

Vehicle tyre particles in the environment

Background

The Foresight Briefs are published by the United Nations Environment Programme (UNEP) to, among others, highlight a hotspot of environmental change, feature an emerging science topic, or discuss a contemporary environmental issue. The public is thus provided with the opportunity to find out what is happening to their changing environment and the consequences of everyday choices, and to think about future directions for policy. The thirty-fourth edition of UNEP's Foresight Briefs looks at the negative effects of tyre abrasion particles and how they can be regulated.



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Abstract

Tyre-wear particles are one of the most abundant types of primary microplastics discharged into the environment. During their degradation in the environment, various tyre components are released, including some chemicals with harmful effects to organisms. There are various prevention and mitigation methods that can alleviate the problems, but effectively designed and enforced policies are needed to support these strategies.

Introduction

Driving a vehicle causes abrasion of the tyres, generating very large amounts of small particles, known as tyre-abrasion or tyre-wear particles. These particles are emitted into and spread throughout the environment (Giechaskiel *et al.* 2024; Gieré and Dietze 2022). Due to their chemical composition, typical size, and mode of formation and release, these particles are classified as primary microplastics (Boucher and Friot 2017;

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Hartmann *et al.* 2019; Järskog *et al.* 2022). Once in the environment, the tyre-wear particles interact with light, air, ozone, and water, as well as with soil, sediments, and biota. These interactions trigger particle degradation, which in turn leads to the release of tyre constituents, including zinc and various organic chemicals (Halsband *et al.* 2020; Gieré and Dietze 2022; Zhang *et al.* 2023). There is increasing evidence that some of these released compounds are highly toxic to various organisms (Brinkmann *et al.* 2022; Chen *et al.* 2023; Bohara *et al.* 2024). It is therefore essential that appropriate measures are taken by both the tyre industry and governments around the world to curtail emission of tyre-wear particles in order to minimize their distribution and concentration in the environment.

Why is this an important issue?

Tyre-wear particles constitute one of the most abundant types of primary microplastics discharged into the environment (Kole *et al.* 2017; Sommer *et al.* 2018;

Kole *et al.* 2019; Furuseth and Rødland 2020; Vogelsang *et al.* 2020). It has been estimated, for example, that of the 1.5 million tonnes of primary microplastics reaching the oceans every year, 28 per cent, or 400,000 tonnes, are tyre-wear particles (Boucher and Friot 2017). According to another study, the annual accumulation of tyre-wear particles in the oceans may be as high as 1.0±0.2 million tonnes (PEW Charitable Trusts, 2020). Tyre-wear particles have also been observed within the intestines of fish and other aquatic species (Leads *et al.* 2019; Parker *et al.* 2020), some of which are consumed by humans.

Tyre-wear particles originate from a tyre's outermost layer, known as the tread (Figure 1).

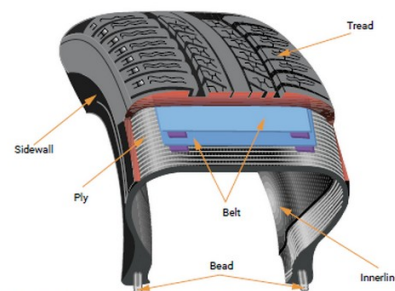


Photo credit: iStock.com / Hitesh Singh. Adapted by UNEP

Figure 1: Basic structure of a passenger car tyre. Belts provide stiffness to the tread, overall tyre strength, and protection from puncture; body ply maintains tyre shape and prevents it from tearing; beads enable the tyre to firmly grip to the wheel.

EARLY WARNING AND ASSESSMENT DIVISION

Caption:

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