The Washoff Potential of Fipronil from Dogs Treated with Fipronil Pet-Care Products

Leah Judson, Robert Budd, and Jennifer Teerlink

Introduction

- Dog ownership in the United States is 0.24 dogs per capita and survey data indicate 75% of dog households use a flea and tick product.
- Products often contain a mixture of active ingredients (AIs).
- The majority of pesticide-containing pet products sold are topical products (Figure 1).
- Sales data show predominant AI in topical product market changes over time (Figure 2).
- A 2015 commercial shelf-survey found large number of fipronil-containing products, suggesting a shift from last available sales data.
- Fipronil selected for focus of this study as a result of reported occurrence in wastewater and aquatic toxicity (Table 1).
- Popular AIs in spot-on flea and tick treatment: Fipronil, Etofenprox, Imidacloprid, Permethrin, Phenothrin, Pyriproxyfen, S-Methoprene.

Fipronil Product Wastewater Pathway

This study focused on fipronil containing spot-on products.

- 9.1% fipronil (some products also include 8.8% S-Methoprene).
- Four product sizes based on the dog’s weight (0.087–0.402 grams fipronil).
- Product labels do not recommend personal protective equipment such as gloves during application.
- Recommended frequency of application is 30 days.
- Most labels claim products are waterproof once dried, and none of the labels prohibit bathing or swimming post application.

Routine Washing

Rinse can enter wastewater through plumbing inside the house. Rinse entering the storm drain system may discharge directly to surface water.

Wastewater Treatment

Limited studies report the concentrations of pesticides in wastewater effluent. The data available show treated effluent contains pesticide concentrations that exceed USEPA Aquatic Benchmarks (Table 1). Little is known about relative contribution from different sources. Washoff of pesticides from pet products through routine bathing has been a proposed source, however, prior to this study had not yet been quantified.

Surface Water

in the Western United States, surface water streams can be dominated by wastewater effluent, even further exasperated during drought conditions. Wastewater effluents flow discharges consistently representing a steady loading of associated chemical load.

Acknowledgements

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Figure 1. Proportion of pet product types by mass of AI, including all AIs, for 2005–2014. Topical includes spot-on products.

Figure 2. Mass of pet topical products sold by AI from 2005–2014.

Table 1. Comparison data for available pesticide concentrations in wastewater effluent and USEPA Aquatic Benchmarks

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>Wastewater Effluent (ng/L)</th>
<th>USEPA Aquatic Benchmark (ng/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fipronil</td>
<td>&lt; 10-70°</td>
<td>11</td>
</tr>
<tr>
<td>Etofenprox</td>
<td>Not Available</td>
<td>170</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>&lt;20-387°</td>
<td>1,050</td>
</tr>
<tr>
<td>Permethrin</td>
<td>&lt;5-170°</td>
<td>1.4</td>
</tr>
<tr>
<td>Phenothrin*</td>
<td>Not Available</td>
<td>470</td>
</tr>
<tr>
<td>Pyriproxyfen</td>
<td>Not Available</td>
<td>15</td>
</tr>
<tr>
<td>S-Methoprene</td>
<td>Not Available</td>
<td>480</td>
</tr>
</tbody>
</table>

*Phenothrin is also known as sumithrin.

Methods

- Volunteer dogs (n=34) were washed 2, 7, or 28 days after application.
- Dogs were rinsed in a large bin, rinsate collected, and volume recorded.
- Rinseate analyzed for total fiproles.

Results

- Mass of total fiproles washed off ranged between 0.2–.86% of total mass applied (Figure 3).
- Degradates made up ≤10% of total mass, and largest fraction was in 28 day samples (Figure 4).
- Total mass of fiproles washed off generally decreased with time post-application.

Implications

- Fipronil-containing products washoff dogs during routine bathing confirming a proposed pathway for fipronil to enter the sewershed.
- Topical pet products with different AIs may also enter sewershed through routine bathing.

Other Questions

- Is the relative contribution from fipronil-containing dog products significant compared to wastewater influent load?
- Do treated dogs swimming in surface water pose a risk to aquatic organisms?
- What fraction of applied fiproles are in dog urine and feces?
- Transfer to humans from pets has been demonstrated. Human urine and feces as a wastewater source?

References