SECTION 9

Tire-related chemicals

A lake re-emerges: Analysis of contaminants in the *Semá:th Xó:tsa* (Sumas Lake) region following the BC floods of 2021
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RAINCOAST CONSERVATION FOUNDATION

TIRE-RELATED CHEMICALS

Capsule

We detected low levels of three tire-related chemicals in the surface waters and groundwater of the former *Semá:th X̱ó:tsa* (Sumas Lake) following the catastrophic BC floods of 2021. This included the tire chemical 6-PPD and its highly toxic breakdown product 6-PPD Quinone, indicating the potential for localized fish kills in waterways adjacent to roads in the Sumas area. The presence of these chemicals in groundwater raises questions about the impact that roads and traffic are having on fish habitat in the area.

Introduction

The catastrophic floods of late 2021 in British Columbia and Washington State overwhelmed urban, agricultural and industrial infrastructure in the *Semá:th X̱ó:tsa* (Sumas Lake) area, raising concerns about the impacts of contaminant discharges into fish habitat. The absence of pre-flood baseline data and ongoing monitoring of freshwater quality in the area highlighted the urgent need for water sampling and analysis to assess the level of risk to fish and the environment.

A chemical additive in automotive tire rubber (6-PPD with a formula of *N*-(1,3-dimethylbutyl)-*N'*-phenyl-*p*-phenylenediamine) is an anti-oxidant and anti-ozonant designed to protect tires from degradation caused ozone and temperature fluctuations. This chemical leaches onto road surfaces, where it breaks down into 6-PPD Quinone (6-PPDq) and rinses off into fish habitat during precipitation events (1).

Tire chemicals (e.g. 6-PPD) and their breakdown products (one of which is 6-PPD Quinone or 6-PPDq) in road runoff were recently discovered as the causative agent causing the deaths of large numbers of coho salmon in Washington State (2,3,4,5). These fish kills in urban and semi-urban areas highlight emerging questions about the impacts of road runoff on salmon and their habitat.

Diphenylamine is used as a pesticide, industrial chemical and as an anti-oxidant in rubber manufacturing, and is considered toxic to fish (US EPA - Pesticides - Fact Sheet for Diphenylamine ; Re-evaluation Note REV2017-25, Special Review of Diphenylamine: Proposed Decision for Consultation - Canada.ca).

Methods

We collected 2 surface water samples and 4 groundwater samples in the Sumas Lake area of the Fraser Valley, British Columbia on February 2, 2022. Samples were stored in the field at 4°C in suitable containers supplied by partnering laboratories, and were submitted to SGS AXYS Analytical Services (https://www.sgsaxys.com/) in Sidney BC for analysis of three target tire rubber-related compounds (diphenylamine, the parent chemical 6-PPD, and its breakdown product 6-PPDq using their MLA-118 Rev 01 protocol. For Quality Assurance purposes, a laboratory blank and a spiked matrix were included in analyses. Data are presented in nanograms per litre (ng/L).

We report here on the concentrations of three tire-related chemicals in 2 surface and 2 ground water samples following the British Columbia floods of late 2021. The two additional groundwater samples from Abbotsford sources will be evaluated separately. There are no Environmental Quality Guidelines for 6-PPDq in Canada.

Results

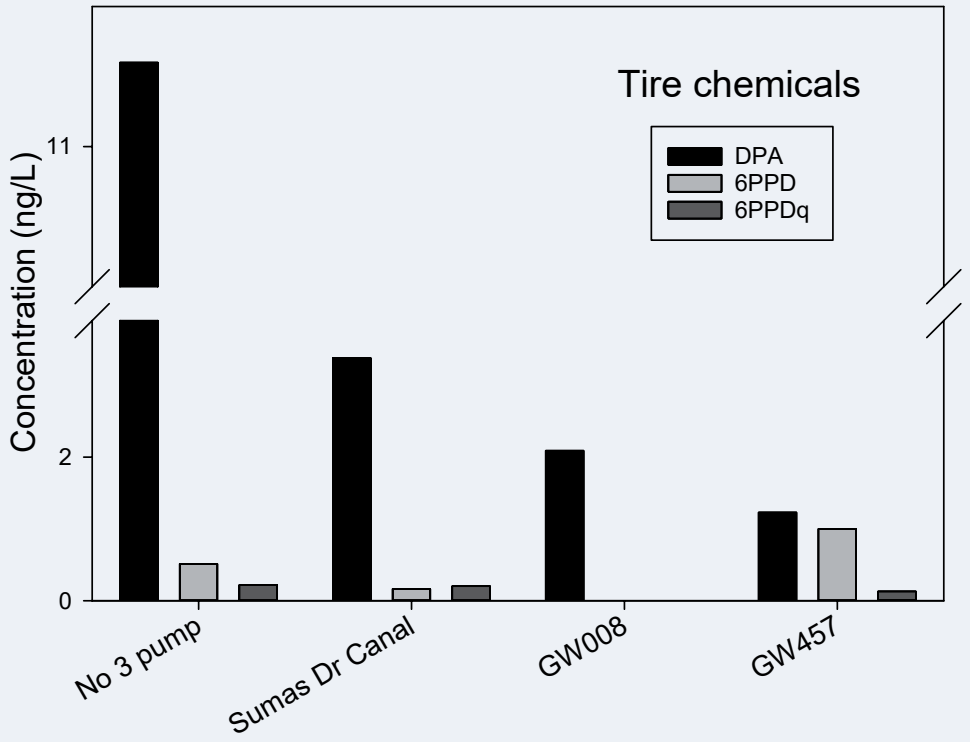
Surface water

- We detected the tire-related chemicals diphenylamine, 6-PPD, and 6-PPDq in both surface water samples and 50% of groundwater samples (2/4).
- Diphenylamine concentrations averaged 7.3 ng/L in surface water and 1.7 ng/L in groundwater.
- 6-PPD concentrations averaged 0.34 ng/L in surface water and 0.84 ng/L in groundwater.
- 6-PPD Quinone concentrations averaged 0.21 ng/L in surface water and 0.12 ng/L in groundwater.
- The ratio of the parent breakdown chemical (6-PPD : 6-PPDq) was 6.92 in surface water, indicating a greater proportion of the parent chemical in fish habitat, and a risk of further breakdown into the highly toxic 6-PPDq.

Groundwater

- The ratio of parent breakdown chemical (6-PPD : 6PPDq) was 1.57 in groundwater, potentially suggesting either a greater groundwater infiltration of the breakdown chemical or a greater degree of breakdown in the groundwater itself.

Figure 9.1: Tire-related chemicals were detected in surface and groundwater



Tire-derived chemicals were found in both fish habitat and in groundwater in the Sumas Lake after the 2021 floods, although concentrations were low.

Conclusions

This is the first public report of the tire chemical 6 PPD and its toxic breakdown product 6 PPD Quinone in British Columbia. Several recent studies highlight the relevance of this chemical to fish health (6), and there are currently several research projects underway in BC to fill this gap. With 6-PPD and 6-PPDq degrading following collection, we anticipate that our findings under report true values for these compounds in the Sumas area. Sampling and analysis protocols are currently revised by those studying this emerging contaminant of concern.

There are no Environmental Quality Guidelines for the tire-related chemicals diphenylamine, 6-PPD or 6-PPD Quinone in Canada. However, concentrations of 6-PPD Quinone measured here were lower than a recently established lethal threshold (LC50) of 95 ng/L for coho salmon (4,5). Additional research

suggests that other species, including brook trout and white sturgeon, are vulnerable to the toxicity of 6-PPDq, but are less sensitive than coho salmon (7).

The presence of tire-related compounds in fish habitat is a high priority concern, with reports of significant mortalities of adult coho salmon from Washington State (4). Rainfall events are suspected of causing large amounts of the toxic 6-PPD Quinone to be flushed into fish habitat, highlighting the potential for significant consequences in surface waters such as ditches, streams and other water bodies in the Sumas area. Our findings also highlight the vulnerability of groundwater to road contaminants, with additional work needed to better characterize the nature and severity of this priority contamination topic in the Sumas area and across BC. Future water quality monitoring should prioritize the poorly studied sources and impacts of tire related contaminants in fish habitat.

References

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