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AMITRAZ

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7.2 The registrant's response to the DCI (dated 8/23/91) have been addressed in previous reviews (EFGWB# 910025,920349) and memoranda (EFGWB# 920206, 921339).

7.3 Environmental Fate Assessment:

Based on supplemental and acceptable environmental fate data from the 1987 Registration Standard to present, parent amitraz degradation is not persistent ($t_{1/2}$ = 1 day) in soil and aquatic environments. Amitraz degradation is dependent on abiotic hydrolysis. The hydrolytic degradates are BTS 27919, BTS 27271 and 2,4-dimethylaniline (BTS 24868). BTS 27271 should not persist ($t_{1/2}$ < 14 days) in neutral and alkaline environments; however, BTS 27271 could be more persistent ($t_{1/2}$ = 2280 days) in acid environments. BTS 27271 degradation appears to be dependent on alkaline catalyzed abiotic hydrolysis and microbial mediated processes ($t_{1/2}$ = 67 to 82 days in aerobic mineral soil; DT_{50} = 7 days in aerobic aquatic environments). BTS 27919, a common hydrolytic degradate of amitraz and BTS 27271, should be moderately persistent ($t_{1/2}$ 67 to 117 days) in soil and aquatic environments. BTS 27919 degradation appears to be strictly dependent on microbial-mediated processes. Amitraz dissipated rapidly ($t_{1/2}$ < 1 day) in field soils to form BTS 27271 and BTS 27919. BTS 27271 and BTS 27919 were moderately persistent in orchard soils ($t_{1/2}$ = 110 and 150 days for BTS 27271 and BTS 27919, respectively) and cotton soils ($t_{1/2}$ = 17 to 70 days for BTS 27271 and BTS 27919, respectively).

Parent amitraz appears to be moderately mobile to immobile in sand and clay textured soils, respectively. Since amitraz degradation is rapid in soil and aquatic environments, it should not pose a contamination problem for groundwater and surface waters. BTS 27271 and BTS 27919 appear to be relatively immobile in soil column leaching studies and field studies. However, unidentified radiolabeled residue was detected in the leachate of aged soil column studies and apparent false positive residue detections of BTS 27271 and BTS 27919 were observed in deep soil layers of field studies. Hence, the mobility of BTS 27271 and BTS 27919 may require confirmation through adsorption-desorption studies.

Amitraz degradation is dependent on abiotic, acid catalyzed hydrolysis. The hydrolysis rate was inversely related to the pH of the medium. Amitraz hydrolysis was faster in slightly acidic environments ($t_{1/2}$ = 2 hours) than in alkaline environments ($t_{1/2}$ = 25.5 hours). Furthermore, photodegradation in water of amitraz occurred at approximately the same rate as hydrolysis, indicating that amitraz degradation is primarily a hydrolytic process. In aerobic mineral soil, parent amitraz had a half-life of less than one day. The amitraz degradates formed during aerobic soil metabolism were as follows: BTS 27271 (~13%), BTS 27919 (~35%), BTS 24868 (~13%), and CO_2 (~35%). Similarly, parent amitraz had a field dissipation half-life of less than a day in Florida, California, and Texas. Similar half-lives have been observed in aquatic metabolism laboratory studies. Hence, amitraz appears to be extremely unstable in terrestrial and aquatic ecosystems.

Amitraz hydrolyzes rapidly to form BTS 27271, and BTS 27919, and BTS 24868. BTS 27271 may further hydrolyze ($t_{1/2}$ < 14 days) in neutral (pH 7) and alkaline (pH 9) buffer solutions; however, BTS 27271 was stable to hydrolysis in acid (pH 5) buffer solution. BTS 27919 was stable to abiotic hydrolysis in acid (pH 5), neutral (pH 7), and alkaline (pH 9) buffer solutions. In aerobic soil metabolism studies, the half-life of BTS 27271 and BTS 27919 ranged from 67 to 82 days and 61 to 117 days, respectively. (Reviewer Note: Aerobic soil metabolism half-lives were not adequately described using a first-order degradation model; interpolated biphasic degradation half-lives may be less than predicted by a first-order degradation model.) Similar field dissipation half-lives were reported in Texas orchard soil ($t_{1/2}$ = 110 and 150 days for BTS 27271 and BTS 27919, respectively) and cotton soils in Florida and California ($t_{1/2}$ = 17 to 70 days). In aquatic metabolism studies, the calculated 50% dissipation time (DT_{50}) of BTS 27271 and BTS 27919 ranged 6 to 7 days and 10 to 20 days, respectively, in water columns and whole microcosms. Hence, BTS 27271 degradation appears to be dependent on abiotic alkaline catalyzed hydrolysis and microbial mediated processes; and BTS 27919 degradation appears to be dependent on microbial mediated processes.

Freundlich adsorption coefficients of parent amitraz were 1.69 ($1/n$ = 0.53) in a Shelby loamy sand soil, 3.01 ($1/n$ = 0.76) in a Speyer sand, 89.13 ($1/n$ = 1.22) in a Terling clay loam soil, and 16.31 ($1/n$ = 0.75) in a Shelford Field clay soil. These data indicate that parent amitraz may be mobile in sandy soil with low organic matter contents (1.72% O.M.) and immobile in finer textured soils (e.g., loam, silt loam, clay loam, silty clay loam). Aged radiolabeled amitraz residues including BTS 27271 and BTS 27919 appear to be relatively immobile (72 to 82% of applied ^{14}C in the surface 10 cm of column) in packed soil columns; however, unidentified polar residues were detected (< 5% of applied ^{14}C) in leachate samples. Supplemental TLC studies indicate that BTS 27271 was classified as being intermediately mobile in sandy loam, silt loam, and clay textured soils (R_f 0.36-0.48) and very mobile in sand (R_f 0.91). Field dissipation studies in California and Florida indicate that amitraz residues (including amitraz, BTS 27271, and BTS 27919) were retained in the surface 15 cm of soil; however, apparent false positive detections of BTS 27271 and BTS 27919 were found in deep soil samples. BTS 27271 and BTS 27919 should act as a strong base (pK_a = 9.0) and hence should be in a cationic form in most environments. Such information suggests that BTS 27271 and BTS 27919 may electrostatically bind through ion exchange to minerals and organic matter in soil. Integrated mobility and persistence data suggest that parent amitraz should not pose a problem to groundwater and surface waters because it degrades rapidly in soil and aquatic environments. The amitraz degradates, however, appear to be moderately persistent in and relatively immobile in soil. BTS 27271 and BTS 27919 also should be in a cationic form in most soil environments and hence could electrostatically bind to soil. However, unidentified radiolabeled residue was detected in the leachate of aged soil column studies and apparent false positive residue detections of BTS 27271 and BTS 27919 were observed in deep soil layers of field studies. These observations suggest that quantitative confirmatory adsorption-desorption studies may be required to assess completely the binding affinity of BTS 27271 and BTS 27919 to soil.

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Although the amitraz degradates (BTS 27271, BTS 27919, and BTS 24868) have vapor pressures that exceed 10^{-6} mm Hg trigger, laboratory soil volatility studies indicate that BTS 24868 and CO_2 were the only volatile degradates. The average air concentration of BTS 24868 was $2.29 \mu\text{g m}^{-3}$ at amitraz application rates of $1.55 \text{ kg a.i. ha}^{-1}$. These data suggest that volatilization is not a major route of dissipation for amitraz and its hydrolytic degradates.

Amitraz had bioconcentration factors of 1821X, 588X, and 1838X in the viscera, flesh, and carcass of sunfish bluegill, respectively. Bioaccumulated residues were identified as BTS 27919, BTS 27271, unidentified polar degradates. The bioaccumulated residues were eliminated over a 14 day depuration period. Field rotational crops studies suggest that amitraz and its hydrolytic degradates are not accumulated ($<0.05 \mu\text{g g}^{-1}$) in rotated crops.

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