

References

- Adachi K, Tainosho Y (2004) Characterization of heavy metal particles embedded in tire dust. *Environ Int* 30:1009–1017. <https://doi.org/10.1016/j.envint.2004.04.004>
- American Chemical Society (2014) Molecule of the Week Archive “Zinc Oxide.” <https://www.acs.org/molecule-of-the-week/archive/z/zinc-oxide.html>. Accessed 1 Aug 2023
- Ashoori N, Teixido M, Spahr S, et al (2019) Evaluation of pilot-scale biochar-amended woodchip bioreactors to remove nitrate, metals, and trace organic contaminants from urban stormwater runoff. *Water Res* 154:1–11. <https://doi.org/10.1016/j.watres.2019.01.040>
- Atlantis Rubber Powders B.V. (2023) Actifine FMRP - Functionalized Micronised Rubber Powder. <https://www.atlantisrubberpowders.com/product>. Accessed 13 Aug 2023
- Baensch-Baltruschat B, Kocher B, Kochleus C, et al (2021) Tyre and road wear particles - A calculation of generation, transport and release to water and soil with special regard to German roads. *Science of the Total Environment* 752:. <https://doi.org/10.1016/j.scitotenv.2020.141939>
- Baensch-Baltruschat B, Kocher B, Stock F, Reifferscheid G (2020a) Tyre and road wear particles (TRWP) - A review of generation, properties, emissions, human health risk, ecotoxicity, and fate in the environment. *Science of the Total Environment* 733
- Baensch-Baltruschat B, Kocher B, Stock F, Reifferscheid G (2020b) Tyre and road wear particles (TRWP) - A review of generation, properties, emissions, human health risk, ecotoxicity, and fate in the environment. *Science of the Total Environment* 733
- Böhm M, Kobetičová K, Fořt J, Černý R (2022) Determination of Metals Leakage from Rubber Granulate. In: AIP Conference Proceedings. American Institute of Physics Inc.
- Brewer A, Dror I, Berkowitz B (2021) The Mobility of Plastic Nanoparticles in Aqueous and Soil Environments: A Critical Review. *ACS Environmental Science and Technology Water* 1:48–57
- Crosta GF (2011) Morphological classification and microanalysis of tire tread particles worn by abrasion or corrosion. In: *Scanning Microscopies 2011: Advanced Microscopy Technologies for Defense, Homeland Security, Forensic, Life, Environmental, and Industrial Sciences*. SPIE, p 80360H
- Cruz Bolaños MA (2022) Biochar and Activated Carbon for Enhanced Retention of Relevant Vehicle-Related Contaminants in Green Infrastructures
- Cruz MA, Xu J, Foppen JW, et al (2023) Transport and removal of stormwater vehicle-related mobile organic contaminants in geomedia-amended sand columns. *Science of the Total Environment* 892:. <https://doi.org/10.1016/j.scitotenv.2023.164264>
- Cunningham B, Harper B, Brander S, Harper S (2022) Toxicity of micro and nano tire particles and leachate for model freshwater organisms. *J Hazard Mater* 429:. <https://doi.org/10.1016/j.jhazmat.2022.128319>

- Davis AP, Traver RG, Hunt WF, et al (2012) Hydrologic Performance of Bioretention Storm-Water Control Measures. *J Hydrol Eng* 17:604–614. [https://doi.org/10.1061/\(ASCE\)HE.1943-5584.0000467](https://doi.org/10.1061/(ASCE)HE.1943-5584.0000467)
- Eisentraut P, Dümichen E, Ruhl AS, et al (2018) Two Birds with One Stone - Fast and Simultaneous Analysis of Microplastics: Microparticles Derived from Thermoplastics and Tire Wear. *Environ Sci Technol Lett* 5:608–613. <https://doi.org/10.1021/acs.estlett.8b00446>
- Gao J, Pan S, Li P, et al (2021a) Vertical migration of microplastics in porous media: Multiple controlling factors under wet-dry cycling. *J Hazard Mater* 419:. <https://doi.org/10.1016/j.jhazmat.2021.126413>
- Gao J, Pan S, Li P, et al (2021b) Vertical migration of microplastics in porous media: Multiple controlling factors under wet-dry cycling. *J Hazard Mater* 419:. <https://doi.org/10.1016/j.jhazmat.2021.126413>
- Gao Z, Cizdziel J V., Wontor K, et al (2022) On airborne tire wear particles along roads with different traffic characteristics using passive sampling and optical microscopy, single particle SEM/EDX, and μ -ATR-FTIR analyses. *Front Environ Sci* 10:. <https://doi.org/10.3389/fenvs.2022.1022697>
- Gibert O, Hernández Amphos M, Vilanova E, et al (2012) Guidelining protocol for soil-column experiments assessing fate and transport of trace organics Title: Guidelining protocol for soil-column experiments assessing fate and transport of trace organics Work Package: 12 Deliverable number: Partner responsible: CETaqua Deliverable author(s): Quality assurance
- Gilbreath A, McKee L, Shimabuku I, et al (2019) Multiyear Water Quality Performance and Mass Accumulation of PCBs, Mercury, Methylmercury, Copper, and Microplastics in a Bioretention Rain Garden. *J Sustain Water Built Environ* 5:. <https://doi.org/10.1061/jswbay.0000883>
- Habib RZ, Al Kendi R, Ghebremedhin F, et al (2022) Tire and rubber particles in the environment—A case study from a hot arid region. *Front Environ Sci* 10:. <https://doi.org/10.3389/fenvs.2022.1009802>
- Halsband C, Sørensen L, Booth AM, Herzke D (2020) Car Tire Crumb Rubber: Does Leaching Produce a Toxic Chemical Cocktail in Coastal Marine Systems? *Front Environ Sci* 8:. <https://doi.org/10.3389/fenvs.2020.00125>
- Harrison RM, Allan J, Carruthers D, et al (2021) Non-exhaust vehicle emissions of particulate matter and VOC from road traffic: A review. *Atmos Environ* 262:118592. <https://doi.org/10.1016/j.atmosenv.2021.118592>
- Hou J, Xu X, Lan L, et al (2020) Transport behavior of micro polyethylene particles in saturated quartz sand: Impacts of input concentration and physicochemical factors. *Environmental Pollution* 263:. <https://doi.org/10.1016/j.envpol.2020.114499>
- Kargro Recycling (2023) Cryogenic powders. <https://www.kargrorecycling.com/inner-pages/powder-granulates>. Accessed 13 Aug 2023
- Kelley JP (2018) PERFORMANCE OF BIOSWALES FOR CONTAINMENT AND TREATMENT OF HIGHWAY STORMWATER RUNOFF

- Ling X, Yan Z, Liu Y, Lu G (2021) Transport of nanoparticles in porous media and its effects on the co-existing pollutants. *Environmental Pollution* 283
- Liu Y, Shao H, Liu J, et al (2021) Transport and transformation of microplastics and nanoplastics in the soil environment: A critical review. *Soil Use Manag* 37:224–242
- Lu F, Su Y, Ji Y, Ji R (2021) Release of Zinc and Polycyclic Aromatic Hydrocarbons From Tire Crumb Rubber and Toxicity of Leachate to *Daphnia magna*: Effects of Tire Source and Photoaging. *Bull Environ Contam Toxicol* 107:651–656. <https://doi.org/10.1007/s00128-021-03123-9>
- Marsalek R (2014) Particle Size and Zeta Potential of ZnO. *APCBEE Procedia* 9:13–17. <https://doi.org/10.1016/j.apcbee.2014.01.003>
- MAXXIS HOW A TIRE IS MADE. <https://www.maxxis.com/nl/en/technology/how-a-tire-is-made/>. Accessed 6 Aug 2023
- McCarty K, Mian HR, Chhipi-Shrestha G, et al (2023) Ecological risk assessment of tire and road wear particles: A preliminary screening for freshwater sources in Canada. *Environmental Pollution* 325:121354. <https://doi.org/10.1016/j.envpol.2023.121354>
- Mengistu D, Coutris C, Paus KAH, Heistad A (2022) Concentrations and Retention Efficiency of Tire Wear Particles from Road Runoff in Bioretention Cells. *Water (Switzerland)* 14:. <https://doi.org/10.3390/w14203233>
- Moeck C, Davies G, Krause S, Schneidewind U (2023) Microplastics and nanoplastics in agriculture—A potential source of soil and groundwater contamination? *Grundwasser* 28:23–35. <https://doi.org/10.1007/s00767-022-00533-2>
- Müller A, Österlund H, Marsalek J, Viklander M (2020) The pollution conveyed by urban runoff: A review of sources. *Science of the Total Environment* 709
- Napper IE, Thompson RC (2020) Plastic Debris in the Marine Environment: History and Future Challenges. *Global Challenges* 4:1900081. <https://doi.org/10.1002/gch2.201900081>
- O'Connor D, Pan S, Shen Z, et al (2019) Microplastics undergo accelerated vertical migration in sand soil due to small size and wet-dry cycles. *Environmental Pollution* 249:527–534. <https://doi.org/10.1016/j.envpol.2019.03.092>
- Page TS, Almeda R, Koski M, et al (2022) Toxicity of tyre wear particle leachates to marine phytoplankton. *Aquatic Toxicology* 252:. <https://doi.org/10.1016/j.aquatox.2022.106299>
- Paulthangam KM, Som A, Ahuja T, et al (2022) Role of Zinc Oxide in the Compounding Formulation on the Growth of Nonstoichiometric Copper Sulfide Nanostructures at the Brass-Rubber Interface. *ACS Omega* 7:9573–9581. <https://doi.org/10.1021/acsomega.1c06207>
- Pokorný J, Šál J, Ševčík R (2022) Waste tires and their material recycling. p 150006
- Ranjan VP, Joseph A, Sharma HB, Goel S (2023) Preliminary investigation on effects of size, polymer type, and surface behaviour on the vertical mobility of microplastics in a porous media. *Science of the Total Environment* 864:. <https://doi.org/10.1016/j.scitotenv.2022.161148>
- Rødland ES, Lind OC, Reid MJ, et al (2022) Occurrence of tire and road wear particles in urban and peri-urban snowbanks, and their potential environmental implications. *Science of the Total Environment* 824:. <https://doi.org/10.1016/j.scitotenv.2022.153785>

- Selbes M, Yilmaz O, Khan AA, Karanfil T (2015) Leaching of DOC, DN, and inorganic constituents from scrap tires. *Chemosphere* 139:617–623. <https://doi.org/10.1016/j.chemosphere.2015.01.042>
- Shaniv D, Dror I, Berkowitz B (2021) Effects of particle size and surface chemistry on plastic nanoparticle transport in saturated natural porous media. *Chemosphere* 262:. <https://doi.org/10.1016/j.chemosphere.2020.127854>
- Smyth K, Drake J, Li Y, et al (2021) Bioretention cells remove microplastics from urban stormwater. *Water Res* 191:. <https://doi.org/10.1016/j.watres.2020.116785>
- Sommer F, Dietze V, Baum A, et al (2018) Tire abrasion as a major source of microplastics in the environment. *Aerosol Air Qual Res* 18:2014–2028. <https://doi.org/10.4209/aaqr.2018.03.0099>
- Song Z, Yang X, Chen F, et al (2019) Fate and transport of nanoplastics in complex natural aquifer media: Effect of particle size and surface functionalization. *Science of the Total Environment* 669:120–128. <https://doi.org/10.1016/j.scitotenv.2019.03.102>
- Spanheimer V, Katrakova-Krüger D (2022) Analysis of tire wear airstrip particles (TWAP). *Sci Rep* 12:. <https://doi.org/10.1038/s41598-022-19986-9>
- Stojanovic N, Abdullah OI, Grujic I, Boskovic B (2022) Particles formation due to the wear of tires and measures for the wear reduction: A review. *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering* 236:3075–3089
- Suntako R (2018) Effect of synthesized ZnO nanoparticles on thermal conductivity and mechanical properties of natural rubber. In: *IOP Conference Series: Materials Science and Engineering*. Institute of Physics Publishing
- Svensson N, Andersson-Sköld Y (2021) Dispersion and fate models for microplastics from tyre and road wear State of the art and opportunities
- Tan Z, Berry A, Charalambides M, et al (2023) Tyre wear particles are toxic for us and the environment 02 Imperial Zero Pollution Tyre wear particles are toxic for us and the environment
- Teixidó M, Charbonnet JA, LeFevre GH, et al (2022) Use of pilot-scale geomedia-amended biofiltration system for removal of polar trace organic and inorganic contaminants from stormwater runoff. *Water Res* 226:. <https://doi.org/10.1016/j.watres.2022.119246>
- Teixidó M, Schmidlin D, Xu J, et al (2023) Contaminants in Urban Stormwater: Barcelona case study. *Advances in Geosciences* 59:69–76. <https://doi.org/10.5194/adgeo-59-69-2023>
- Tian Z, Zhao H, Peter KT, et al (2021) A ubiquitous tire rubber-derived chemical induces acute mortality in coho salmon. *Science* (1979) 371:185–189. <https://doi.org/10.1126/science.abd6951>
- Trudsø LL, Nielsen MB, Hansen SF, et al (2022) The need for environmental regulation of tires: Challenges and recommendations. *Environmental Pollution* 311:. <https://doi.org/10.1016/j.envpol.2022.119974>
- Ulrich BA, Im EA, Werner D, Higgins CP (2015) Biochar and activated carbon for enhanced trace organic contaminant retention in stormwater infiltration systems. *Environ Sci Technol* 49:6222–6230. <https://doi.org/10.1021/acs.est.5b00376>

- Unice KM, Bare JL, Kreider ML, Panko JM (2015) Experimental methodology for assessing the environmental fate of organic chemicals in polymer matrices using column leaching studies and OECD 308 water/sediment systems: Application to tire and road wear particles. *Science of the Total Environment* 533:476–487. <https://doi.org/10.1016/j.scitotenv.2015.06.053>
- Verschoor A, Poorter L de, Dröge R, et al (2016) Emission of microplastics and potential mitigation measures Abrasive cleaning agents, paints and tyre wear
- Wagner S, Hüffer T, Klöckner P, et al (2018) Tire wear particles in the aquatic environment - A review on generation, analysis, occurrence, fate and effects. *Water Res* 139:83–100
- Wagner S, Klöckner P, Reemtsma T (2022) Aging of tire and road wear particles in terrestrial and freshwater environments – A review on processes, testing, analysis and impact. *Chemosphere* 288:. <https://doi.org/10.1016/j.chemosphere.2021.132467>
- Werbowski LM, Gilbreath AN, Munno K, et al (2021) Urban Stormwater Runoff: A Major Pathway for Anthropogenic Particles, Black Rubbery Fragments, and Other Types of Microplastics to Urban Receiving Waters. *ACS ES&T Water* 1:1420–1428. <https://doi.org/10.1021/acsestwater.1c00017>
- Zhang M, Yin H, Tan J, et al (2023) A comprehensive review of tyre wear particles: Formation, measurements, properties, and influencing factors. *Atmos Environ* 297