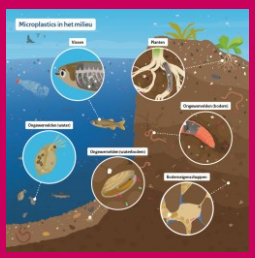


National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

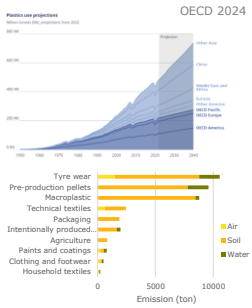
Necessity of plastics circularity

Environmental impacts of microplastics

Joris Quik (and colleagues)

Microplastics

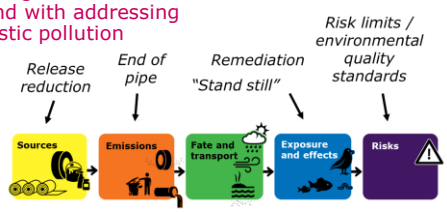
- Particles 1 – 5000 µm
- Emission increases
- Microplastics in every environmental compartment
- Effects expected



Quik 2025

Building knowledge base goes hand in hand with addressing plastic pollution

- Research agenda MP environment (2023 Dutch)

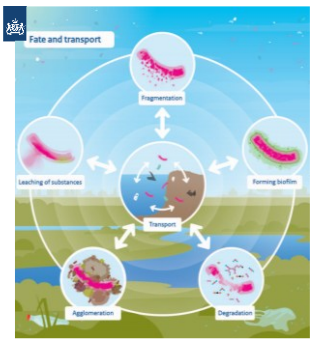


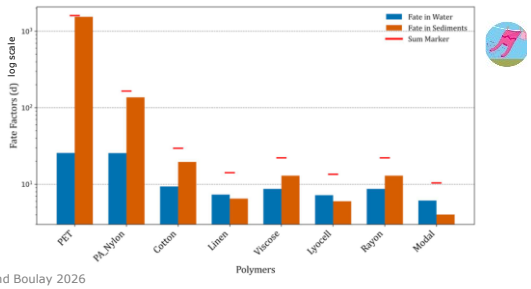
Emission Reduction

- Product system
  - Textile emission from clothing
    - 10 - 100 ton microplastics emission avoided from changing washing procedure or using an external filter
- Production
  - Reduce losses during manufacturing (e.g. pellets)
- Material
  - Durability/abrasiveness
- Use of emission modelling:
  - Schwarz 2023, Quik 2024

Degradability and Fragmentation

- Material function
- Fragmentation (few data)
  - Depends on UV irradiation and physical abrasion
  - Deep vs surface soil
- Degradability
  - Mineralization, only molecules remain
- Substance leaching, increase environmental impact.



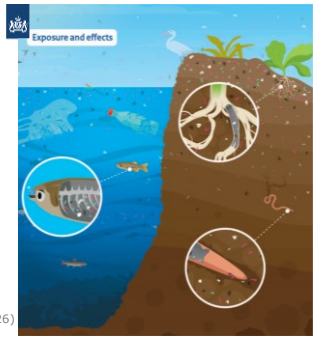


Saadi and Boulay 2026

Figure 1 Fate factors (FF) in the marine environment for 10 µm microfibers, for an emission in marine water, shown on a log-scale. The sum represents the total time-integrated mass of microfibers in the marine environment (water and sediments combined). PET = Polyethylene terephthalate; PA = Polyamide.

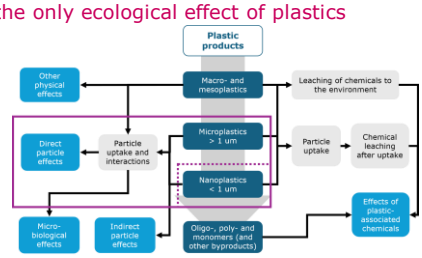
Microplastic particle effects

- No distinction between polymers (yet)
- Volume and surface are important factor
  - Food dilution
  - Tissue translocation



Swart 2025, Coffin et al. (2026)

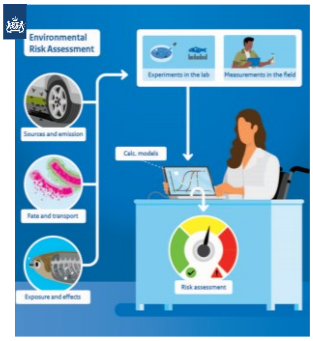
Particle effects not the only ecological effect of plastics



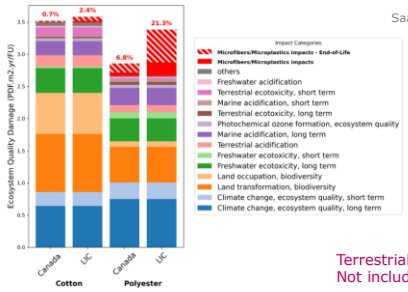
Swart 2025

Ecological Risk Assessment

- Environmental measurements sometimes exceed effect thresholds
  - Koelmans 2023, Redondo-Hasselerharm 2024
- Risk thresholds not used (yet) for regulation
- Tools: Life Cycle Assessment (LCA)



Saadi and Boulay 2026



Terrestrial ecosystem Not included

Figure 5. Impacts on ecosystem quality of physical effects on biota of microfibers emitted over the life cycle of a tee shirt in Canada and in a low-income country (LIC), compared to other impact categories. Impacts of microfibers released are shown in red, for a use phase in Canada and in an LIC. Impacts of end-of-life fragmentation of microfibers are shown in dashed red. The percentage in red shows the contribution of microfiber emissions (use and end-of-life) to ecosystem quality damage. PDF = potentially disappeared fraction of species.

Include microplastics in assessing environmental impacts of innovation

- Plastic pollution will increase, is a widespread and persistent problem
  - Microplastics pollution is not reversible
- Product system Life Cycle Assessment incl. particle effects is possible
  - ReCiPe update expected ~fall 2026
    - synthetic polymers, biobased polymers, cellulose based materials and tire wear particles
  - Saadi et al pre-print
- Assess effectivity of circular product strategies

Questions?

Joris Quik
and colleagues

References

OECD, 2024. Policy Scenarios for Eliminating Plastic Pollution by 2040. OECD Publishing. https://doi.org/10.1787/76400890-en

Quik, J.T.K., Hids, A.R., Mellink, Y., van Broggen, A., 2025. Possibilities for reducing emissions of microplastics from textiles - A Dynamic Probabilistic Material Flow Analysis Study on Clothing and Footwear aimed at the Netherlands (RIVM letter report No. 2025 - 0152). Rijksinstituut voor Volksgezondheid en Milieu RIVM, Bilthoven, The Netherlands.

Quik, J., Faber, M., Ridder, J., Waaijers-van der Loop, S., 2023. Wat weten we over microplastics in het milieu? Kennisagenda Microplastics in het milieu. Rijksinstituut voor Volksgezondheid en Milieu RIVM. https://doi.org/10.21945/RIVM-2022-0186

Schwarz, A.E., Lenaen, S.M.C., Langeveld, E., Parker, L.A., Urbanus, J.H., 2023. Plastics in the global environment assessed through material flow analysis, degradation and environmental transportation. Science of The Total Environment 875, 162649. https://doi.org/10.1016/j.scitotenv.2023.162649

Quik, J.T.K., Hids, A.R., Steenmeijer, M.A., Mellink, Y., van Broggen, A., 2024. Emission of Microplastics to Water, Soil, and Air. What can we do about it? (RIVM report No. 2024-0100). Rijksinstituut voor Volksgezondheid en Milieu RIVM, Bilthoven, The Netherlands.

Saadi, N., Boulay, A.-M., 2026. Microfibers in life cycle assessment: comparing the physical effects of cellulosic and synthetic fibers via characterization factors development. Integrated Environmental Assessment and Management vjaq0207. https://doi.org/10.1002/ieam.vjaq0207

Swart, E., van Braemen, P., Koelmans, A., Quik, J., 2025. Towards ecological risk assessment of microplastics for regulatory purposes (No. RIVM rapport 2025-0095). National Institute for Public Health and the Environment, Bilthoven, The Netherlands. https://doi.org/10.21945/RIVM-2025-0095

Coffin, S., Bertrand, L., Ahmed, K.T., de Souza Lehe, L., Cowger, W., Sifa, S., Barrick, A., Kukkola, A., Almroth, B.C., Miller, E., Yeh, A., Kennedy, S., Mair, M.M., 2026. A Probabilistic Risk Framework for Microplastics Integrating Uncertainty Across Toxicological and Environmental Variability: Development and Application to Marine and Freshwater Ecosystems. Journal of Hazardous Materials 141021. https://doi.org/10.1016/j.jhazmat.2025.141021

Redondo-Hasselerharm, P.E., Rico, A., Huerta Lwanga, E., van Gestel, C.A.M., Koelmans, A.A., 2024. Source-specific probabilistic risk assessment of microplastics in soils applying quality criteria and data alignment methods. Journal of Hazardous Materials 467, 133732. https://doi.org/10.1016/j.jhazmat.2024.133732

Koelmans, A.A., Redondo-Hasselerharm, P.E., Mohamed Nor, N.H., Gouin, T., 2023. On the probability of ecological risks from microplastics in the Laurentian Great lakes. Environmental Pollution 325, 121445. https://doi.org/10.1016/j.envpol.2023.121445