Section VII

Termiticides and Safety
1. Worldwide Recommended Termiticides

An insecticide is a pesticide used against insects. pesticides include (but are not limited to) herbicides (weed killers), insecticides, fungicides, nematicides, rodenticides, piscicides (fish killers), molluscicides (kill mollusks), algicides, slimicides, insect repellents, insect growth regulators, some other chemicals.

A termiticide is any pesticide or treated article intended to protect a structure against subterranean termites.

Worldwide Recommended Termiticides

- Lindane 20 EC
- Chlorpyriphos 20 EC & 50 EC
- Imidachloprid 30.5 SC
- Bifenthrin 2.5 EC
- Fipronil

Termiticides Registered and Recommended by CIB (India) and Indian Standards:
- Lindane 20 EC
- Chlorpyriphos 20 EC & 50 EC
- Imidachloprid 30.5 SC
- Bifenthrin 2.5 EC

Termiticides registered BUT RECENTLY BANNED IN INDIA:
- Lindane 20 EC (IN THE YEAR 2013)

Termiticides: Technical Information

A) Lindane 20 EC (gamma hexachlorocyclohexane)

Chemical Group : Organochlorine

Stability : Extremely stable even up to temperatures of $180^\circ$C & to acids. In alkaline pH it undergoes dehydrochlorination thus is ineffective.

Solubility : In water 7.3 mg/lit
**Mode of action** : Contact, stomach and respiratory poison

**Toxicity** : Acute oral LD$_{50}$ for rats – 88 mg/kg, dermal LD$_{50}$ of 1000 mg/kg

**Fish** : LC$_{50}$ For Guppy fish – 0.16-0.3mg/lit

**Dose** : Lindane 20 EC – 1 lit in 19 lit.

**Antidote** : No specific antidote known. Symptomatic treatment

<table>
<thead>
<tr>
<th>Route of Exposure</th>
<th>Symptoms</th>
<th>First Aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>MAY BE ABSORBED!</td>
<td>Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.</td>
</tr>
<tr>
<td>Eyes</td>
<td>Redness.</td>
<td>First rinse with plenty of water for several minutes.</td>
</tr>
</tbody>
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**Table 1: Toxicity and first aid**

**B) Chlorpyrifos 20 EC & 50 EC**

(O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate)

**Chemical Group** : Organophosphorous

**Stability** : Stable in neutral & weak acids, hydrolyzed by strong alkalies

**Corrosiveness** : Corrosive to copper and brass

**Mode of action** : Contact, stomach & respiratory action, Cholinesterase inhibitor

**Toxicity** : Acute Oral 163mg/kg, Acute Dermal 1505mg/kg

**Degradation** : In soil Chlorpyrifos is slowly degraded with a Half Life within 80-100 days

**Dose** : Chlorpyrifos 20 EC – 1 lit in 19 lit.
Solubility: 2mg / lit at 25°C

Fate in soil: Chlorpyrifos is tightly adsorbed by soil and not expected to leach significantly. Volatilisation from soil surface will contribute to loss. Depending on soil type, microbial metabolism of Chlorpyrifos may have a half-life of up to 279 days. Higher soil temperatures, lower organic content and lower acidity increases degradation of chlorpyrifos.

Where it is used in subterranean termite control it may remain effective for up to 5-17 years* (depending on many factors) When applied to sandy soil, a 50% loss was noted after 2 weeks and when applied to high organic matter soil, a 50% loss was noted after 8 weeks.

Health Effects: Short Term: Chlorpyrifos is very toxic to humans, between 1 teaspoon and 1 ounce may be fatal.

Chlorpyrifos toxicity is considerably greater if administered orally compared to dermal. Primary routes of exposure are inhalation, skin or eye contact. Inhalation exposure to high concentration may cause upper respiratory irritation, central nervous system depression headache, dizziness, increased sensitivity to epinephrine, irregular heartbeats, in coordination, muscle twitching, tremor, pinpoint pupils, blurred vision, tightness in chest, and convulsions. Eye contact may cause pain, moderate irritation. Poisoning also impairs Central Nervous System.

Long Term: Continual absorption at intermediate dosage may cause influenza-like illness which includes symptoms like weakness, anorexia and malaise.

Prolonged or repeated over exposure to the product may result in delayed liver and or kidney damage. (1) Other chronic exposure effects are behavioural neurotoxicity and organo-phosphate induced delayed neuropathy.

C) Imidachloprid 30.5 SC

Chemical Group: Neo-nicotinoid Insecticide

Dose: 2.1 ml/lit. of water or 1 lit per 475 lit

Antidote: Symptomatic treatment

Toxicity: Rat Oral 450 mg/kg Rat dermal ≥ 5050 mg/kg
Aerobic half life : 997 days

Mode of Action: Non-repellent, hence no avoidance to chemical. Insects are killed by absorbing chemical through cuticle and by contact- passing on chemical between members in colony by grooming. Termites also cannibalise dead members and thus the chemical is spread within the colony. At sub lethal doses, the termites get disoriented and stop grooming and are killed by development of pathogenic fungus on their bodies.

Imidacloprid has low vapor pressure. The chemical breaks down to inorganic molecules by both photolysis and microbial action. Although it is not "persistent" in the technical sense since it does degrade, it can have a half-life in soil under aerobic conditions of as long as 997 days. In the body, 96% of the chemical is eliminated within 48 hours;

Toxicology: Animal toxicity is similar to that of the parent compound, nicotine; fatigue, twitching, cramps, and weakness leading to asphyxia.

D) Bifenthrin 2.5 EC

Chemical Group : Trifluromethyl

Solubility : 0.1 mg/lit

Mode of action : Contact and stomach action

Toxicity (Mammals) : Acute oral LD₅₀ is 54 mg/kg in female rats and 70 mg/kg in male rats. Non-irritant to skin and eyes

Dose : Bifenthrin – 1 lit in 49 lit.

Mode of action: By acting on the sodium channels to depolarize the pre-synaptic terminals, pyrethroid insecticides effectively paralyze organisms by severely limiting neuro-transmission

Field dissipation: Half-life tests have been conducted for bifenthrin in a wide range of soils and conditions. Half-lives ranged from 122 to 345 days. Bifenthrin has very low water solubility and high affinity for soils, hence Bifenthrin has a very low tendency to volatilize from wet soil.
Toxicological Effects

- **Acute Toxicity:** Bifenthrin is moderately toxic to mammals when ingested. Large doses may cause in coordination, tremor, salivation, vomiting, diarrhea, and irritability to sound and touch. Although it does not cause inflammation or irritation on human skin, it can cause a tingling sensation which lasts about 12 hours.

- **Breakdown of Chemical in Soil & Groundwater:** Bifenthrin does not move in soils with large amounts of organic matter, clay and silt. It also has a low mobility in sandy soils that are low in organic matter. Bifenthrin is relatively insoluble in water, so there are no concerns about groundwater contamination through leaching. Its half-life in soil, the amount of time it takes to degrade to half of its original concentration, is 7 days to 8 months depending on the soil type and the amount of air in the soil.

- **Breakdown of Chemical in Vegetation:** Bifenthrin is not absorbed by plant foliage, nor does it translocate in the plant.

- **Physical Properties and Guidelines:** It is photostable, stable to hydrolysis, has minimal volatility, and is stable in storage. It has a negative temperature coefficient, so it works better at lower temperatures.

- **Antidote:** No specific antidote known. Symptomatic treatment. Do not administer milk, cream or substances containing vegetables or animal fats which enhances absorption of lipophilic substances.

E) FIPRONIL 5% SC: Fiproles (or Phenylpyrazoles)

Fipronil is the only insecticide in this new class, introduced in 1990 and registered in the U.S. in 1996.

\[(+)-5\text{-amino-1-(2,6-dichloro-a,a,a-trifluoro-p-talyl)-4-trifluoromethylsulfinylpyrazole-3-carbonitrile}\]

**Chemical Group:** Phenylpyrazole

**Intended Use:** Insecticide

**Stability:** Stable for 2 years under normal conditions of storage and use

**Corrosiveness:** Not Corrosive
Mode of action: Non-repellent material with contact and stomach activity. Fipronil works by blocking the gamma-aminobutyric acid (GABA) regulated chloride channel in neurons, thus disrupting the activity of the insect’s central nervous system.

**Toxicity (Acute)** : Oral: LD-50 336mg/kg (Rats), Dermal: LD-50 382mg/kg (Rats)

**Degradation** : Fipronil is the most polar and water soluble of the breakdown products. Dissipation of the Fipronil in the environment is a result of exposure to sunlight to produce Fipronil-desulfinyl, reductive processes in soil lead to Fipronil-sulfide.

**Dose** : Fipronil 5% SC – 5 ml in 1 lit. of water

**Health Effects**: The product may be harmful swallowed. It may pose risk of serious damage to eyes. Clinical sign & symptoms of Fipronil toxicity includes sweating, nausea, vomiting, headache, abdominal pain, dizziness, agitation and weakness. Clinical sign of exposure to Fipronil are generally reversible and resolve spontaneously.

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*Total no. of diagrams, figures and tables in this chapter:*

Charts: 0 nos., Diagram: 0 nos., Figures: 0 nos. Tables: 1 nos.
2. Safety in Termite Management

- **Site inspection**: Before the application, professional pest control operator shall visit the site first to understand the termite infestation as well as soil condition i.e. moisture etc. During site inspection he shall confirm the storage place for Termiticides, note all the entry points of pests and should plan the physical control measures before planning for chemical control.

- **Training to the operators**: Training to the operators i.e. actual pest control workers is very much necessary. Untrained operators may misuse the pesticides i.e. use of wrong pesticide, over dose, mixing of two different group of pesticides. Trained operator ONLY shall take the responsibility of structural pest control.

- **Selection of suitable termiticide for effective Termite Management**: As per the site requirement he shall decide the select the repellent or non-repellent termiticide first.

- **Maintenance of documents**: To keep control to avoid misuse of termiticides he shall maintain the documents of day to day chemical consumption as well as the stock at stores.

- **Training to the customers**: He shall guide and educate the customer about the toxicity of termiticide, its residual effects, dose and anti-dote.

Safety aspect is divided into following categories

- **Clients point of view**: Safety of Site staff, Workers, Children's, Pet Animals etc.

- **Environment point of view**: Safety of environment i.e. treatment area, nearby trees, underground water, bore well i.e. ground water and the soil.

- **Operators point of view**: The operator who is actually engaged in termite management he shall be more careful about the safety. He is the person who is in contact with concentrated termiticides while during the dilution or mixing. He shall ware all the personal protection equipments (PPE) during mixing and during operations.

**Personal Protective Equipment (PPE)**

**A. Coveralls and chemical resistant suit**
The worker safety regulations contain two quite different standards for employer-provided body protection. The requirement for coveralls requires body covering of tightly woven cloth, or equivalent, extending from the neck to wrists to ankles. The desire for disposable or limited use clothing that meets this more stringent chemical-resistant requirement caused to evaluate specialty fabrics that might meet this requirement.

Figure 1: Safety equipment

B. Eyewear and closed systems

Eye protection must be worn when preparing to use of termiticides. Protective eyewear is required when using closed systems that operate under positive pressure. When using a closed system, protective eyewear must be available on site.

C. Gloves

The use of glove liners is allowed only when the following conditions are met:

* Pesticide product labeling does not prohibit the use of glove liners.
* Glove liners must be separable from the chemical-resistant glove.
* Liners may not extend outside of the chemical-resistant gloves.
* Liners must be replaced immediately if directly contacted by a pesticide.
* Liners must be discarded at the end of each workday.
* Contaminated liners must be disposed of in accordance with federal, state or local regulations.
D. Respirators

The employer shall assure that employees use approved respiratory protection equipment when pesticide product labeling or regulations require respiratory protection or when respiratory protection is needed to maintain employee exposure below an applicable exposure standard.

Safety Training

For the workers or operators safety, the labor contractor or the pest manager shall time to time conduct various training programmes related to the day-to-day practice of termite management and training related to the pesticide safety. The person who hires the services of a pest control labor or contractor’s employees to perform work on the home owner’s property must assure that those employees have received the required training.

Material Safety Data Sheet status as labeling

A reference to the Material Safety Data Sheet (MSDS) is often found on the pesticide label. However, it is issued not with the intent to highlight the labeling requirements.

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