



Technical Update

Standards including

Fipronil

Fipronil Metabolites

Oxychlorane

o,p'-Methoxychlor



PESTICIDES

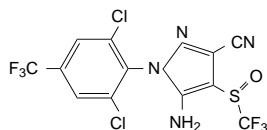
AccuStandard

Pesticides and Their Metabolites

Without pesticides the world would not be able to feed as many people as it does. With pesticides, there have been a multitude of health effects, including death. The bridge between these two ends of the spectrum is in understanding. That understanding comes from research into pesticides, including research into the products or metabolites that pesticides convert in the environment.

Fipronil and Its Metabolites: An Example

In recent years, there has been much discussion about the toxicity of Fipronil. Along with the discussion of Fipronil, there came even more discussion about its metabolites: Fipronil Sulfide, Fipronil Sulfone, and Fipronil Desulfynyl (1). Fipronil is a member of the phenyl pyrazole class of pesticides. It is a highly effective, broad-spectrum insecticide with potential value for control of a wide range of crop, public hygiene, amenity and veterinary pests. It can be applied at low to very low dose rates to achieve pest control (2). Fipronil, as the parent compound, is classified as a World Health Organization (WHO) Class II moderately hazardous pesticide. It is neurotoxic, that is, it disrupts normal nerve function (6) in both rats and dogs, and is carcinogenic to male rats at 300 mg/kg, where the LD50 (the dose required to kill half a population of lab animals) is 97 mg/kg (4). Fipronil is used in Frontline flea and tick products such as Top Spot and Spray treatment (5) for cats and dogs, but at low levels that at worst, have been found to result in skin irritation and/or hair loss at the site of application (1,2,3). These formulated products are not absorbed through the skin and have low toxicity if ingested (3,6). In laboratory studies, it has been found that Fipronil has a half-life of 122-128 days in oxygenated sandy loam soil, while in field studies, it ranged from 0.7 days to 1.7 months (3). Fipronil has been found to degrade slowly by anaerobic metabolism in the soil, resulting in the metabolite known as Fipronil Sulfide (1,3). It can undergo photodegradation, resulting in the metabolite Fipronil Desulfynyl (1,3). When it degrades in the soil under oxidative conditions, it results in the metabolite Fipronil Sulfone (1). Because it binds to the soil, Fipronil and its metabolites have a low potential for groundwater contamination (1,3,6) and have not been found to be volatile in nature (1). However, the metabolites have been determined to be much more toxic to various organisms than the parent compound, Fipronil. Fipronil Sulfide is more toxic than Fipronil to freshwater invertebrates, while Fipronil Sulfone is more toxic to avian species and freshwater fish and invertebrates (6). Fipronil Desulfynyl is generally more toxic to a variety of animals while being very persistent in the environment (8).

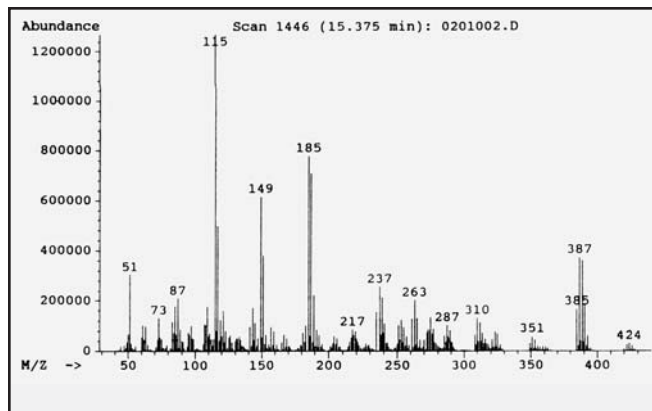


Fipronil & Metabolite Kit

| | | | |
|---|-------------------------|-----------------|----------------------------|
| P-FIP-MET-KIT | | 4 x 1 mL | |
| <i>(All in 100 µg/mL in MeOH, except Fipronil in Acetone)</i> | | | |
| P-738S-A | Fipronil | P-781S | Fipronil sulfide |
| P-780S | Fipronil sulfone | P-782S | Fipronil desulfynyl |

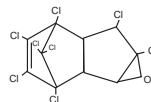
Oxychlordan: A Metabolite of Chlordane

Oxychlordan is an organochlorine compound that is the most persistent metabolite of Chlordane (7,8). It is bioaccumulative and is one of the most toxic of the chlordane compounds (7,9). Because of its toxicity and ability to bioaccumulate, it was banned in the United States in 1988 (11), banned in 47 other countries and severely restricted in 14 others (10). Even though it has been 15 years since the ban has been implemented, chlordane can still be detected in some foods grown in the United States (10). Chlordane has been used on corn and citrus crops, and on residential lawns and gardens (8,10). One of its most common uses was as a pesticide for termites (8,10). Chlordane is potentially volatile but is capable of binding to sediment in water and soil (8). If it binds to sediment in water or soil, the degradation process can be very slow, taking potentially up to 20 years (8,10). Since chlordane can bind itself to sediment in water, fish and shellfish are especially susceptible to ingesting the chemical. Humans become exposed to high doses of chlordane through consuming the fish that have already bioaccumulated it. "Other less significant routes of exposure may include eating crops grown in soil containing chlordane; breathing air or touching soil near homes treated for termites with chlordane; and breathing air or touching soil near waste sites or landfills. The seriousness of these minor routes depends on the extent of the chlordane contamination, but significantly, none of them involve bioaccumulation" (10). Once ingested, some of the chlordane is excreted within several days (8,10).



Oxychlordan

2,3,4,5,6,6a,7,7-Octachloro-1a,1b,5,5a,6,6a-hexahydro-2,5-methano-2H-indeno(1,2,b)oxirene
CAS No. 27304-13-8



$C_{10}H_4Cl_8O$
M.W. = 420

Oxychlordan formulations available

| Description | Conc. / Solvent (1 mL) | Cat. No. |
|-------------|------------------------|-------------|
| Oxychlordan | 10 µg/mL in MeOH | P-331S-0.1X |
| Oxychlordan | 100 µg/mL in MeOH | P-331S |
| Oxychlordan | 100 µg/mL in Hexane | P-331S-H |



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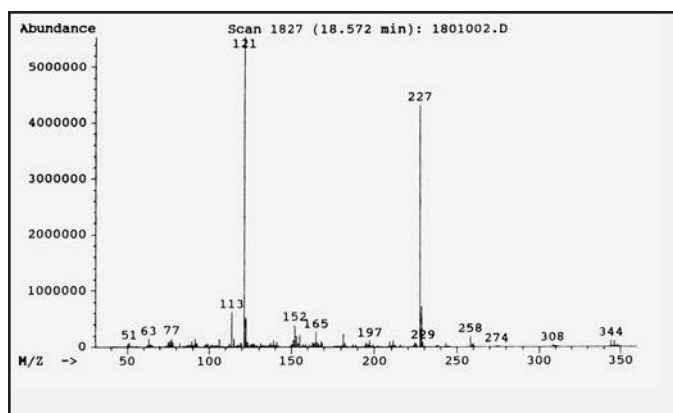


The chlordane that remains in the body is converted to the toxic metabolite in a mammal's liver and gets stored in adipose tissue as chlordane metabolites: quite often oxychlordane (12). The oxychlordane stored in this adipose tissue can take years before leaving the body. Another way in which the oxychlordane leaves the body is through mother's breast milk or across the placenta in utero (12).

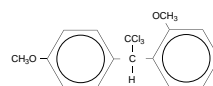
Methoxychlor: Another Alternative

Methoxychlor is an organochlorine that has been increasingly used since 1972, when the ban of DDT was set in place. With a relatively low toxicity and relatively low persistence in the biological system, it has been found to be an excellent replacement for DDT (11,12). Methoxychlor is effective against pests that are found in agriculture, residences, and residential plantings. Methoxychlor has been used on vegetables, fruits, forage crops, DDT-sensitive crops such as squash, melons, etc. (13) and in forestry as well as to kill parasites on dairy and beef cattle (13). Canada has implemented its usage for the control of biting flies (14). It has been found to be very persistent in soil with a half-life of 120 days without the presence of oxygen. With the presence of oxygen in soil, the half-life can be as little as 1 week. As it is insoluble in water, it is not likely to contaminate groundwater. However, because there have been low levels detected in ground and surface water, the mechanism is believed to have entered the water as the result of high levels of rain, an excessive amount applied to the soil or vegetation or it is believed to have bound to a soil particle and the soil particle enters the groundwater system (11,13). Studies have demonstrated that Methoxychlor does not accumulate in the body in adipose tissue or any other location in any significant amount. In a study conducted with mice, over 98% was excreted within 24 hours after a single dose. In an extended study occurring over 18 weeks, there was no Methoxychlor detectable in the body two weeks after study conclusion (11). It has been found to be slightly toxic to birds, highly toxic to fish and aquatic invertebrates and not toxic at all to bees (11).

Like technical DDT, technical Methoxychlor is composed of its para – para and ortho – para isomers. The Methoxychlor available from the usual Reference Material merchants is the para – para isomer. For environmental analysis, the ortho – para is also needed. AccuStandard synthesizes each of these.



o,p'-Methoxychlor
1,1,1-Trichloro-2-[o,p'-(dimethoxy phenyl)]ethane
CAS No. 30667-99-3



$C_{16}H_{15}Cl_3O_2$
M.W. = 344

o,p'-Methoxychlor formulations available

| Description | Conc. / Solvent (1 mL) | Cat. No. |
|--------------------------|------------------------|-----------|
| o,p'-Methoxychlor | 100 µg/mL in MeOH | P-535S |
| o,p'-Methoxychlor | 100 µg/mL in Isooctane | P-535S-TP |
| p,p'-Methoxychlor-olefin | 100 µg/mL in MeOH | P-466S |

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AccuStandard synthesizes the pesticides and metabolites in this article and many others shown in our catalog. They have the advanced technology, capabilities and knowledgeable chemists on staff that manufacture high quality neat products of pesticides. Additionally, with about 3,200 pesticides available in catalog and custom offerings, AccuStandard will exceed your laboratory's expectations as a Certified Reference Material Manufacturer.

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Pesticide Standards as Neats, Low & High Concentration Solutions

Most solutions are in MeOH, Neats are 10 mg

| | | | | |
|----------------------------|---------------------------------|---------------------------|----------------------------|-------------------------|
| Abamectin | Atrazine | bis(Tributyltin)oxide | Carbophenothion | Clethodim |
| Abate | Atrazine-desisopropyl | bis-2-Ethylhexyl adipate | Carbosulfan | Clofentezine |
| a-BHC | Atrazine-desisopropyl-2-hydroxy | Bitrex | Carboxin | Clomazone |
| Acephate | Azadirachtin | Bloc | Cartap hydrochloride | Clopyralid methyl ester |
| Acetochlor | Azametiphos | Bolstar | Chinomethionate | Copper oxychloride |
| a-Chlordane | Azinphos ethyl | Bonzi | Chloramben | Coumachlor |
| a-Chlordene | Azinphos methyl | Botran | Chloramben methyl ester | Coumaphos |
| Acifluorfen | Azocyclofen | Brodifacoum | Chlorbenseide | Coumatetralyl |
| Acifluorfen methyl ester | Azoxystrobin | Bromacil | Chlorbromuron | Crimidin |
| a-Cypermethrin | Barbamate | Bromadiolone | Chlorbufam | Crufomate |
| Alachlor | Barnon | Brominal | Chlordane | Cyanazine |
| Alanap | Alar | Bromofenoxim | Chlordene | Cyanofenphos |
| Alar | Albendazole | Bromophos-ethyl | Chlordimeform | Cyanophos |
| Albendazole | Aldicarb | Bromophos-methyl | Chlorfenvinphos | Cycloate |
| Aldicarb | Aldicarb sulfone | Bromopropylate | Chlorflorecol-methyl ester | Cycloheximide |
| Aldicarb sulfoxide | Aldrin | Bromoxynil methyl ether | Chlorflurenol | Cycloxydime |
| Aldrin | Allethrin | Bromoxynil octanoate | Chlorflurenol ethyl | Cyfluthrin |
| Allethrin | Allidochlor | Bueno | Chlormephos | Cyhexatin |
| Allidochlor | Alloxydim-sodium | Bupirimate | Chlormequat chloride | Cymoxanil |
| Alloxydim-sodium | Aluminium phosphide | Buprofezin | Chlorobenzilate | Cypermethrin |
| Aluminium phosphide | Ametryn | Busan | Chloroneb | Cyphenothrin |
| Ametryn | Aminocarb | Butachlor | Chlorophacinone | Cyprazine |
| Aminocarb | Aminomethylphosphonic acid | Butocarboxim | Chloropicrin | Cyproconazole (Tech) |
| Aminomethylphosphonic acid | Amitraz | Butocarboxim sulfoxide | Chloropropylate | Cyprodinil |
| Amitraz | Amitrole | Butralin | Chlorothalonil | Cyromazine |
| Amitrole | Ammonium sulfamate | Buturon | Chloroxuron | Cythion |
| Ammonium sulfamate | Ancymidol | Butylate | Chlorpropham | Dacthal |
| Ancymidol | Anilazine | Cadusafos | Chlorpyrifos-methyl ester | Dalapon acid |
| Anilazine | Aramite | Captafol | Chlorsulfuron | Dalapon methyl ester |
| Aramite | Aspon | Captan | Chlorthiamid | Danitol |
| Aspon | | Carbaryl | Chlorthion | Dasanit |
| | | Carbendazim | Chlorthiophos | Dazomet |
| | | Carbetamide | Chlortoluron | DBCP |
| | | Carbofuran | Chlozolinate | d-BHC |
| | | Carbofuran phenyl acetone | Chorpyrifos-oxon | DCMU |
| | | | Cidrin | DCPA diacid |
| | | | | DDT |

For a complete listing of over 3,200 pesticide standards (A to Z), visit our website at www.accustandard.com or call us at 203-786-5290.

| | | | | |
|----------------------------------|------------------------------------|-------------------------------|-----------------------------|--------------------------------|
| Omethoate | Piperonyl | Pyriproxyfen | Tefluthrin | Triphenyl phosphite |
| o-Phenylphenol | Pirimicarb | Pyriproxyfen | Teflubenzuron | Triphenyl phosphite |
| Orbencarb | Pirimphos-ethyl | Pyroquilon | Tefluthrin NEW | Toxaphene |
| Oryzalin | Pirimphos-methyl ester | Queletox | TEPP | Traloxymid |
| Ovex | Potassium dimethyl dithiocarbamate | Quinalphos | Terbacil | Tralomethrin |
| Oxadiazon | Prebana | Quinclorac | Terbufos | Transfluthrin |
| Oxadixyl | Pretilachlor | Quizalofop ethyl | Terbufos sulfone | trans-Nonachlor |
| Oxamyl | Probenazole | Resmethrin | Terbufos sulfoxide | Triadimefon |
| Oxycarboxin | Probenazole | Ronnel | Terbumeton | Triadimenol |
| Oxychlorandane | Prochloraz | Rotenone | Terbuthylazin-desethyl | Triallate |
| Oxydemeton-methyl | Procymidone | S421 NEW | Terbuthylazine | Triasulfuron |
| Oxyfluorfen | Prodiamine | Schradan | Terbutol | Triazophos |
| p,p'-DDA | Profenofos | Sebuthylazine | Terrazole | Tribenuron-methyl |
| p,p'-DDD | Profluralin | Secbumeton | Tetrachlorvinphos | Trichlorfon |
| p,p'-DDE | Propachlor | Sethoxydim | Tetraconazole | Trichloronate |
| p,p'-DDT | Promecarb | Siduron | Tetradifon | Triclopyr |
| p,p'-Methoxychlor-olefin | Prometon | Silafluofen | Tetrahydro-phthalimide | Triclopyr methyl ester |
| Paraoxon | Prometryne | Silvex | Tetramethrin | Triclopyr-2-butoxy ethyl ester |
| Paraquat CL • 4H2O (as Paraquat) | Pronamide | Silvex 2-ethylhexyl ester | Tetrasul | Tricresyl phosphate |
| Parathion | Propachlor | Silvex methyl ester | Thiabendazole | Tricyclazole |
| PCNB | Propamocarb hydrochloride | Simazine | Thidiazuron | Tridemorph |
| PCP methyl ether | Propanil | Simeton | Thifensulfuron methyl | Trietazine |
| Penconazole | Propargite | Simetryn | Thiobencarb | Triethylphosphate |
| Pencycuron | Propazine | Sodium diethyldithiocarbamate | Thiocyclam hydrogen oxalate | Trifenmorph |
| Pendimethalin | Propetamphos | Strobane | Thiodicarb | Trifluralin |
| Pentachloroanisole | Propham | Sulfallate | Thiofanox | Triflumizole |
| Permethrine (cis/trans) | Propineb | Sulfometuron methyl ester | Thiofanox sulfoxide | Triflururon |
| Perthane | Prosulfocarb | Sulfoquinaxaline | Thiometon | Trifluralin |
| Phenmedipham | Prothoate | Sulfotep | Thionazin | Triforine |
| Phenothiazine | Prtallethrin | Sulfoxide | Thiophanate | Trimethyl phosphate |
| Phenthoate | Pyraclufos | Sumithrin | Thiophanate-methyl | Trimidal |
| Phenyl mercury acetate | Pyrazon | Swep | Thiram | Triphenyl phosphite |
| Phenyl valerate | Pyrazophos | TCA | Tillam | Vacor |
| Phorate | Pyrazoxyfen | Tebuconazol | Tilt | Vamidithion |
| Phorate sulfone | Pyrethrins | Tebufenozide | Tokuthion | Vanicide-20S |
| Phorate sulfoxide | Pyridaben | Tebupirimfos | | Vernolate |
| Phosalone | | | | Vinclozolin |
| Phosfolan | | | | Warfarin |
| Phosmetoxon | | | | Zinc Phosphide |
| Phosphamidon | | | | Zineb |
| Phoxim | | | | Ziram |
| Picloram | | | | Zolone |
| Picloram methyl ester | | | | |



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