan, Egodan, Endan, Endodan, Endosulfan, Endrew, Endye, Endyne, Etonic, Exxo-Z, Famcodan, Fortune, Freedan, Gardner, Gycin, Hor Mush, Hydrodan, J-teedan, Jack Dum, Kasidan, L P dan, Lordjim, Malix, Manyoo, Metrodan, Nayam, Newcodan, Nockdyne, Ox Xa, Patodan, Pestdye, Pro-d-dan, Sandan, Shevanex, Simadan, Sonydan, Summer, Tanadan, Teophos, Thanyacarb, Thimul, Thiofor, Torpidan, Urofen, Wephos, Zumic.

Other Names: Chlorthiepin, Cyclodan, Endox, Thifor, Thiomul, Thionate.

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