1. Chemical Product Identification

Product Name: Esfenvalerate
Molecular Formula: \( \text{C}_{25}\text{H}_{22}\text{ClNO}_{3} \)
Molecular Weight: 419.90
Structural Formula:

![Structural formula of Esfenvalerate]

Chemical Name: 
(S)-alpha-cyano-3-phenoxybenzyl(S)-2-(4-chlorophenyl)-3-methylbutyrate
Form: Liquid
Color: yellow
Odor: Sweet, almond-like odor
CAS No.: 66230-04-4

2. Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>Composition</th>
<th>CAS No.</th>
<th>Content %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esfenvalerate</td>
<td>66230-04-4</td>
<td>95.0</td>
</tr>
<tr>
<td>Other ingredients</td>
<td></td>
<td>5.0</td>
</tr>
</tbody>
</table>
3. Hazards Identification
Causes eye irritation. Harmful if Absorbed through skin. Avoid contact with skin, eyes or clothing. Combustible liquid, Do not use near heat or open flame or any ignition source.

4. First Aid Measures
Eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, and then continue rinsing eyes. Call a poison control center for treatment advice.

Skin: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Inhalation: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.

Ingestion: Call a poison control center or doctor immediately for treatment advice. Do not induce vomiting unless told to do so by a poison control center or a doctor. Do not give any liquid to the person. Do not give anything by mouth to an unconscious person.

5. Fire-Fighting Measures
Flash Point: 185 ºF / 85 ºC
This product is classified as combustible.


Extinguishing Media: Foam, carbon dioxide, or dry chemical.

Fire Fighting Instructions: Treat as a oil fire. Keep personal removed and upwind of fire. Use a full-faced self-contained breathing apparatus along with full protective gear. Keep nearby containers and equipment cool with a water spray. Contain the run-off, if possible, for proper disposal.

6. Accidental Release Measures
Small Spill: Shut off ignition sources. Stop release, if possible without risk. Dike or contain release, if possible, and if immediate response can prevent further damage or danger. Isolate and control access to the release area. Take actions to reduce vapors. Absorb with appropriate absorbent. Clean spill area of residues and absorbent.

Large Spill: Shut off ignition sources. Stop release, if possible without risk. Dike or contain release, if possible, and if immediate response can prevent further damage or danger. Isolate and control access to the release area. Take actions to reduce vapors. Collect
product into drums, etc. via drains, pumps, etc. Absorb with appropriate absorbent. Clean spill area of residues and absorbent.

Waste Disposal Method: Contaminated absorbent and wash water should be disposed of according to local, state and federal regulations.

7. Handling and Storage

Handling: Wear chemically impervious gloves such as neoprene and nitrile. Wear an OSHA-approved safety glasses with side shields, goggles or face shield. Mechanical ventilation should be used when handling this product in enclosed spaces. Wearing a respirator is not normally required when handling this material but recommended in absence of good mechanical ventilation. Do not contaminate water, feed or food by storage, handling or disposal. Read and observe all precautions and instructions on the label.

Storage: Store containers upright and closed. Store in areas that are cool, dry and well-ventilated. Keep away from heat, ignition sources and strong oxidizers. Emptyed containers may retain product residues.

8. Exposure Controls/Personal Protection

Engineering Controls: Mechanical ventilation should be used when handling this product in enclosed spaces. Local exhaust ventilation may be necessary.

Respiratory Protection: Wear an OSHA approved respirator with organic vapor cartridge in absence of proper mechanical ventilation.

Skin Protection: Wear chemically impervious gloves and protective clothing. Do not allow contact with skin.

Eye Protection: Wear OSHA-approved safety glasses with side shields, goggles or face shield.

9. Physical and Chemical Properties

Vapor Pressure: $2 \times 10^{-7} \text{Pa@25}^\circ \text{C}$

Vapor Density: Not established

Boiling Point: 151-167\degree C

Melting Point: 59-60\degree C

Density: $1.26@24-26^\circ \text{C}$

Solubility: Soluble with most organic solvents.

PH: Not applicable

10. Stability and Reactivity

Chemical Stability: Stable.
Incompatibility: Strong acidic or alkaline materials.

Hazardous Decomposition Products: Small amounts of hydrogen cyanide may be formed by thermal decomposition or by contact with alkaline substances such as soda ash & lye.

Hazardous Polymerization: Will not occur.

11. Toxicological Information

Acute toxicity: Esfenvalerate is a moderately toxic compound via the oral route. The reported oral LD50 of esfenvalerate is 458 mg/kg in rats. It is slightly toxic via the dermal route, with a reported dermal LD50 of 2500 mg/kg in rabbits. It is practically non-toxic via inhalation, with a reported inhalation LC50 of greater than 2.93 mg/L in rats. Because esfenvalerate is a relatively new compound it has little usage history. The bulk of evidence related to acute poisonings in humans due to esfenvalerate comes from incidents in India. Nearly 600 individual cases of poisoning were reported between 1982 and 1988. These cases were due to improper handling of the pesticide. Acute toxic effects were observed in workers and among the general public. Symptoms of acute poisoning included dizziness, burning and itching (which was worsened by sweating and washing). Severe cases of direct contact caused blurred vision, tightness in the chest, and convulsions. The changes appear to be reversible. In rats, high acute exposure to esfenvalerate produced muscle incoordination, tremors, convulsions, nerve damage, and weight loss. The compound may produce nausea, vomiting, headache, temporary nervous system effects such as weakness, tremors, and incoordination at acute exposure levels in humans. Esfenvalerate is a strong eye irritant, producing tearing or blurring of vision.

Chronic toxicity: Rats fed fenvalerate at concentrations of approximately 12.5 mg/kg/day for two years had no compound-related changes in the blood or urine. In other studies significant reduction in body weight was the main adverse effect seen in both rats and mice of both sexes.

Reproductive effects: In a three-generation rat study, low doses (up to 12.5 mg/kg/day) of fenvalerate produced no toxicity in the fetus. Some maternal toxicity was noted in the second generation at the higher dose. When pregnant mice and rabbits were fed low dietary levels of fenvalerate (2.5 mg/kg/day) on days 6 to 15 of gestation, there was maternal toxicity in both species. It seems that during pregnancy, the females are more sensitive to fenvalerate than they would otherwise be, even though the toxicity is not reflected in any effect on the fetus. There are no specific data available for esfenvalerate, but it is not expected to cause reproductive effects at low doses.

Teratogenic effects: Esfenvalerate did not produce any birth defects in offspring at low dietary doses. It appears the the pesticide would not pose a teratogenic threat to humans at expected exposure levels.

Mutagenic effects: Esfenvalerate shows no mutagenic effects. Numerous tests in hamsters, mice and rats show no signs of mutagenic activity associated with this compound. It is likely that it poses no mutagenic risk to humans.
Carcinogenic effects: A rat study of fenvalerate conducted over a wide range of doses of up to 75 mg/kg, for two years, resulted in no evidence of cancer. Mice fed diets containing small amounts of fenvalerate for two years showed no adverse effects. It appears that fenvalerate does not cause cancer.

Organ toxicity: Studies to date have not shown any dose-related effects on internal organs of test animals or in human populations.

12. Ecological and Ecotoxicological Information

Effects on birds: Esfenvalerate is slightly toxic to birds. Oral LD50 values for the compound are 1312 mg/kg in bobwhite quail and greater than 2250 mg/kg in mallard ducks.

Effects on aquatic organisms: Based on laboratory studies, fish are very sensitive to esfenvalerate. It has a 96-hour LC50 of 0.0003 mg/L in bluegill, 0.0003 mg/L in rainbow trout, 0.001 mg/L in carp, and 0.0002 mg/L in killfish. The LC50 in Daphnia magna, an aquatic invertebrate, is 0.001 mg/L. The pesticide is very highly toxic to these species. Water turbidity, such as would be found in the field, tends to reduce the toxicity of this compound. Bioaccumulation factors in rainbow trout are about 400 times the background (ambient water concentration of the pesticide) levels.

Effects on other organisms: Esfenvalerate is highly toxic to bees. The compound tends to repel bees for a day or two after application, causing bee visitations to drop during that time. Since most intoxicated bees die in the field before they can return to contaminate the hive, the brood is not exposed except by direct spray. Dried spray residues are not expected to pose a significant threat to bees.

13. Disposal Considerations

Disposal Method: Product should be disposed of according to local, state and federal regulations. When disposing of waste or surplus avoid contact with eyes and skin. Wear impervious gloves/clothing and chemical safety goggles. Do not wash into drains Do not mix with other waste materials.

14. Transport Information

Not applicable.

15. Regulatory Information

Not applicable.

16. Other Information

All information and instructions provided in this Material Safety Data Sheet (MSDS) are based on the current state of scientific and technical knowledge at the date indicated on the present MSDS and are presented in good faith and believed to be correct. This
information applies to the product as such. In case of new formulations or mixes, it is necessary to ascertain that a new danger will not appear. It is the responsibility of persons on receipt of this MSDS to ensure that the information contained herein is properly read and understood by all people who may use, handle, dispose or in any way come in contact with the product. If the recipient subsequently produce formulations containing this product, it is the recipients sole responsibility to ensure the transfer of all relevant information from this MSDS to their own MSDS.