CA Department of Pesticide Regulation
Environmental Monitoring Branch
Surface Water Protection Program
1001 I Street, Sacramento, CA 95812

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[1,2] and survey data indicate 75% of dog households use a flea and tick product[3].
- 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[4].
- **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.

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

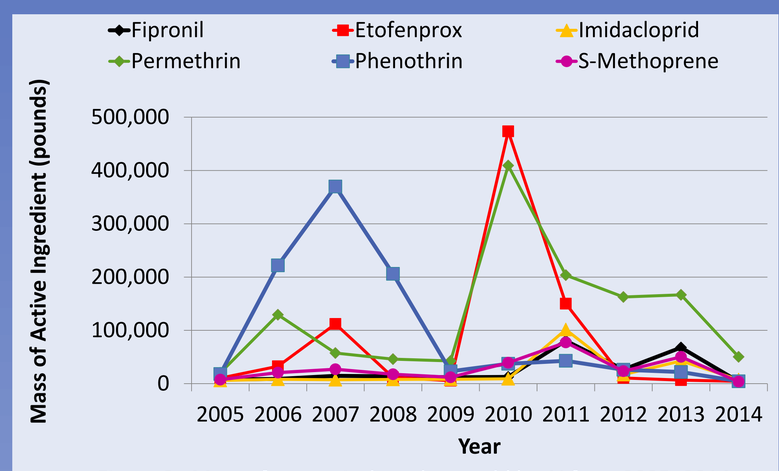
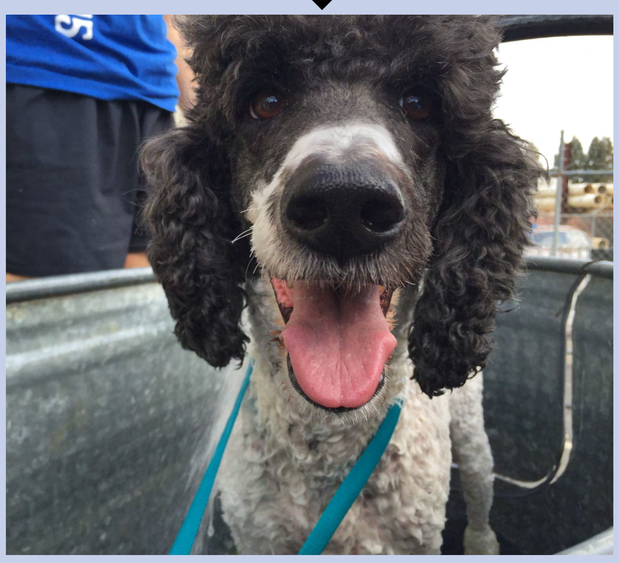


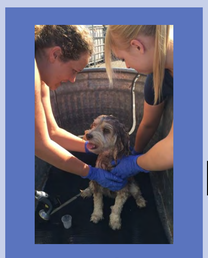
Figure 2. Mass of pet topical products sold by AI from 2005–2014.

Fipronil Product Wastewater Pathway

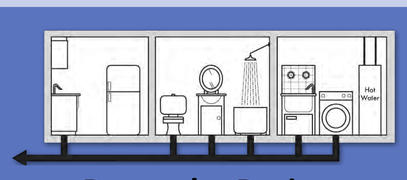
This study focused on fipronil containing spot-on products.

- 9.1% fipronil (some products also include 8.8 % S-Methoprene).
- Four product sizes based on the dog's weight (0.067–0.402 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



Down the Drain

Rinsate can enter wastewater through plumbing inside the house. Rinsate 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[5] (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

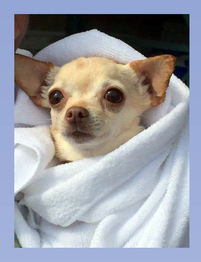
In the Western United States, surface water streams can be dominated by wastewater effluent, even further exasperated during drought conditions. Wastewater effluents flow discharges consistently representing a steady loading of associated chemical load.

Objectives

- Quantify mass of fiproles (fipronil + degradates) that washoff during routine bathing of dogs.
- Quantity the washoff potential as a function of time after application.

Methods

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



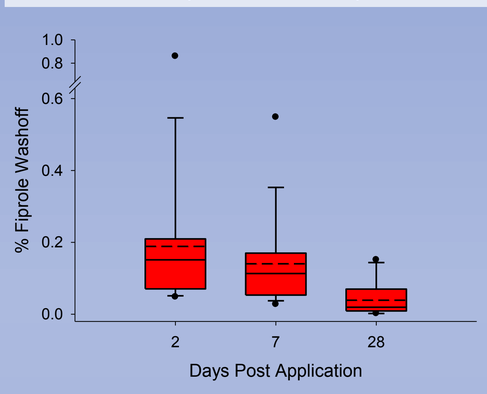


Figure 3. Percent total fiproles washed off as a function of days post application.

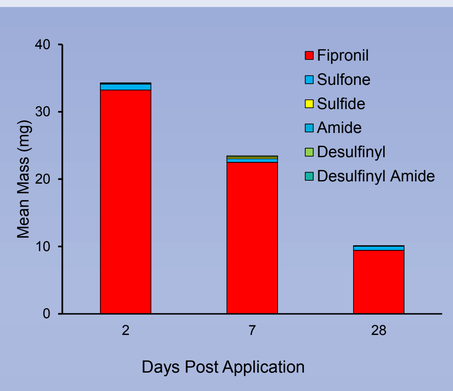
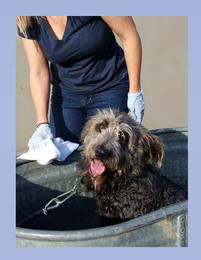
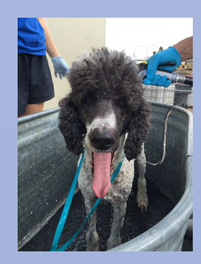


Figure 4. Mean mass washoff as a function of time.



Results

- Mass of total fiproles washed off ranged between 0.2–86.0% 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.



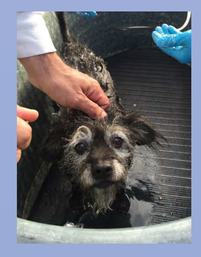
Implications

- 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.

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

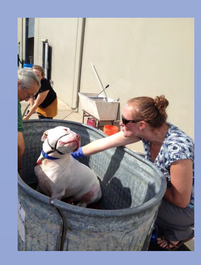
Active Ingredient	Wastewater Effluent (ng/L)	USEPA Aquatic Benchmark (ng/L)
Fipronil	< 10-70[6]	11
Etofenprox	Not Available	170
Imidacloprid	<20-387[7]	1,050
Permethrin	<5–170[5]	1.4
Phenothrin*	Not Available	470
Pyriproxyfen	Not Available	15
S-Methoprene	Not Available	480

*Phenothrin is also known as sumithrin.



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[8]. Human urine and feces as a wastewater source?



Acknowledgements

We would like to graciously thank the many volunteer pet and pet owners for taking the time to participate in this study, many of whom volunteered multiple times. Construction of sample basins by Jesse Ybarra allowed for maximum comfort of dogs and staff. Sincere thanks to Jorge Hernandez with California Department of Food and Agriculture for sample analysis in a challenging matrix. We also thank Sue Peoples for sample coordination and KayLynn Newhart for coordinating sample collection and logistics. Finally, we would like to thank many Environmental Monitoring staff for lending a hand to wash dogs.

References

[1]American Pet Products Association. (2015) 2015-2016 APPA National Pet Owners Survey. 660 p.
[2]US Census Bureau. (2016). Monthly Population Estimates for the United States: April 1, 2010 to December 1, 2016. Population Estimate, US resident population.
[3]Puro, G. (2015). Packaged Facts: Pet Medications in the US, 4th Edition. 159 p.
[4]VanderWerf, R., Aldana, A., Teerlink, J., Budd, R. (2015). Retail Store Survey of Consumer-Use Indoor Pesticide Products, 2014. Data Analysis Report. Department of Pesticide Regulation, Sacramento, CA.
[5]Markle, J.C., Van Buuren B.H., Moran, K.D., Barefoot, A.C. (2014). Pyrethroid pesticides in municipal wastewater: A baseline survey of publicly owned treatment works facilities in California in 2013, Pyrethroid Working Group.
[6]Heidler, J. and R. U. Halden (2009). Fate of organohalogens in US wastewater treatment plants and estimated chemical releases to soils nationwide from biosolids recycling. Journal of Environmental Monitoring **11**(12): 2207-2215.
[7]Hope, B. K., L. Pillsbury, and B. Boling. (2012). A state-wide survey in Oregon (USA) of trace metals and organic chemicals in municipal effluent. Science of The Total Environment **417–418**: 263-272.
[8]Bigelow Dyk, M., Liu, Y., Chen, Z., Vega, H., and Krieger, R.I. (2012). Fate and distribution of fipronil on companion animals and in their indoor residences following spot-on flea treatments. Journal of Environmental Science and Health, Part B **47**(10): 913-924.