

Organophosphorus

Hazards of Pesticide Use According to the World Health Organization (WHO), it is estimated that 3 million acute pesticide poisonings occur annually leading to 250,000 fatalities, of which 99% occur in developing countries (Stephens, 1991; Rosenstock, 1991). In Sri Lanka, nearly 13,000 people are admitted annually to hospitals for pesticide poisoning that result in approximately 1000 fatalities. It is estimated that 40,000 farmworkers of third world countries die each year as a result of pesticide intoxication. Generally, these agricultural workers are poisoned because either they cannot read, understand, or implement safety instructions, or the instructions themselves are inadequate (Perutz, 1991).

Organophosphorus (OP) Insecticides Organophosphorus (OP) compounds are members of the insecticide arsenal that includes carbamates, chlorinated hydrocarbons, and pyrethroids. To date, more than 50,000 organophosphorus (OP) compounds have been synthesized and evaluated for their insecticidal potential (Gutmann, 1990).

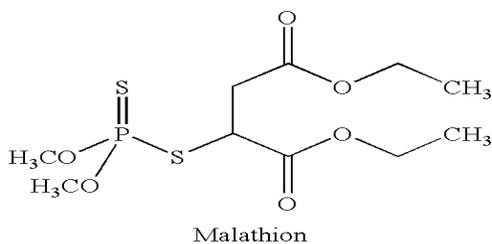
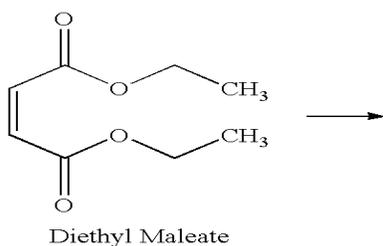
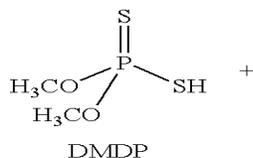
Mode of Action of OP' s -

General Aspects Regardless of the effectiveness of OP's in insect control, numerous accidental OP poisonings of humans occur every year. The toxicity of organophosphates to mammals and insects is primarily due to their ability to inactivate the enzyme acetylcholinesterase (AChE). AChE is found in both the central and peripheral nervous system, the primary role of which is to catalyze the hydrolysis of the neurotransmitter acetylcholine. During the transmission of a nerve signal, ACh is released from presynaptic vesicles and diffuses across the synapse to bind at ACh receptors of the post-synaptic membrane, thus, completing the signal. AChE rapidly removes surplus ACh from the synapse to either terminate the neural transmission at cholinergic synapses

Malathion

Malathion 6 [O,O-dimethyl-S-1,2-bis(ethoxycarbonyl)ethyl phosphorodithioate] is one of the world's most widely used organophosphate insecticides.

Malathion may be prepared by reacting O,O-dimethyldithiophosphoric acid (DMDP) with diethyl maleate (U.S. Pat. Nos. 2,578,652, 2,879,284, 3,403,201, 3,463,841, 3,470,272, 4,367,180 and 4,681,964).



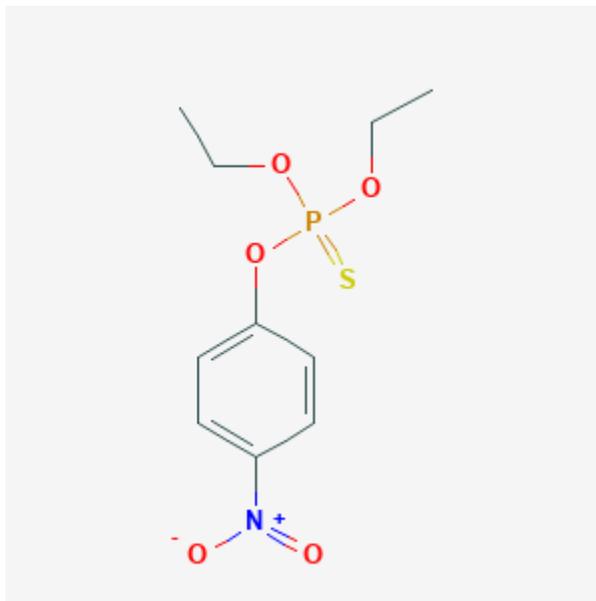
Parathion

Parathion is a broad spectrum, organophosphate pesticide used to control many insects and mites. It has non-systemic, contact, stomach and fumigant actions. It has a wide range of applications on many crops against numerous insect species. Parathion is available in dust, emulsion concentrate, granular, ULV liquid, and wettable powder formulations.

Parathion is one of a class of insecticides referred to as organophosphates. These chemicals act by interfering with the activities of cholinesterase, an enzyme that is essential for

the proper working of the nervous systems of both humans and insects. Please refer to the Toxicology Information Brief on cholinesterase-inhibition for a more detailed description of this topic.

The organophosphate insecticides are cholinesterase inhibitors. They are highly toxic by all routes of exposure. When inhaled, the first effects are usually respiratory and may include bloody or runny nose, coughing, chest discomfort, difficult or short breath, and wheezing due to constriction or excess fluid in the bronchial tubes. Skin contact with organophosphates may cause localized sweating and involuntary muscle contractions. Eye contact will cause pain, bleeding, tears, pupil constriction, and blurred vision. Following exposure by any route, other systemic effects may begin within a few minutes or be delayed for up to 12 hours. These may include pallor, nausea, vomiting, diarrhea, abdominal cramps, headache, dizziness, eye pain, blurred vision, constriction or dilation of the eye pupils, tears, salivation, sweating, and confusion. Severe poisoning will affect the central nervous system, producing in coordination, slurred speech, loss of reflexes, weakness, fatigue, involuntary muscle contractions, twitching, tremors of the tongue or eyelids, and eventually paralysis of the body extremities and the respiratory muscles. In severe cases there may also be involuntary defecation or urination, psychosis, irregular heartbeats, unconsciousness, convulsions and coma. Death may be caused by respiratory failure or cardiac arrest.



Parathion is **synthesized** from diethyl dithiophosphoric acid $(\text{C}_2\text{H}_5\text{O})_2\text{PS}_2\text{H}$ by chlorination to generate diethylthiophosphoryl chloride $((\text{C}_2\text{H}_5\text{O})_2\text{P}(\text{S})\text{Cl})$, and then the chloride is treated with sodium 4-nitrophenolate (the sodium salt of 4-nitrophenol).

References

<http://pmep.cce.cornell.edu/profiles/extoxnet/metiram-propoxur/parathion-ext.html>