

# Tyre Anti-Degradants and their Impact on the Environment



## What are Tyre Anti-Degradants?

Tyre anti-degradants are additives utilised in the manufacturing of various rubber types, predominantly applied in vehicle tyres. These additives are incorporated to bolster the materials' ability to endure degradation stemming from an array of environmental factors such as heat, oxygen, ozone, UV radiation, as well as a spectrum of chemical and physical stresses. These additives actively contribute to preserving the structural integrity, flexibility, and overall quality of the tyre rubber. Moreover, they play a pivotal role in averting issues like cracking, fading, and reduced elasticity. A diverse amalgamation of tyre anti-degradants is currently employed for this purpose.



6PPD-Q has been identified to have a toxic impact on Coho Salmon in freshwater streams

## Environmental Concerns

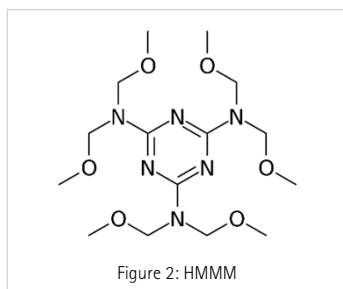
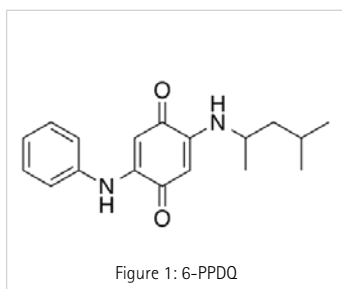
The operation of cars and vehicles on roads results in the release of dust and small particles from tyres. Subsequently, these particles find their way into stormwater systems and become widely distributed within aquatic ecosystems also referred to as Urban Runoff Mortality Syndrome (URMS). This situation gives rise to two distinct environmental concerns in this case. Firstly, there is the matter of the particles themselves, categorised as microplastics, posing a significant challenge due to their persistence and environmental impact. Secondly, there is a noteworthy concern surrounding the abundance of tyre anti-degradants. These compounds can potentially leach into the environment, with some having been identified as toxic to aquatic ecosystems.

Moreover, the use of recycled tyres on sports fields and children's playgrounds introduces the possibility of these chemicals leaching into the surroundings. Presently, two specific compounds N-1,3-dimethylbutyl)-N'-phenyl-1,4-phenylenediamine quinone (6PPD-Q) and Hexamethoxymethyl melamine (HMMM), have garnered attention as contaminants of emerging concern due to their documented toxicity to aquatic systems. Nevertheless, ongoing research is underway to examine additional compounds as part of the comprehensive assessment process.

**6PPD-Q** (Figure 1) is the ozonation product of 6PPD which is its exceptional antiozonant engaging in more rapid reactions with ozone compared to ozone's interaction with the rubber. In 2020 it has been discovered in freshwater streams that 6PPD-Q is

toxic to Coho Salmon ( $LC_{50} = 95 \text{ ng/L}$ , 24h), killing them before they spawn. Further studies also identified the toxic impact on species like brook trout ( $LC_{50} = 0.59 \text{ } \mu\text{g/L}$ , 24h) and rainbow trout ( $LC_{50} = 1.0 \text{ } \mu\text{g/L}$ , 24h).

**HMMM** (Figure 2) is used as a crosslinking agent in the production of coatings and tyres. It improves the adhesion between the rubber and the steel reinforcing cords. HMMM has shown an acute toxic effect on daphnia. It is also linked to toxicity and mortality events of aquatic organisms. However, there are currently no published lethal concentrations for aquatic animals yet.



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## What can be done?

Presently, extensive research is underway to identify alternative compounds to replace these ecotoxic substances, but these are early days. But the current optimal management practices for tyre anti-degradants include source control, flow control, and runoff treatment. The most effective source control method involves preventing rubber materials from entering the stormwater through routine sweeping and the maintenance of roadside ditches. Flow control is aimed at allowing stormwater to be absorbed in infiltration basins prior to reaching groundwater. Runoff treatment encompasses strategies such as chemical sorption and physical filtration.

## Analysis

At Eurofins Environment Testing Australia, we are at the forefront of analysing new Emerging Contaminants. Thus, we have developed an analysis method for identifying 6PPD-Q and HMMM using isotope dilution LC-MS/MS. This approach enables us to analyse various sample types, including drinking water and stormwater, sand, sediment, rubber materials, and leachates. These analyses are very important to understand the extent of the problem, especially here in Australia, where little data is available on their impact on native fish species.



Contact our Emerging Contaminants Team Today - [EmergingContaminantsAUS@eurofins.com](mailto:EmergingContaminantsAUS@eurofins.com)

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