A WHITE PAPER

ON THE

REPORT ON THE VISIT OF THE EXPERT TEAM CONSTITUTED BY THE KERALA AGRICULTURE UNIVERSITY FOR INVESTIGATING THE ENVIRONMENTAL EFFECTS OF AERIAL SPRAYED ENDOSULFAN ON CASHEW PLANTATIONS IN PERLA AREA OF KASARAGOD DISTRICT

September 2001

ENDOSULFAN SPRAY PROTEST ACTION COMMITTEE *(ESPAC)*
Perla - Padre - 671552 Kasaragod , Kerala

.....acknowledgement

ESPAC acknowledges participation of our villages and the people, members of the steering committee and public-interest scientists, who provided information which was useful in preparing this white paper. We also acknowledge the technical assistance from Thanal Conservation Action and Information Network in preparing this document.

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KAU REPORT ON THE VISIT OF THE EXPERT TEAM CONSTITUTED FOR INVESTIGATING THE ENVIRONMENTAL EFFECTS OF AERIAL SPRAYED ENDOSULFAN ON CASHEW PLANTATIONS IN PERLA AREA OF KASARAGOD DISTRICT

Background

The people of Kasaragod, mostly from Cheemeni, Periya-Pullur, Rajapuram, Panathadi, Muliyar, Perla have been complaining against aerial spraying of endosulfan by the PCK in their cashew plantations for the last 20 years. Reports have come in the media right from 1979 pointing out the hazards of the use of pesticides and aerial spraying of the same. None of the concerned authorities nor the scientists have ever thought it necessary to look into the environmental and health problems. Court cases against the spraying have been filed from Periya-Pullur from 1998 onwards and the PCK only responded by writing to the companies producing and supplying endosulfan to give them information which will help in continuing its use.

From December 2000, the media had played an important role in highlighting this issue and more importantly in waking up the authorities who were feigning a slumber. For the first time, the hue and cry was loud enough for authorities and the scientists to hear. Now they say that the media, the voluntary organisations and environmentalists are sensationalizing the issue. Who is responsible for this? Now they are saying that this sensationalizing will affect cashew export prospects. Who is responsible for this ? Children with congenital anomalies, skin diseases, cerebral palsy, hydrocephalus were forced to parade before the media, not because they wanted to sensationalize this issue. They did it to make these authorities and scientists open their eyes and ears.

In January 2001, the Centre for Science and Environment collected 25 samples of blood, fat, milk, vegetables, cashew, leaves, soil, water etc from Enmakaje village. There were prominent scientists who guided this study. Prof. M K Prasad and Dr. Raghunandhan guided the sample collection and Dr. Padma Vankar of IIT, Kanpur did the analysis at the State of art lab at CSE. All samples had very high levels of endosulfan. This was the first evidence that endosulfan was in the environment and human beings. The persistence of endosulfan (half-life of 2-7 days in plants and upto 800 days in soil) was a known fact and we realised that our exposure to endosulfan was not just at the time of spray but through out the year as well. We also knew very well from literature that endosulfan could harm in many possible ways – reproductive system, endocrine system, central nervous system, skin, kidneys and liver disorders and cancer to name a few.

On January 16th, ESPAC sent a letter to the then Vice-Chancellor of KAU asking for clarification on a reported recommendation that they had given on endosulfan use and requesting the VC to withdraw the certification issued, if any. There was no reply to this letter. Later we understood that an expert team of agriculture scientists was set up to study the issue and on the 19th of February they visited the area to do a preliminary investigation into the problems due to aerial spraying of endosulfan. These scientists, many of whom

INVESTIGATING THE ENVIRONMENTAL EFFECTS OF AERIAL SPRAYED ENDOSULFAN ON CASHEW PLANTATIONS IN PERLA AREA OF KASARAGOD DISTRICT

Background

samples and left. Inspite of the fact that they were 20 years late, we welcomed them in hope that they would see the intensity of the impact and report to the University and other authorities. Events that followed proved that they had not come here with a clean heart and an open mind. The result was a series of happenings which have turned out to be humiliating to the Kerala Agricultural University, other fellow scientists and the State.

The results of the CSE analysis was released on February 21st and was nationally covered by all the media. This must have innerved the KAU. On 28th of February, the deadline set by the University for submitting the report, this expert committee of the Kerala Agriculture University released a letter through the official email of the College of Agriculture, Padanakkad- kaupad@vsnl.com saying that the CSE study was exaggerated and sensational. The team member who authored the letter requested that maximum publicity be given to this opinion. Even the methodology of the CSE study was questioned in the email letter. But the expert team did the most untimely and silly thing. They challenged the CSE results on frivolous grounds and that too even before their own analysis was done. Expectedly enough, on April 10th a member of the expert team called up ESPAC and said that none of the samples that they had collected had endosulfan contamination and some samples had only traces which were very much below the tolerable levels. These results were also released "unofficially" from the official email of the College of Agriculture, Padanakkad.

While the CSE had followed very meticulous, transparent and scientific procedures for the sample collection – taking the utmost care to collect in sampling bottles, packing in ice boxes and sealed containers – the KAU team came with empty hands, collected the samples and took them back in polythene covers. Later, we understood that the expert committee had submitted a report to the Vice-Chancellor of KAU and had also distributed a Thought paper among the scientists in the KAU. While we were not given these reports, the PCK General Manager and the Managing Director were quoting these results and the report in the media. We then got a copy of this report unofficially and found that the report was baseless, unscientific and an insult to the already beleaguered people of Kasaragod. We discussed this report with prominent scientists, media persons and leaders of the community and we are sorry to state that this report demonstrates the pathetic state of affairs of research and knowledge levels of this team of scientists of the Kerala Agriculture University. *These scientists have all proven to harbor a clear bias and we are forced to realize the vested interest that led the scientists to submit such a poor report.*

Hence, ESPAC has decided to produce a white paper of the report with the good intention and moral responsibility to point out before the Vice-chancellor of the KAU and others of concern in the State what actually happened during the expert teams fact-finding visit. We are doing this because we know that neither the Kerala Agriculture University nor the esteemed scientists in the University who have been contributing their best to science and society would approve of such wrong and mean ways of some of their fellow scientists. We also hope that this white paper on the report will start a serious introspection among the Agriculture Scientists about their state of research, understanding of issues and credibility.

Note to the Critique : The Original Report of the KAU is fully reproduced below in small italics and it is interspersed at relevant points with our critical comments in boxes.

REPORT ON THE VISIT OF THE EXPERT TEAM CONSTITUTED FOR INVESTIGATING THE ENVIRONMENTAL EFFECTS OF AERIAL SPRAYED ENDOSULFAN IN PERLA AREA OF KASARAGOD DISTRICT

Kerala Agricultural University
Cashew Research Station Madakkathara 680651

As per order DO. No. DR.70/2001 dt. 13.2.2001 of the Director of Research Kerala Agricultural University, an expert committee was constituted with the following members to study the environmental effects of aerial sprayed endosulfan spray on cashew plantations of Kasaragod district

1.	*Dr. M. Abdul Salam* *Associate Professor and Head, CRS, Madakkathara, Thrissur*	*Convenor*
2.	*Dr. S. Nazeema Beevi* *Associate Professor and Head,* *A.I.C.R.P. on pesticide residues, College of Agriculture Vellayani, Trivandrum*	*Member*
3.	*Dr. A.M. Ranjith* *Associate Professor, Dept. of Entomology,* *College of Horticulture, Vellanikkara, Thrissur*	*Member*
4.	*Dr. Samuel Mathew* *Associate Professor (Ag. Chem), AMPRS, Odakkali*	*Member*
5.	*Dr. K.M. Sreekumar* *Assistant Professor (Entomology), College of Agriculture, Padannakkad*	*Member*

The study was ordered at the instance of a complaint filed by Mr. Aravinda, Chairman, Endosulfan Spray Protest Action Committee, Padre to theVice-Chancellor, Kerala Agriculture University. It was directed by the University to submit a preliminary report before 28th Feb. 2001. Accordingly, the members of the above committee (excepting Dr. Nazeema Beevi) visited the problem area on 19th Feb 2001. The following members were also present.

1. *Dr. B. Jayaprakash Naik, Associate Professor RARS, Pilicode.*
2. *Sri. M. Bhaskaran, Dy. Director, Dept. of Agriculture, Kasaragod*

The following environmental activists also accompanied us.

1. *Dr. Sripadi Kajampadi*
2. *Sri Ganapathi Bhatt, Pattadka House (P.O) Vani Nagar*
3. *Narayana Sasthri, Kollengala*
4. *Rajagopal Sharma*
5. *Venkita Ramana Bhatt, Edamala*
6. *K. Srinivasa Naik, Ward Member*

The study was not ordered at the instance of a complaint filed by Mr. Aravinda of ESPAC. The PCK had reportedly released a press statement saying that "In Kasaragod since 1976 , endosulfan is being aerially sprayed and that Agri University has certified that there is no much harm by this sort of spray " (as reported in Janavahini A Kannada daily , dtd .January 9 2001). ESPAC had sent a letter to the VC of KAU seeking clarification in the light of the above statement. This clarification has not been answered till date. Copy of this letter is in attachement-1.

About 25 people accompanied the team of experts and none of them are "environmental activists" The six names listed above are members of ESPAC. Dr Sripathy Kajampady is a Local Medical Practitioner at Perla and K.Srinivasa Naik is the Panchayath Member of Ward 6, which the team has visited. The others are farmers and affected people. KAU expert team has unnecessarily alleged that they are "environmental activists" to create a ground for further argument

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Recently, a large number of reports have appeared in the mass media, both print and electronic, on the alleged effects of endosulfan on the environment following aerial applications of this insecticide on cashew plantations in Kasaragod district.

About Endosulfan

The committee has made an attempt to gather sufficient information from various sources to make an assessment of the toxicological and environmental aspects of endosulfan. The toxicological data are presented in Annexure 1. Critical information on the subject is abstracted below.

1. *Endosulfan is a neuro toxic insecticide belonging to the group of cyclodienes. Some of the related insecticides of the same groups viz., Chlordane, Heptachlor, Aldrin, endrin and Dieldrin were banned for use in agriculture because of long persistance of their toxic residues in the environment.*

Endosulfan is a neurotoxic insecticide belonging to the group organochlorine and the sub-group cyclodienes. All the related insecticides in this sub-group viz Chlordane, Heptachlor, Aldrin, Endrin, Dieldrin and Mirex has been banned in India and is slated for a global phase out by the Stockholm Convention. Endosulfan is chemically very close to Dieldrin, substituting a heterocyclic sulfur in place of the saturated bicyclic ring system.

2. *It is reported that Endosulfan is not likely to cause reproductive effects in humans at expected exposure levels.*

It is impossible to conclude that Endosulfan is not likely to cause harm to reproductive system in human beings, because no experiments have ever been conducted on the reproductive system effects on human beings and it is also impossible, dangerous and unethical to do so. The only experiments we know about the reproductive system effects are studies on aquatic organisms and mammals (rats, rabbits etc). A large number of studies done on fish, rats, mice and rabbits prove that endosulfan is an insecticide which can affect the reproductive system. (Barry et al., 1995; Barry, 1996; Chakravorty et al., 1992; Kulshrestha & Arora, 1984; Pandy, 1988; Wilson & LeBlac, 1998; Sinha et al., 1997; Singh & Pandey, 1989; 1990; Gupta & Chandra, 1977; Gupta et al., 1978). The National Institute for Occupational Safety & Health (NIOSH) states that the Reproductive System is a target organ of endosulfan poisoning.

3. *It is also reported that endosulfan does not appear to be carcinogenic.*

It is dangerous, especially by agricultural scientists, to make statements like "does not appear to be carcinogenic" about a chemical which many studies have proven to display carcinogenic properties. Most of the studies reviewed by the WHO, were studies done by scientists affiliated to Hoechst, the patent holder of endosulfan, and no wonder they did not prove conclusively that endosulfan is carcinogenic, mainly due to high mortality of the experimental animals. Furthermore, there are other studies which show that endosulfan can cause cancer (Reuber, 1981; Fransson-Steen, 1992). The second study also showed that endosulfan is a potential liver tumour promoter.

Moreover, Endosulfan has been proven to be Mutagenic, Clastogenic and Genotoxic in many in vitro and in vivo assay studies (Sylianco, 1978; Adams, 1978; Naqvi & Vaishnavi, 1993; Yadav et al., 1982; Mc Gregor et al., 1988;Dubois et al., 1996; Dzwonkowska & Hubner, 1986; Dhouib et al, 1995; Velazquez et al., 1984; Pandey et al., 1990a). Studies done on human cells both in vitro and in vivo also showed that endosulfan is mutagenic and genotoxic (Sobti et al., 1983; Dulout et al., 1985; Yuquan et al., 2000)

Cytotoxic effects of endosulfan and cell structure damage was shown in many studies (Bain & LeBlanc, 1996; Huang & Casida, 1996; Rosa et al., 1996; Dubey et al., 1984; Yamano & Morita, 1995). Daniel et al (1986) showed that even at a concentration of 0.001 microgram/ml (1 ppb) endosulfan was found to damage human red blood cell membranes.

4. *Endosulfan rapidly degraded mainly into water-soluble compounds and eliminated in mammals with very little absorption from the gastro-intestinal tract.*

This is an unscientific, vague and too simplified a statement. The fate and degradation of endosulfan is dependent on the fate and degradation of each of its isomers and also its metabolites. This is different in different medium.

It is known that endosulfan (both alpha and beta isomers) are metabolized in the mammalian system, but it is not known how much of it is absorbed and how much is eliminated and over what time. We now know that it induces toxic effects in kidneys, liver, the CNS and Reproductive systems (NIOSH, 1997). Studies also show that the alpha-isomer is known to persist longer than the beta-isomer, particularly in brain tissue and plasma (Gupta, 1978). Ceron et al (1995) detected alpha-endosulfan in liver and brain tissues in rabbits exposed to endosulfan.

5. *It is moderately persistent in the soil environment with reported average half-life of 50 days. It has a moderate capacity to adhere to soils. Owing to low water solubility and immobility in soils, it is not likely to cause threat to ground water.*

This statement is summarily wrong, because it is not possible to be so accurate and single-numbered in talking about its fate and degradation in soil. Endosulfan isomers show different rates of dissipation from soil (Stewart and Cairns, 1974). The study found that half-life of alpha-endosulfan is 60 days and beta-endosulfan is 800 days. In another report, the half-lives were estimated as 35 and 150 days respectively (EXTOXNET, 1996). The major products of degradation of endosulfan in soil are endosulfan diol and endosulfan sulfate (Martens, 1976; El Beit et al., 1981). The metabolite endosulfan sulfate is more persistent than the parent compound. (Stewart and Cairns, 1974). So even if endosulfan disappears from soil, its metabolites which are much more stable and toxic compounds could be there for years.
Even if endosulfan is immobile in soil, the top soil (upto 15 cm) where 90% of endosulfan residue may be found (Stewart and Cairns, 1974) may itself be mobile and can contaminate water sources like streams and ponds.

6. *It is relatively toxic to fish, but comparatively safe to honey bees*

The Annexure I in this KAU report itself says that endosulfan is extremely toxic to fish, but in this abstract it has become "relatively toxic" This is the best example of a casual approach or intentional misleading. Every document and research all over the world says that endosulfan is extremely toxic to aquatic organisms. Even very low concentrations of endosulfan use has resulted in fish kills. For example, in June 1969 itself, a massive fish kill in the Rhine River was associated with a maximum endosulfan concentration of 0.7 micro-gram/L (Greve & Wit, 1971) Many countries all over the world has banned or severely restricted endosulfan mostly for its aquatic toxicity. This was recognized in 1991 itself by the Dr. Banerjee Committee appointed by the Central Insecticides Bureau and later by the Dr. R B Singh Committee in 1999. They had recommended that endosulfan should not be used near waterbodies. The Agriculture University and the Department has been recommending endosulfan in Kerala, ignorant of this. Media has already raised doubts as to whether this has been intentional (to promote the industry ?)

Endosulfan is acutely toxic to honeybees. In our area, one of the most significant environmental impact was the total death of bees. Farmers who had more than 40 nests of bees have totally lost all their bees, over the years. The US National Wildlife Federation says that endosulfan is extremely toxic to wildlife and acutely toxic to bees. (NWF, 1987). The HIL (Hindustan Insecticides Limited) has themselves in their document on endosulfan said that "Endosulfan is toxic to honey bees in the laboratory" But they also add that it "appears" to be "without significant impact" in the field. While this is a highly ambiguous statement, the KAU has gone one step ahead and stated that endosulfan is comparatively safe to honeybees.

7. *It is permitted to be used as spray from helicopter (aerial spray) at 2 to 3 meters height from crop canopy.*

This permission is as old as 1983, when endosulfan along with other banned chemicals like BHC, Toxaphene was also allowed for aerial spray. The Central Insecticides Bureau has not been giving permission for aerial spray since 1993. From the expert committee report it is shocking to note that even the Agriculture University is ignorant of these facts. The Hindustan Insecticides Limited, the company from which PCK buys endosulfan (Hildan) itself says as precautions that "Do not apply under meteorological conditions or from spraying equipment which could be executed to cause spray to drift into wetlands and waterbodies" They had also warned that contamination is possible through "Drift, Volatilization and Particle Transport"

The KAU experts should also have enquired why and how aerial spraying was done from 1976 onwards, but the concentration and method of spray was only

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Details of Spot Inspection

The team visited the Perla, Swagha, Perialadka, Kollengal, Galigopura, areas of Kasaragod Taluk and interviewed a random sample of 10 families of the area. According to Mr. Aravinda there are 156 cases of Central Nervous System (CNS) and related disorders in Padre Village as detailed below.

Cancer (living)	:	*3*
Cancer (Dead)	:	*46*
Mental retardation	:	*23*
Psychic cases	:	*43*
Epilepsy	:	*23*
Born handicapped	:	*9*
Suicides	:	*9*

The team did not do any random sampling as they have stated. They only went to those houses we took them to.

During the investigation, we come across three groups of people with following views.

(i) A group of people strongly arguing that the CNS related abnormalities are due to aerial spray of endosulfan. These persons stay in the adjoining areas of plantation within 3 to 4 kilometers with some sharing boundaries with PCK. These people also reported that the minimum precautions prescribed for aerial spraying were seldom observed. The details of five families inspected are given below.

There was no such group and all these people mentioned below are staying within 500 metres from the plantation and some on the border. Why has the University team hidden the details they have collected ? Why are they trying to down play the toxicity and health hazards of endosulfan ? The actual health problem seen in each of these houses is described in the boxes here.

1. Korangpappa Rai, Padre, Enmakaje Panchayath (House wife suffering from Neurological complaints and bedridden for last 2 years.)

Koragappa Rai, 73 years old was almost bed ridden for the last two years for backache and numbness.
Lekshmi, wife - was suffering from Parkinson's Disease for the last two years (neurological disease) and died after the team visited.
Ramanna Rai, second son, married for the last 18 years and issueless. Indravathi, his wife is anaemic and weak.
Kamala, daughter, born handicapped. She suffered from a disease whose symptoms were like jaundice. She died of liver cancer at the age of 25.
Leela, second daughter had multiple abortions and issueless for long time. Now has a son who suffers from asthma.
Yamuna, third daughter suffering from some neuro-muscular complaint- swelling joints and pain undiagnosed. She also has a girl with chronic ailment.

The KAU team had seen the suranga outlet and the small pond covered with a fertiliser bag supplied by the PCK. They saw the family using this suranga water and Dr Abdul Salam even observed that endosulfan could be smelt even after two months of spraying.
This house is almost on the border of the plantation and Koragappa said that endosulfan drizzles down on them during the helicopter spray. Their 10 month old cow has stunted growth. Koragappa complains that such cows do not milk in

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2. *Govt. H.S.S. Padre, P.O. Vaninagar, Enmakaje Panchayath – Explained by C. Narayanan, Assistant Headmaster (9 mentally and physically retarded students out of 153 in the lower primary section)*

1.	Udayakumar	14 Years
2.	Rohini	10 Years
3.	Mahesh Babu	14 Years
4.	Jayakumari	12 Years
5.	Nalini	12 Years

The Govt. Higher Secondary School has a total strength of 622 students. Of this there are 153 students in the lower primary section. Mr. C Narayanan is an Asst. Teacher, and not the Asst. Headmaster.
Nine children in the LP section is mentally and physically retarded and 21 others are of low/very low IQ. The list of these 30 students in the LP section with scholastic backwardness has been submitted to the Block Resource Centre, Badhiadukka and to all the enquiry committees. The list does not have Nalini. There is one girl Nalini in the school who is neither mentally nor physically retarded, but she is suffering from skin disease. A number of such children are suffering from various other ailments like asthma, fits and epilepsy, handicap, frequent ear oozing and problems with eye sight.
The School Resource Group Meeting of 3rd January 2000 had noted that "40 children coming from the west side (back side) of the school are found to have mental and physical weakness. Most of them are frequently ill. Their learning capabilities are very low. What may be the reason ?" This observation was made even before the local doctors identified endosulfan to be cause for the many ailments in Padre. The PCK plantations are at the west side of the school. Many children coming to school during the spraying season have headache, vomiting, stomach ache, itching and are rushed to the hospital or doctors.

3. *Sheena Shetty, 59 years, Periyaladkam (Daughter 23 Years old married and healthy, Elder son 21 Years is mentally retarded and the younger son 16 years is also with low IQ)*

Sheena Shetty 59 years, NayarBalike (not Periyaladukam)
Wife : Mukthaka Shetty, 52 years whose blood showed 196.47 ppm of total endosulfan in CSE test. Lakshmi, their eldest daughter, born normal, became epileptic at the age of 15, died after falling and injuring her head at the age of 22, 10 years ago. Saraswathi, their second daughter, born normal, aged 25 now is married. Kittanna, 21 years was born cerebral palsy (and not just mentally retarded as reported by KAU scientists). He needs help for everything. CSE tests showed 109.5 ppm of endosulfan in his blood. Shreedhara, 17 years is mentally retarded (not just low-IQ) and studies in the 6th standard. Their house is on the banks of the Kodenkeri stream and very near the plantation borders. This case was widely reported in the media. Were the KAU scientists that hard hearted to even misreport these cases in the most casual way or was it intentional?
Mukthaka regularly goes to collect cashew and firewood from the plantation. Their cow which was carrying was grazing in the plantation at the time of spray in December 2000. They let her as usual for grazing, as PCK had not informed about the spray. The cow returned bleeding and vomiting and had a fatal haemorrhage and died in 8 days.

4. *Sai Pangalu Kukkunadi Narayana Bhatt, Kollegal P.O. Padre*

Sai Pangalu Kukkanadi Narayana Bhatt, age 47
His father, Vishnu Bhatt died of abdominal cancer 6 years ago
His mother also died of cancer soon after.
His sister Girija, age 35 suffers from epilepsy for the last 17 years and is now very weak.
His nephew (one sisters son) Vishnu Bhatt (age 22) was born mentally retarded and suffers from fits (congenital)
Another nephew(another sisters son) Vishnu Kulkarni (18 years) suffers from the same problem. He also has gynaecomastia (breast enlargement). His blood showed 108.9 ppm of endosulfan in the CSE analysis. Both the boys are mentally challenged and are living with Narayana Bhatt as both his sisters have left them in his custody and live elsewhere.
This house is on the border of the plantation. The team visited the house but has not reported any of these problems. Why ?
This case also shows a social problem. What is going to happen to all these children once their guardians are not any more able to look after them.

5. *Sri Hari Sajjangade Bhatt, Periyaladkam (House wife is a lucoderma and asthma patient. However disease symptoms developed only 2 years back, other family members are not affected.)*

There is a mistake here. Even though Srihari Sajjangade Bhatt accompanied the team, his family was neither visited nor information collected.
From what is little described this case looks like that of Kollengana Narayana Shasthri, 56 years. He has a chronic back problem and recently developed diabetes. His wife Prabha N Sasthri is a leucoderma and asthma patient, age 47. She developed asthma and leucoderma some time in 1986 only after coming to Padre to stay after her marriage. She is mildly diabetic and has been recently diagnosed for endometriosis. Her blood showed 114.13 ppm of endosulfan in the CSE tests.
His brother – Kripanithi, age 43 developed skin disease 20 years ago. He spent nearly Rs. 50,000 on various treatment and over the last one and half year is controlled. His son also has skin disease. All of them live in the same house.
This house is also very near the plantation and the Kodenkeri stream.
Their cow died due to liver problem after delivery. A buffalo also had liver problems but could be treated.

Although persons with CNS related disorders were present in these families, no evidence was available to confirm the involvement of endosulfan.

What is the kind of evidence that will confirm the involvement of endosulfan ?
The team confirms that they found CNS related disorders, do they recognise that CNS related diseases can be caused by endosulfan ? What kind of evidence did the team look for in a fact-finding visit which just lasted some hours ? Did the KAU experts expect that the ordinary, uneducated, affected people should

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His mother also died of cancer soon after.
His sister Girija, age 35 suffers from epilepsy for the last 17 years and is now very weak.
His nephew (one sisters son) Vishnu Bhatt (age 22) was born mentally retarded

ii. *A group of following persons living in the adjoining area of the plantation who believed that they were not affected by the aerial spraying.*

The KAU report says that this "group" is living adjoining the plantation. But they say the first group earlier listed lived within 3-4 km. This is done with a clear malintention. All these people are living very near the plantation, some adjoining and the experts are manipulating and misleading with words.

1. *Baire, farm labourer, Periyaladkam. (11 member family all are healthy)*

Baire, is around age 60.
One of his daughters is of age 25, is retarded in growth and looks the size of about 15 years.
His grandson in another daughter, Ravi, is physically and mentally retarded.

The expert team had visited Baire's house, but only casual enquiries were made with him.

2. *Janaki 50 years (house wife) Periyaladkam, Son Janardhana, 18 years (both did not complain about any health problem)*

This case is true, though no house visit was made and is a casual finding on the way. We do not know if there are any health problems in the family.

3. *Rama Bhatt, 35 years, Periyaladkam (his father 60 years developed paralysis 8 months back, his paternal uncle 62 years was born handicapped). No CNS related disorders were reported in their families.*

There is a serious mistake in this case. There is no such person as Rama Bhatt who suites this description.
Did the team make a mistake or did they actually cook up a name. We wonder because while they have taken care not to mention the many cases in the family of the earlier samples, the expert team seems to purposefully mention about a parental uncle who was born handicapped to show that the many cases of congenital handicaps found in Padre need not be because of endosulfan.

We are also not claiming that. All we are saying is that there are a lot of health problems and endosulfan is the primary possible agent that can cause this. There are no other agents in the area that can cause it and so endosulfan is suspected. The scientists on the other hand want to prove that there is some other agent and endosulfan is not the agent causing these diseases. This is a very narrow minded and unscientific approach.

In this case the person they have mentioned here does not exist at all.

The KAU report says that this "group" is living adjoining the plantation. But they say the first group earlier listed lived within 3-4 km. This is done with a clear malintention. All these people are living very near the plantation, some adjoining and the experts are manipulating and misleading with words.

iii. *A group of persons who are employees of PCK and staying inside the aerial sprayed plantations who argued that aerial spraying did not cause any adverse effect on their health as highlighted recently in the media.*

It is quite true that the PCK employees have been "arguing" that aerial spraying did not cause any adverse effects. The workers usually handspray or use rocker sprayers, without any safety measures and clothing. They spray endosulfan, carbaryl, quinalphos etc and compared to ground spraying, aerial spraying is safer for the employees health. They would only be as affected as the rest of the people in the locality. But, this argument has been twisted by the scientists to show that the aerial spraying has not caused any adverse effects.

Moreover, it cannot be expected from workers working under a repressive management as the PCK to come out and talk about their problems. Did the team ask them about the safety measures provided to them during spraying ? Did the team ask them how many times in the last 26 years they have been medically checked up for their blood levels for acetyl cholinesterase ? Did the team find out the concentrations at which endosulfan was used in Kasaragod ? These are the crucial matters and nothing of this is mentioned in the report.

1. *Mr. Manapattali (52 years, field supervisor, PCK Estate, Vani nagar)*

Mr. Mana Pattali is a chronic alcoholic and was under intoxication when talking to the scientists. His wife has psychiatric problems and was recently admitted for treatment. All his children are underweight and anaemic.

2. *Mr. Moitheen kutty, 47 years, PCK estate, Padre.*

The workers of the plantation are not just victims of the chemical but their own silence as well. Mr. Moideenkutty asks "My father also died of cancer, do you mean to say that it is due to endosulfan ?"

The workers of the plantation are our own people and we are concerned about their health and welfare. We understand that they are not in a position to come out and talk about this issue and their health problems. The workers are not even able to complain to anybody that they are not being given the mandatory safety equipments for spraying.

Here also no CNS related disorders was reported from their families.

The unfortunate workers of the plantation have not even been paid their salaries regularly, and have been subject to the worst human rights violation and their voices are gagged by the authorities, threatening disciplinary action, which underpaid people like this cannot afford to face.

How many worker's families did the team visit ? In Perla Division alone there are 56 workers and families in PCK ? We know that many families of workers in this division alone have CNS and other diseases.

It is quite true that the PCK employees have been "arguing" that aerial spraying did not cause any adverse effects. The workers usually handspray or use rocker sprayers, without any safety measures and clothing. They spray endosulfan, carbaryl, quinalphos etc and compared to ground spraying, aerial spraying is safer for the employees health. They would only be as affected as the rest of the

Samples collected for Residue Analysis

For undertaking of a preliminary study on endosulfan residues we have collected the following samples from the sprayed plantations as well as from the adjoining environment.

1. *Soil samples*
2. *Plant samples*
3. *Well water samples*
4. *Rivulet water samples*
5. *Black pepper samples*
6. *Betel leaf samples*
7. *Butter samples*

The residue analysis is proposed to be conducted simultaneously at two of our laboratories, viz. AMPRS, Odakkali, and AICRP on Pesticide Residues Laboratory, College of Agriculture Vellayani for confirmation of results.

Scientists and other employees working in the above mentioned labs have confirmed in private conversations that the labs cannot do proper testing, because they do not have the necessary standards to do the testing. The standards with which they have tested are nearly 2-3 years old and since it is costly to buy new standards for endosulfan and metabolites, they had to do it with the outdated standards. This speaks very badly of the University, which we think should have been equipped.

Moreover, are the scientists going to prove that endosulfan is not the cause of the health problems, simply by doing a residue analysis ? Even a layman knows that a residue analysis only shows how much of endosulfan remains in these samples after a period of time. It cannot be used to prove that sprayed endosulfan is "safe" and "harmless" as the scientists have been claiming. Moreover, the samples were collected nearly two months after the last spray.

An Important Observation

The PCK plantations of the area are randomly distributed in hilltops with deep valleys and a number of water bodies in between. The cashew tree population of this plantation is sparse. There exist a large number of other trees also in-between. The topographical lie of the land and a high degree of inhabitation make it very difficult to satisfy the following precautionary measures that are essential for undertaking aerial spraying.)

1. *Regulating the height of the helicopter at a specified level (2 to 3 meters) from the crop canopy to avoid drift.*
2. *Minimizing drift to the inhabited area by stopping spraying 10 meter ahead of the borders.*
3. *Effective covering of the water bodies existing in large numbers.*

As such there is a necessity to prevent PCK from aerial spraying in this area, to avoid contamination of the inhabited environment.

The National Research Centre for Cashew (NRCC) is located at Puttur, which is near the PCK plantation borders (about 20-30 km by road). The College of Agriculture at Padanakkad is also very near the PCK plantations. The Directorate of Agriculture has a Regional office at Kasaragod. The people have been complaining for the last 20 years. What were these agencies doing for the last 20 years ? Now, the scientists are saying the topography is not suitable for aerial spraying ? They have "discovered" that it is difficult to satisfy the precautionary measures for aerial spraying. But many scientific studies have been done at the Cashew Research Station of KAU and why did they not discover

3. *Well water samples*
4. *Rivulet water samples*
5. *Black pepper samples*
6. *Betel leaf samples*
7. *Butter samples*

The residue analysis is proposed to be conducted simultaneously at two of our laboratories, viz. AMPRS, Odakkali, and AICRP on Pesticide Residues Laboratory, College of Agriculture Vellayani for

We were facing the following difficulties during the course of the investigation.

1. *To deal with a panic stricken and emotional group of villagers who were agitated due to the alleged involvement of aerial sprayed endosulfan in creating various health hazards among the local people.*

The people are panic-striken and emotional because families have been living with abnormally born children and more and more children are being born with congenital anomalies. Our own assessment of Cancer related deaths show a near doubling of number of deaths in the last decade. On one hand scientists were saying that endosulfan is a "harmless" pesticide. On the other hand all the documents we had referred to say that endosulfan is an extremely hazardous neurotoxicant with carcinogenic, genotoxic, mutagenic and endocrine disruption properties. Endosulfan can affect reproductive systems. There are so many people with infertility problems, miscarriages, still-births. Would the team members which came to study not panic or be emotional if their own children and families were being affected like this ?
The people were also finding it difficult to convey this message to the emotionless scientists, who showed a lot of sympathy. This report proves that all the sympathy they showed was only to extract from us the needed information about our problems and write a report like this quite contrary to the reality - biased, narrow and insulting.

2. *Non-availability of the quick and reliable method to assess the level of endosulfan contamination in the environmental samples such as soil, plant tissues, drinking water, animal samples and human samples.*

If the expert team did not have a quick and reliable method, why did they collect samples ? How will they do analysis ?

It is understood that there are very reliable methods of residue and contamination analysis like in the study done by Centre for Science and Environment, NewDelhi.

The expert team scientists have claimed that they will do analysis in two of their labs and at the same time they also say that "quick and reliable" methods are not available. With neither expertise nor infrastructure they also keep repeating that endosulfan will not cause health problems.

3. *Continuous sensationalisation of this issue both in the print and electronic media even at national level.*

No village would like to be in the glare of the media and be sensationalized for the most devastating of things like this. If anybody has to be responsible for this, it is the PCK, the KAU, the NRCC, the CPCRI, the Agriculture Department and the Central Insecticides Bureau for playing their own parts in failing to protect the people's health and future and conniving with the industry and Pesticide Manufacturers (and PMFAI).

The people are panic-striken and emotional because families have been living with abnormally born children and more and more children are being born with congenital anomalies. Our own assessment of Cancer related deaths show a near

When affected villagers come out to voice about a human right violation that they have been subjected to, it is natural that the scientists, who have silently watched this go on and sometimes even been party to this, blame voluntary and environmental organisations for this. In this case, the affected villagers, the doctors, panchayath representatives have also been branded as environmentalists in the report. This issue has been aired since 1980 mostly by elected representatives of the people. Enmakaje and Kumbadaje panchayath has been passing resolutions since mid-80's asking stopping of aerial spraying.

5. *The incidence of a number of health hazards in the area (most of them CNS related disorders) whose causes cannot be clearly traced in a short time.*

Even though the expert team found it difficult to "clearly trace" the causes in a short time, they could trace that endosulfan is not a cause. Nowhere in this report have they raised the doubt that endosulfan could also be a suspect, when people were blaming endosulfan and available literature was also pointing to endosulfan being a possible agent.
Spraying of endosulfan has been going on in atleast 9 panchayaths in Kasaragod, where the people have been directly exposed to the pesticide. All these panchayaths have reported similar health problems. All the health problems in this area have occurred only after spraying was started in the plantation. Any body with a scientific approach and simple logic can easily find that there is endosulfan as the only common link. So it is not the lack of "time" which is the difficulty but the lack of an open and unbiased mind.

6. *The probable damage on the export prospects of cashew would be unpredictable if the issue is aired in a big way in the international media.*

Many of the villagers affected are also cashew growers and we have much more stakes in the fall and rise of cashew price and exports than the scientists who have aired this concern. None of us use endosulfan in cashew and now our economy is getting affected. These scientists actually have nothing to lose, because they can still continue their research (into why exports fell ?, why price went down ?, what is wrong with CSE ?, who is the anti-cashew lobby ?, then get lots of funds for research and keep their lives brimming) and survive. When Cashew plantations all over the world are going organic, and when the Cashew Export Promotion Council was the first one to take up this issue and request stopping of endosulfan use and aerial spraying, how can the scientists air such a concern. It is the use of such chemicals in export crops that is going to ultimately affect export prospects as has been seen in many other cases. Also, in a discussion with ESPAC, Smt. Gowri Amma, the Agriculture Minister had indicated that the State's preferences would be to move to sustainable cultivation. Agenda 21 document prepared by the Ministry of Agriculture of the Government of India outlays a vision to move away from pesticide use. These are progressive steps towards protecting the export prospects of cashew.
We also understand that the convener of the expert team, Dr. Abdul Salam, himself is a cashew grower. We would like to know whether he has used

watched this go on and sometimes even been party to this, blame voluntary and environmental organisations for this. In this case, the affected villagers, the doctors, panchayath representatives have also been branded as environmentalists in the report. This issue has been aired since 1980 mostly by elected representatives of the people. Enmakaje and Kumbadaje panchayath has been

However considering all the above aspects, an attempt is made to analyze the issue objectively giving due consideration to social, environmental and national interests.

Recommendations

1. *From the short visit made and information gathered it is difficult to make any conclusion either in favour or against the argument that endosulfan causes health problems. In view of the above it is essential that a multi-disciplinary expert group (medical, agricultural, environmental scientists) investigates on the various aspects of the health and environment related problems of the area.*
2. *In view of the topographical disadvantages and high degree of inhabitation in the adjoining areas of cashew plantations, the Government may be requested to stop PCK from the aerial spraying in this area with immediate effect. The Director, NRCC Puthur has indicated this view as well.*
3. *The PCK should be advised to rationalize the plant protection operations in cashew on more scientific grounds. The current practice of scheduled spraying should be replaced with a need-based application following insecticide rotation.*
4. *During the last year the country earned foreign exchange to the tune of Rs.2500 Crores through the export of cashew kernels. If the present level of propaganda regarding the use of pesticide on an export crop like cashew is aired internationally, it may drastically damage the export prospects of cashew. This ultimately will affect the farmer himself.*
5. *Necessary technical and financial sanctions may kindly be accorded to the Heads of AMPRS, Odakkali and AICRP on Pesticide Residues Laboratory, College of Agriculture Vellayani to complete the analysis of environmental samples collected on a time bound basis.*

Dr. M. Abdul Salam
Dr. A.M. Ranjith
Dr. Samuel Mathew
Dr. K. M. Sreekumar

Nileswar
20-1-2001.

Annexure-I

Toxicological information on Endosulfan

1. *Acceptable daily intake (ADI) is 0.0075 mg/Kg. (WHO,1975). ADI is the daily maximum dose of a chemical which, during an entire life time, appears to be without appreciable risk on the basis of all the facts known at that time. Without appreciable risk is taken to mean the practical certainty that injury will not result even after a life time of exposure. It is worked out toxicological investigation on test animals like rabbits.*
2. *Mammalian Safety Ratio (MSR) is 2.81 showing that the chemical is only slightly selective. It is toxic to mammals as well as insects.*
3. *Insecticide suitability rating of the insecticide (ISR:39) is 'Fairly acceptable' (Ranging : 30-44) This is worked out taking into consideration the toxicity to target insects, safety to beneficial insects and mammals, Mammalian Safety Ratio and the cost factor.*
4. *LD_{50} (Median lethal dose) for honey bees is 275 mg/Kg body weight*
5. *LD_{50} (Oral for rats) is 18-43 mg/kg body weight.*
6. *LD_{50} (Dermal for rats) is 74-130 mg/kg body weight*
7. *LC_{50} (Median lethal Concentration) for fish is 0.001 ppm. So the insecticide is extremely toxic to fish when compared to mammals and other higher animals.*
8. *The insecticide can be excreted in stools or feces.*
9. *On fruits and vegetables, the tolerance limit is 2 ppm (WHO-1985). (Tolerance limit is the legally permitted concentration of a residue in or on a food, derived taking into account both the range of the residues actually remaining when the food is first offered for consumption following good agricultural practices. it is also known as Maximum Residue Level)*
10. *At a rate 0.1% application the insecticide degraded to 0.88 ppm. on brinjal and to 0.98 ppm. on bhendi within a period of 7 days.*
11. *Maximum waiting period before consumption of the treated food material is fixed at 6-9 days (FAO/WHO-1985). Waiting period for some crops are as follows:*
    a. *Cow pea, Cauliflower, Cabbage : 10 days*
    b. *Tomato : 8 days*
    c. *Bhendi and Brinjal : 7 days*
    d. *Pigeon pea / red gram : 7 days*
12. *Pest management rating for different organisms for an insecticide is as follows:*
    a. *Mammals : 4*
    b. *Fish : 4*

essential that a multi-disciplinary expert group (medical, agricultural, environmental scientists) investigates on the various aspects of the health and environment related problems of the area.
2. *In view of the topographical disadvantages and high degree of inhabitation in the adjoining areas of cashew plantations, the Government may be requested to stop PCK from the aerial spraying in this area with immediate effect. The Director, NRCC Puthur has indicated this view as well.*
3. *The PCK should be advised to rationalize the plant protection operations in cashew on more scientific grounds. The current practice of scheduled spraying should be replaced with a need-*

d. Bees : 2
e. Persistence : 3

Overall rating : 9.7 means that it can be used for pest management purposes under skillful supervision. It was thus found to be comparatively safe to honey bees and natural enemies (parasitoids and predators) of the ecosystem at the applied doses.

13. *Environmental persistence of the insecticide is rated as 3 (that is moderately persistent) It was also observed in the tropical climatic conditions the insecticides degrades faster than that in temperate conditions (Nearly 4 to 12 months in tropics).*
14. *Instances of poisoning – Not available*
15. *The chemical is still recommended for pest management on a variety of field and plantation crops like cereals, pulses, cotton, fruits, vegetables, tea, coffee, cashew etc.*

Acknowledgement

The committee wishes to place on record their appreciation and thanks to

1. *Sri. M. Bhaskaran Deputy Director, Dept. of Agriculture, Kasaragod District for the excellent arrangements at Kasaragod and also for accompanying the team throughout.*
2. *Dr. B. Jayaprakash Naik, Associate Professor, RARS, Pilicode for serving as the tongue of the team, to interview the respondents in Kannada and Tulu Languages.*
3. *The Associate Dean, College of Agriculture, Padannakkad for providing computer facilities and infrastructure support and*
4. *The Associate Director, RARS Pilicode for the help rendered.*

Convenor
Expert Committee.

<u>News paper cuttings attached</u>

1. *"Aerial spray of pesticides makes life cheaper than Cashew" The Evidence Weekly Dec 25-31, 1981*
2. *"Pesticides turn pests – Polluted crabs spell dread diseases in Karnataka Village" Sri Padre,*
3. *"Where a cashew pesticide is turning homicide", The Hindu Business Line 17-1-2001*
4. *"Insecticide blamed for making Swarga a hell", Indian Express, 5-01-2001*
5. *"Health hazards of pesticide spray: panic grips hamlet" The Hindu, 5-02-2001*

We do not wish to comment on the recommendations as the expert team has the freedom to make observations based on their own learning and understanding of the issues and their knowledge base.

We did not wake up one fine morning to say that endosulfan is the cause of all our health problems. In the last two and half decades we have been living and seeing the growing health crisis in our families. We have been suspecting various possible causes. The search also took us to the nearby panchayaths. We found similar health problems in more than ten panchayaths in our district. And all these panchayaths had only one common factor – endosulfan.

We did a thorough review of literature on endosulfan and shortlisted the possible health problems it can cause or induce. To our shock, it matched with the list of diseases that we shortlisted as common in the affected panchayaths. So, after a 26 year trial in our community and villages we are convinced that endosulfan is the culprit.

Rachel Carson wrote in *Silent Spring* of a public "fed little tranquilizing pills of half-truths. We urgently need an end to these false assurances to the sugarcoating of unpallatable facts." This was in 1962. We wish to ask the same to all who were responsible for this tragedy of our villages and to all who are desperate to cover up or "sugarcoat" the truth about this poison.

13. *Environmental persistence of the insecticide is rated as 3 (that is moderately persistent) It was also observed in the tropical climatic conditions the insecticides degrades faster than that in temperate conditions (Nearly 4 to 12 months in tropics).*
14. *Instances of poisoning – Not available*
15. *The chemical is still recommended for pest management on a variety of field and plantation crops like cereals, pulses, cotton, fruits, vegetables, tea, coffee, cashew etc.*

Acknowledgement

Copy of letter from ESPAC to the Vice-Chancellor, KAU.

REGISTERED MAIL

16th January 2001

From :
Aravinda .Y .,
Chairman
Endosulfan Spray Protest Action Committee -Padre
Yedamale ,
Post : Padre ,Via Perla 671552
Kasaragod

To :
Dr.K.N.Shyamasundaran Nayar
Vice-Chancellor
Kerala Agri University (KAU)
Vellanikkara
Thrissur,Kerala

Sir

Sub : Endosulfan aerial spray by PCK suspected to be the reason behind very high incidence of dreaded diseases in our village
Clarification about your reported certification of endosulfan as 'harmless' sought

In our village we have very recently realised that there is a very high incidence of CNS-related diseases like Cancer , Mental Retardation Psychiatry , Epilepsy and a host of other diseases like Asthma , Skin diseases like Psoriasis etc .Results of an informal Survey conducted by Dr. YS Mohankumar ,MBBS, practicing in our area since the last 19 years is as follows: (Statistics collected upto 5th Jan 2001)

Cancer living	3
Cancer - dead	46
Mentally Retarded	23
Psychiatric Cases	43
Epilepsy	23
	138
Congenital anomaly (Born handicapped)	9
Suicide cases	9
	18
	156

(This in about 4 sq.km area of Padre village, Enmakaje Panchayath,Kasaragod Dt.,Kerala,India, from among an estimated population of 2,000 people, from approximately 200 houses.)

There is no polluting industry in and around We strongly suspect this to be an ill-effect

16th January 2001

From :
Aravinda .Y .,
Chairman
Endosulfan Spray Protest Action Committee -Padre
Yedamale ,

The PCK has reportedly released a press statement saying that " In Kasaragod since 1976 , endosulfan is being aerially sprayed and that Agri University has certified that there is no much harm by this sort of spray ." (as reported in Janavahini A Kannada daily , dtd January 9 2001, xerox copy enclosed)

The above statement wherein your certifying the insecticide as causing no much harm is very vague and misleading In the light of the above , we request you to kindly clarify the following aspects to us in the interest of public health.

(1) Have you conducted field trials of aerial spray of endosulfan ? If yes,in which year this trial was conducted and what was the concentration and type of endosulfan then
used ? Was the long time effect studied ?

(2) What are the precautionary measures suggested by you ?

(3) You must be aware that in the recent decades lot of toxological studies have been conducted and lot of information on possible ill-effects of endosulfan are available Just to quote one Endosulphan has a proven toxic effect on the human foetus (and on mammalian fetus) and produces mutations. Organochlorines in general have the whole range of possible toxic effects on liver, kidney, bonemarrow, blood, brain (loss of intellectual functions and psychiatric illness), carcinogenicity, damage to reproductive system and to foetus/embryo. Organochlorides differ in their most prominent of toxic effects, in the amount needed to trigger short-term poisoning symptoms and long-term poisoning, and the most easy route of ingestion/absorption into the body." (Source :a German publication from 1988:Gefährdungen der Gesundheit durch Pestizide to be translated as "Health dangers arising from pesticides" by a team of authors:Irene Witte, Ruth Jähne, Rolf Weinert, Kilian Köhrich, Heike Jacobi)(Frankfurt, Germany, 88)

(4) We understand that all the prescribed precautionary measures and including the maximum allowed concentration of endosulfan is not being followed by PCK Under this circumstances and in view of the latest findings about ill-effects of endosulfan don't you think summarily endorsing endosulfan as 'not causing much harm' is unfair and would bring a bad name to your esteemed institution's reputation ?

We therefore request your goodself to kindly clarify the above points and in view of the co-relation to the endosulfan spray that seems to exist with the very high incidence of diseases in our area , to conduct a fresh field trial about short term and long term and long term toxicity of the above insecticide in our field conditions Until such a thorough study is conducted in the interest of public health and humanity we request you to withdraw the certificate issued by you to the PCK

We'll appreciate a prompt reply from you considering the urgency of the situation

Respectfully yours,

Aravinda Yedamale

Endosulfan – Regulations and Violations

(A note on the regulation in India and how it was violated in the PCK owned plantations of Kasaragod)

The Central Insecticides Bureau

The Central Insecticides Bureau (CIB) is the Central Govt. Agency, which regulates pesticide use in India. They have periodical reviews of use of pesticides and is the agency for registering its manufacture, sale and use.

The Designated Licensing officer in the States issue licenses for manufacture, sale, stocking and use of pesticides.

Aerial spraying of Endosulfan

Among other conditions like giving prior information to the people in the area advising them to keep away from the area of application for a period of 20 days, covering all the water sources during spraying etc as stipulated by the Insecticides Act 1968, the CIB prescribed that the spraying of endosulfan should be undertaken at a height of not more than 2 to 3 metres above the foliage. This was always violated in the PCK plantations.

It has also come to light now that aerial spraying of endosulfan was never allowed by the CIB from 1993. The CIB had given approval for aerial spraying of endosulfan only till December 1992. But the PCK, the Department of Agriculture in Kerala and the District Collector has been issuing aerial spraying orders even after 1993 up to the last season, without the approval of the CIB.

General Use of Endosulfan

Dr. Banerjee committee -1991

In 1991 the CIB appointed a committee under the chairmanship of Dr. Banerjee to review whether some pesticides, including endosulfan should be continued to be used in India. Among other recommendations this expert committee concluded

1. *That the use of endosulfan be continued*
2. *That the registration committee should not allow the use of endosulfan near rivers, lakes, sea and ponds, which are expected to be polluted. The committee also recommended putting this in the certificate of registration as a condition and a warning on the labels and leaflets in the containers.*

Dr. R B Singh committee - 1999

In 1999, the CIB appointed an expert committee under the chairmanship of Dr. R B Singh to review the continued use of some pesticides including endosulfan.
This Committee also recommended the continued use of endosulfan and among others it recommended that

Labeling should be made mandatory in bold letters to avoid use of endosulfan near water sources.

The Registration Committee meeting

The 195th Registration Committee (of the CIB) meeting held on 14th December 1999 agreed for the continued use of endosulfan and suggested to incorporate a warning statement on the labels and leaflets indicating that endosulfan should not be used near water sources

the PCK owned plantations of Kasaragod)

The Central Insecticides Bureau

Inter-ministerial Committee

The 10th meeting of the Inter-Ministerial Committee to review the use of insecticides and hazardous chemicals held on 29-12-1999 also recommended among others that

1. the continued use of endosulfan in the country
2. incorporating the warning in the labels and leaflets that endosulfan should not be used near the water resources

The Central Insecticides Bureau and the Ministry of Agriculture has not yet implemented the restrictions suggested by the various committees, while always approving the continued use of endosulfan.

Endosulfan has been aerially sprayed in 4600 ha of cashew plantations owned by the Plantation Corporation of Kerala for nearly 25 years now. It is quite evident as per the recommendations that

> it has been officially recognized that endosulfan is highly toxic to aquatic beings especially fish and contaminates water
> and that it cannot be used anywhere in Kerala where water bodies are plenty in the form of sea, rivers, lakes, backwaters, rivulets, streams, surangams, ponds, wells etc.

In this context had the recommendations been implemented in 1991 the miseries and the toxic burden of the villagers of Kasaragod could have been avoided. Even today, the recommendations are kept aside for reasons unknown and the use of this highly toxic chemical continues to steal the future of many many innocent children of Kasaragod and elsewhere.

In this context the State Government had taken the precautionary measure of suspending all use of endosulfan in Kerala. But the chemical should be suspended from use permanently.

hazardous chemicals held on 29-12-1999 also recommended among others that

1. the continued use of endosulfan in the country
2. incorporating the warning in the labels and leaflets that endosulfan should not be used near the water resources

World wide regulatory status of Endosulfan

The last decade (1990-2000) has been a period when countries all over the world has taken a very progressive and precautionary look at pesticide use. In our knowledge there are so many countries that have banned/severely-restricted endosulfan for farm and agriculture use.

Columbia is the latest to ban endosulfan in all its crops in March 2001. The State Council (Consejo de Estado) the supreme administrative court of Columbia in a landmark judgement banned all use of endosulfan. The court originally considered a ban on use in coffee but after considering its toxicity and risk to human health, it ordered a ban of endosulfan use in all crops.

Endosulfan			
	Banned	**Severely Restricted**	**Priority for re-evaluation**
Africa (1 country)	Belize		
Asia Pacific (16 countries)	Singapore	Bangladesh (*Ban in Rice*)	Pakistan
	Tonga	Cambodia	
	Syria	Japan	
	Indonesia	Korea (*Ban in Rice*)	
		Khasakisthan	
		Kuwait	
		Philippines (*allowed only for Pineapple*)	
		Lithuania	
		Sri Lanka	
		Taiwan	
		Thailand (*Ban in Rice*)	
Europe (12 countries)	Germany	Denmark	Luxembourg
	Sweden	Yugoslavia	Portugal
	Norway	Netherlands	Spain
		Finland	
		United Kingdom	
		Russia	
South and Central America (4 countries)	Brazilian State of Rondonia	Venezuela	
	Colombia	Dominica	
North America (2 countries)		United States Canada	
Australia		Australia	
Total	**10**	**22**	**4**

Most of the countries have banned/severely-restricted endosulfan due to its toxicity to aquatic organisms and mammals. A developing country like Syria follow very practical and scientific criteria based on the precautionary principle for canceling the registration of a pesticide. A pesticide is banned in Syria

if the pesticide was unhealthy
if it is banned in the source country or in two other developed countries
If it is banned by a resolution issued by any international organisation

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ENDOSULFAN – A SHORT SUMMARY

Endosulfan is an organochlorine insecticide of the cyclodiene subgroup. It acts as a poison to a wide variety of insects and mites on contact and as a stomach acaricide.

Uses

It is used as an insecticide for vegetable crops; control of aphids; thrips, beetles, cutworms, bollworms, foliar feeding larvae, mites, bugs, borers, whiteflies, slugs and leaf hoppers in citrus deciduous and small fruit fibre crops, forage crops, oil crops, grains, coffee, tea, forestry, tobacco and ornamentals. It is used to control tse-tse flies and termites and is also used in rice and legumes in India.

Formulations of endosulfan include emulsifiable concentrate, wettable powder, ultra-low volume (ULV) liquid, granules and dust.

Production and Status

Endosulfan is produced by the reaction of hexachlorocyclopentadiene and cis-butene-1,4-diol in xylene, followed by hydrolysis of the adduct to the cis-diol or dialcohol. Endosulfan is then produced by treating this bicyclic dialcohol with thionyl chloride. Technical endosulfan is made up of a mixture (7:3) of two molecular forms (isomers) of endosulfan, the alpha- and beta-isomers. Technical grade endosulfan contains at least 94 per cent of the alpha- and beta- isomers. It may also contain up to two per cent endosulfan alcohol and one per cent endosulfan ether as well as endosulfan sulfate. Of these the alpha-isomer is more toxic than the beta-isomer, while the beta-isomer is the more stable and persistent isomer.

Endosulfan is sold in India in various trade names, some of them are Agrosulfan, Aginarosulfan, Banagesulfan, Seosulfan, Endocel, Endoson, Endonit, Endomil, Endosol, Endostar, Endodaf, Endosulfer, E-sulfan, Endorifan, Hildan, Chemusulfan, Kilex-endosulfan.

Characteristics and Toxicity

Endosulfan is chemically very close to Dieldrin, substituting a heterocyclic sulfur in place of the saturated bicyclic ring system. The other well known chemicals in cyclodiene sub-group are Aldrin, Endrin, Dieldrin, Heptachlor, Chlordane and Mirex. All these cyclodienes, except endosulfan are already banned in India and is going to be globally phased out by the Stockholm Convention signed by World Countries in May 2001 under the auspices of the UNEP. Of the 12 chemicals (Dirty Dozen) to be initially phased out, nine are pesticides of which six of them belong to the Cyclodiene sub-group.

Endosulfan is considered to be highly toxic. It can adversely affect human and wildlife exposed to it. It has been shown to cause damage to the nervous system, as well as other parts of the body, with the liver and kidneys being targeted for chronic exposure in mammals. Endosulfan

It is an organochlorine insecticide of the cyclodiene subgroup. It acts as a poison to a wide variety of insects and mites on contact and as a stomach acaricide.

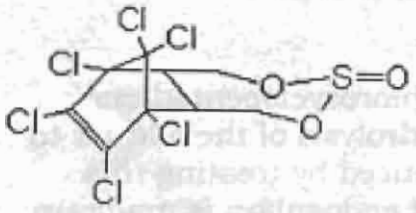
Uses

It is used as an insecticide for vegetable crops; control of aphids; thrips,

Endosulfan is genotoxic, mutagenic and cytotoxic. It is suspected to be teratogenic, it is shown to affect the reproductive system and disrupts the endocrine system. Its teratogenicity could not be reliably proven due to the maternal toxicity it showed on the experimented animals. Its effects particularly, estrogenic properties can have wide and disturbing effects on the human and wildlife health. Endosulfan is extremely toxic to Fish and many other aquatic organisms. It is toxic to insects and also to mammals. It is toxic to honey bees.

Physical and Chemical Properties

Chemical name: 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiopin-3-oxide
Chemical formula: $C_9H_6Cl_6O_3S$
Chemical Structure:



Melting point:
Pure (100%): 106°C
Technical (90%-95% pure): 70°- 100°C
Odour: Slight odour of sulfur dioxide
Solubility in water at 22°C: 0.16-0.15 mg/L
Partition coefficients:
Log K_{ow}: 3.55 and 3.62
Log K_{oc}: 3.5
Vapour pressure at 25°C: $1*10^{-5}$ mmHg
Vapour pressure at 80°C: $9*10^{-3}$ mmHg
Henry's law constant at 25°C: $1 * 10^{-5}$ atm m^3/mol
Bioaccumulation factor (BCF): <3000

Classification

Endosulfan is classified in India as an "Extremely Hazardous" pesticide (ITRC,1989). Endosulfan is classified as a "Moderately Hazardous" chemical by WHO (Class-II). The European Union and the U.S Environmental Protection Agency (USEPA) have classified Endosulfan as Class Ib (Highly Hazardous) . The USEPA has listed the compound in the Extremely Hazardous Substances List under the Environmental Standards. Endosulfan is classified as a "highly toxic" substance as per many other agencies(EXTOXNET 1998). The classification of WHO was found to be inappropriate considering the classification followed in countries all over the world. It is alleged that the WHO has classified endosulfan as a Class II or "Moderately hazardous" pesticide based mainly on LD50 value taken from company generated acute toxicity data

to the maternal toxicity it showed on the experimented animals. Its effects particularly, estrogenic properties can have wide and disturbing effects on the human and wildlife health. Endosulfan is extremely toxic to Fish and many other aquatic organisms. It is toxic to insects and also to mammals. It is toxic to honey bees.

Fate and Degradation in the Environment

The two isomers of endosulfan have different fates in the environment. beta-endosulfan is more persistent than alpha-endosulfan (NRCC, 1975). Endosulfan sulfate is the main degradation product of both isomers, and is itself persistent in the environment (NRCC, 1975). Whereas, endosulfan diol is their hydrolysis product which tends to form in alkaline aquatic environments (NRCC, 1975).

Drift from aerial applications and volatilization from water and plant surfaces are the primary ways of endosulfan entry into the atmosphere. It has been found that some of the endosulfan sprayed on crops and water will volatilize to the air (Simonich and Hites, 1995;Terranova and Ware, 1963). The volatilization half-life from surface water varies from 11days to one year and from plant surfaces from two to three days (Callahan *et al.*, 1979). In air, endosulfan is carried over long distances. Traces of endosulfan have been found in Arctic air as well as snow samples (Gregor and Gummer, 1989).

In water, endosulfan undergoes hydrolysis and microbial degradation. The rate of hydrolysis is influenced by pH. The hydrolytic half-life can range from five weeks at pH 7 to five month at pH 5.5 (Greve and Wit, 1971; Schoetteger, 1970). Microbial degradation products of endosulfan in water include endosulfan sulfate and endosulfan diol (NRCC, 1975). The half-life of endosulfan in water varies from three to seven days to about five months, depending on the dissolved oxygen content and pH of the water as well as the degree to which the water is polluted (NRCC, 1975).

In soil, endosulfan binds strongly to soil particles and is not readily leached out to ground water. The bulk of endosulfan residues is bound to the top 15 cm of soil surface layers. In experimental conditions, 90 per cent of the endosulfan residues were found in the top 15 cm horizon of the soil surface, nine per cent at a depth of 15-30 cm, and only one per cent was found at the depth of 30-45 cm after 503-828 days (Stewart and Cairns, 1974).

In soil, endosulfan is subject to photolysis, hydrolysis or biodegradation. Major products of degradation processes in soil are endosulfan diol and endosulfan sulfate (Martens, 1976; El Beit *et al.*, 1981). Endosulfan isomers show different rates of dissipation from soil. Endosulfan sulfate is more persistent than the parent compound (Stewart and Cairns, 1974). In experimental applications of endosulfan 50 per cent of α–endosulfan disappeared within 60 days, versus 800 days for β–endosulfan. In another report, the half-lives of α- and β–endosulfan were estimated as 35 and 150 days, respectively (EXTOXNET, 1996).

Endosulfan is less persistent on plant surfaces and rapidly degrades to endosulfan sulfate and endosulfan diol. The estimated half-life of endosulfan on plants ranges from 1.95 to 2.74 days.

Residues

Endosulfan is released to the environment mainly as a result of its use as an insecticide.

High concentrations of endosulfan, as alpha--endosulfan, beta-endosulfan and endosulfan sulfate, have been detected in tree bark samples throughout the world, particularly in India and the Pacific Rim (Simonich and Hites, 1995). It was speculated that the high concentrations of endosulfan in these areas were due to its use on rice.

In aquatic ecosystems, endosulfan partitions to plants and animals and also accumulates in sediment. Both endosulfan and endosulfan sulfate have a longer half-life in sediment. Concentrations of endosulfan in sediment have been reported to be 32,000 times higher than in the water column (NRCC, 1975).

Although generally low concentrations of endosulfan have been found in surface water, lethal concentrations may be found in ponds and streams in the vicinities of spraying areas. A study using water containers indicated that drift from aerial agricultural spraying could produce concentrations lethal to fish in shallow exposed water bodies 200 m away from the target spray area. Levels of 1.7 mg/L and 0.04 mg/L were found in water containers in the vicinities of the spraying areas and 200 m away. These levels are found to be lethal to fish (Ernst *et al.*, 1991). This experiment confirms that the agricultural practice of applying endosulfan aerially may lead to increased pesticide concentrations in waters off-site, which could result in fish kills in unexpected areas.

Globally, endosulfan is one of the most commonly identified chemical in any residue analysis in fruits and vegetables, for which it is mostly used. In a study sponsored by Indian Council of Agriculture Research (ICAR) – the All India Coordinated Research Project (AICRP) on Pesticides Residues in 1999 -out of 422 farm-gate vegetables tested for residue of endosulfan 322 (79%) were found to be contaminated. The residue levels ranged upto 18.63 mg/kg (the second most contaminating after residues of copper, upto 75 mg/kg, which is a metal and does not undergo degradation). The allowable Maximum Residue levels of endosulfan in food is 0.5 to 2 mg/kg. Moreover, the contamination percentage of endosulfan (79%) was second only to Lindane (96%).(Toxics Link, 2000)

Exposure

Human Beings may be exposed to endosulfan from

- breathing air near where it has been sprayed
- drinking water contaminated with it, from direct application, spray drifts or runoffs;
- eating contaminated food;
- touching contaminated soil;
- smoking cigarettes made from tobacco with endosulfan residues;
- working in an industry where it is used or living near its vicinity.

Wildlife may be exposed to endosulfan in the environment by consuming plants that have been sprayed with endosulfan, ingestion of soil or dermal contact with soil. Additional exposure can occur through

inhalation of air in the area of agricultural application. Exposures in aquatic environments may occur due to surface runoff following agricultural application, or upon deposition of endosulfan following long-range transport in the atmosphere. Fish have been exposed to sufficient quantities of endosulfan in agricultural run-off to cause mortality (Frank *et al.*, 1990).

In the mammalian system, the alpha-isomer of endosulfan persists in the body longer than beta-endosulfan, particularly, in brain tissue and plasma. Male rats fed with technical-grade endosulfan had detectable levels of alpha-endosulfan in brain tissue and plasma, with less beta-endosulfan, and almost no endosulfan sulfate detected (Gupta, 1978). Similarly, in rabbits, which died following acute exposure, alpha-endosulfan residues were also detected in liver and brain tissue (Ceron *et al.*, 1995), but no residual beta-endosulfan or endosulfan sulfate was found.

Acute toxicity

Endosulfan is classified as a highly toxic substance. It is acutely toxic to birds, marine and freshwater fish, and mammals. Like other chlorinated cyclodienes, endosulfan is a neurotoxin affecting the central nervous system (CNS) of aquatic organisms as well as mammals.

People who are occupationally exposed to endosulfan are advised to avoid eye and skin contact as well as inhalation exposure. Symptoms of acute toxicity in humans are restlessness, irritability and hyperexcitability, followed by headache, dizziness, nausea and vomiting, blurred vision, unconsciousness, insomnia, lack of appetite, loss of memory, albuminuria, haematuria and in some cases, confusion.

Chronic toxicity

Chronic exposure to endosulfan may result in general toxicity symptoms such as liver and kidney damage as well as effects on the CNS, immune system and the reproductive system.

Neurotoxicity

Endosulfan may have adverse effects on the CNS of aquatic organisms, birds and mammals. The main mechanism of action of endosulfan in the CNS is inhibition of brain acetylcholinesterase, causing uncontrolled discharges of acetylcholine. Abnormal behaviour has been observed in fish and mammals being chronically exposed to endosulfan.

Carcinogenicity

Even though, endosulfan was not classifiable as to its carcinogenicity (due to lack of sufficient data), studies have shown that it can be carcinogenic. Reuber, 1981 showed that endosulfan was carcinogenic in male and female rats at all sites examined. It also induced liver tumours in female mice. Another study(Fransson-Steen, 1992) found that endosulfan promoted the growth of altered hepatic foci in rats in a similar manner as the structurally related chlorinated insecticides, chlordane, aldrin and heptachlor did, indicating that endosulfan is a potential liver tumour promoter.

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Immune System

Endosulfan is also known to affect the immune system. Target organs are the kidneys and liver. A number of studies have shown endosulfan to hepatotoxic. Endosulfan inhibits leukocyte and macrophage migration causing adverse effects on the humoral and cell mediated immune system.

Reproductive Effects

A number of studies have shown a potential for adverse effects of endosulfan in the reproductive system of aquatic organisms and mammals. Histological changes in reproductive organs were seen in aquatic organisms following exposure to endosulfan at concentrations as low as 0.00075 mg/L (0.75 µg/L). Endosulfan treatment in male rats was reported to cause a dose-dependent reduction in sperm counts, sperm abnormalities and decreased daily sperm production as well as decreased testis weight.

Endocrine disruptive action

In vitro studies show endosulfan is estrogenic (in the E-SCREEN assay). Endosulfan I competes with [^{3}H]17β-estradiol for binding to the estrogen receptor. Endosulfan sulfate inhibited binding of [^{3}H]R5020 to the progesterone receptor by 40-50 per cent. Low levels of endosulfan (1 nM, 0.41 ppb) can inhibit the human sperm acrosome reaction, initiated by progesterone and glycine, but the inhibition is not complete. Endosulfan II and endosulfan sulfate decreased β-galactosidase activity of progesterone (Jin *et al.*,1997).

In vivo studies showed that Endosulfan decreased plasma vitellogenin levels in catfish (Chakravorty *et al.*, 1992). Endosulfan also decreased the number and size of oocytes in fresh water teleost fish, and increased the number of deformed oocytes, damaged yolk vesicles, and dilated gonadosomatic index. It caused a dose-dependent reduction in sperm counts in rats, reduced the number of spermatids, caused sperm abnormalities and decreased daily sperm production.

Genotoxicity and Mutagenicity

Several independent studies have shown that endosulfan is genotoxic. Data from in vitro and in vivo mutagenicity studies generally provide evidence that endosulfan is mutagenic, clastogenic and induces effects on cell cycle kinetics. (Syliangco, 1978; Adams, 1978; Yadav et al., 1982). Endosulfan was also found to cause chromosomal aberrations in hamster and mouse, sex-linked recessive mutations in Drosophilia, and dominant lethal mutations in mice(Velasquez et al., 1984; Naqvi and Vaishnair, 1993). Studies in human cells both in vitro and in vivo also showed that endosulfan caused the occurrence of sister chromatid exchanges indicating chromosomal damage(Sobti et al., 1983; Dulout et al., 1985). Very recently, a team of researchers in Japan found further evidence of endosulfan genotoxicity using sister chromatid exchanges, micronuclei, and DNA strand breaks as detected by single cell gel electrophoresis as biomarkers (Yuquan Lu et al., 2000).

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Reproductive Effects

A number of studies have shown a potential for adverse effects of

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ANNEXURE 17

राष्ट्रीय व्यावसायिक स्वास्थ्य संस्थान
NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH
(WHO Collaborative Centre for Occupational Health & IPCS Participating Institute)
(Indian Council of Medical Research)
Meghani Nagar, Ahmedabad-380 016, India

Dr. H.N. Saiyed
M.B.B.S.,D.O.H.,Ph.D.(Occ. Helth)
Director

BY SPEED POST

No. 3/4/10/(1)/14/2001/ 3876 11 October, 2001

Dr A. Achyuthan,
Chartered Engineer,
Chairman,
1/3780 Amulyam,
Bilathikulam,
Calicut,
Kerala State -673006

Dear Sir,

I am in receipt of your fax letter dated 8-10-2001 regarding the Enquiry on the Endosulfan spraying in the Cashew Plantations in the Kasargode District of Kerala State. In response to that I wish to state that immediately following reports published in National Dailies and popular Magazines, the Hon'ble National Human Rights Commission (NHRCA) took suo moto action (Case No. 61/11/2001-2002 (Fc) dated 24-7-2002) on the same and amongst others asked Director General, Indian Council of Medical Research (ICMR) New Delhi to submit the requisite information/report within four weeks. The Director-Genera. ICMR in turn asked Director, National Institute of Occupational Health (NIOH), Ahmedabad to take necessary action.

NIOH, Ahmedabad, has taken action as follows:

1 A 3-member team of senior Scientists including Director from NIOH made a preliminary visit to Kasargode District 8-11 August 2001 and held first-hand discussions with the District authorities and people of affected villages, and also visited some Schools in Padre village. It was felt that there is an excess incidence of congenital malformations, subnormal mental development in children, neurological disorders, various forms of cancers in certain villages of Kasargode District of Kerela which needs to be investigated and confirmed scientifically through well planned environmental epidemiological studies of the affected villages and control population and investigate causative factor(s) including Endosulfan.

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Meghani Nagar, Ahmedabad-380 016, India

Dr. H.N. Saiyed
M.B.B.S.,D.O.H.,Ph.D.(Occ. Helth)
Director

BY SPEED POST

After discussions with senior members of the Scientific Advisory Committee of NIOH and its Scientists and taking into account the topography of the area, it was decided that the first phase of the study will be carried out in School children and their family members. Special Questionnaires were designed for children and families The Department of Pediatricts, Kasturba Medical College (KMC) Mangalore, under Dr U.V. Shenoy agreed to carry out medical examination of the children. The study group consisted of 640 children from Govt. Higher Secondary School, P.O. Vaninagar and control group of 414 children from Sri Vidya Vardanka High School and Vani Vilas aided L.P. School at Miyapavadu in Meenja Panchyat. The children were asked to bring their parents and medical examination was carried out after obtaining written consent from one of the parents. Family history of specific diseases and exposures was also recorded simultaneously. Same methodology was followed for the study and control groups. Environmental and biological samples have also been collected from both the areas and the field work has just been completed on 7-10-2001

The data entry, analysis and laboratory investigations will take about two months time and the preliminary report will be available by end of December 2001 However, we intend to do further detailed investigations in positive cases. It would be scientifically incorrect to arrive at any conclusion without analyzing the data.

I request you to send us a copy of the findings of your committee as this will help us in reaching final conclusions.

Thanking you,

Yours faithfully,

(Dr. H. N. Saiyed)
Director

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and its Scientists and taking into account the topography of the area, it was decided that the first phase of the study will be carried out in School children and their family members. Special Questionnaires were designed for children and families The Department of Pediatricts, Kasturba Medical College (KMC) Mangalore, under Dr U.V. Shenoy agreed to carry out medical examination of the children. The study group consisted of 640 children from Govt. Higher Secondary School, P.O. Vaninagar and control group of 414