



Federal Ministry
of Education
and Research



Industrial microplastics and pellets loss: Status quo and possible reduction measures

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Brussels
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Status quo: Industrial microplastic emissions



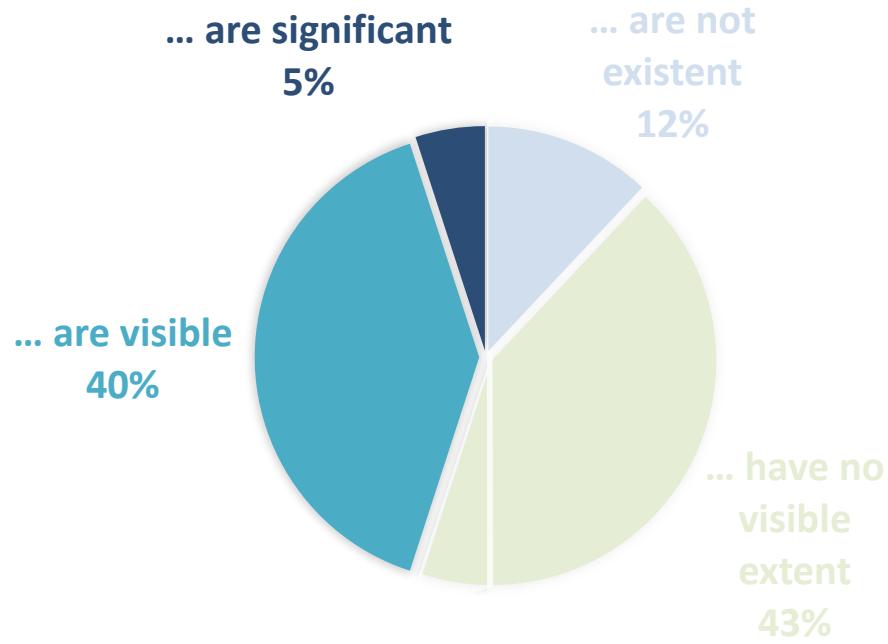
Occurrence of microplastics at industrial sites?

Delphy survey (n=43)

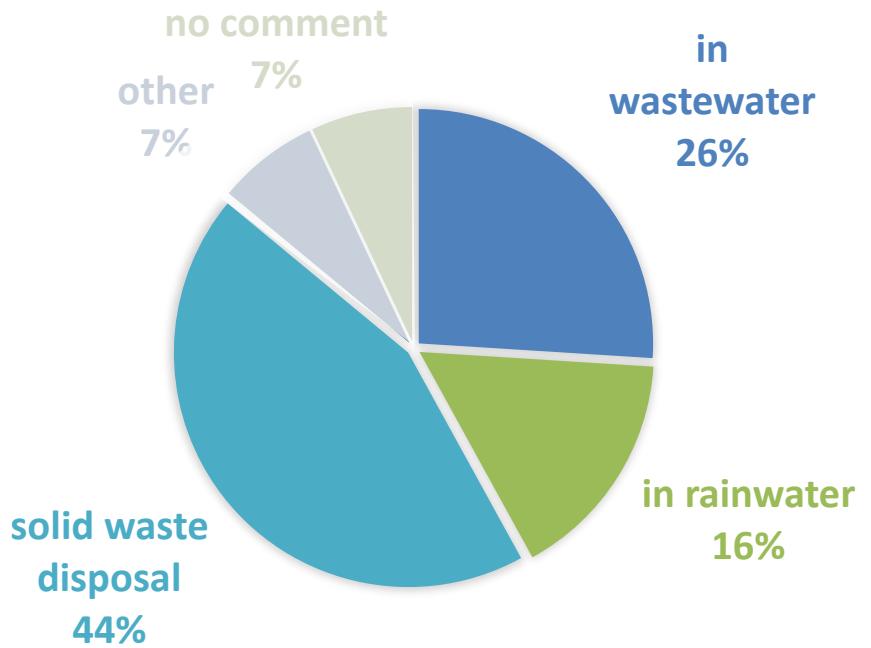
Site inspections

Sampling

Microplastic losses...



Fate of microplastics at industrial sites



Mod. Barkmann et al. 2021: EmiStop final report (<https://bmbf-plastik.de/de/publikation/emistop-schlussbericht>)

Occurrence of microplastics at industrial sites?

Bildquelle: AMB ENTERPRISE KARACHI

Delphy survey (n=43)

Site inspections

Sampling

Outdoor Storages



Waste management



Traffic areas



(un)loading zones



Occurrence of microplastics at industrial sites?

Bildquelle: AMB ENTERPRISE KARACHI

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Site inspections

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Indoor processes

- Controlled environment
- Wastewater system
- Waste management
- Air cleaning

Outdoor processes

- Possible uncontrolled release
- Hotspots

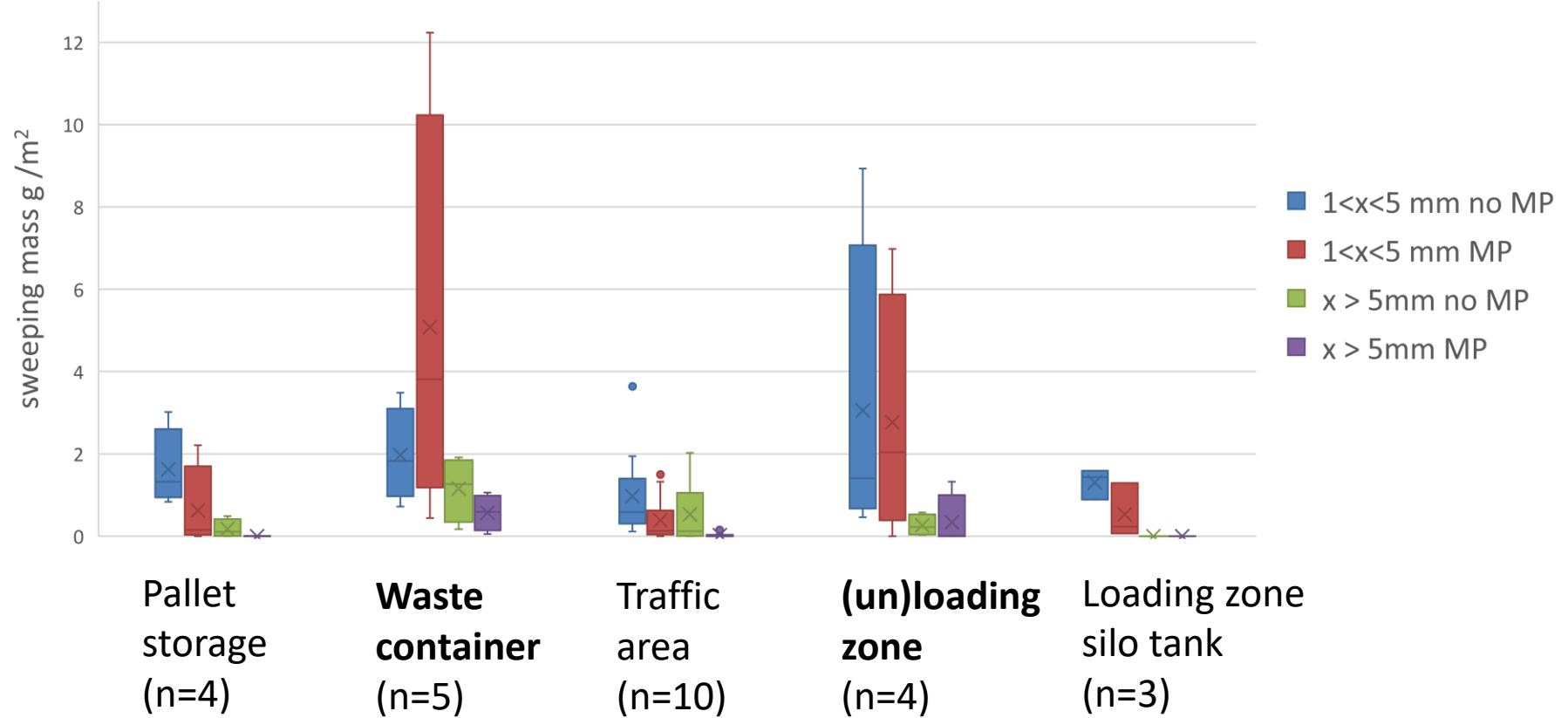


Occurrence of microplastics at industrial sites?

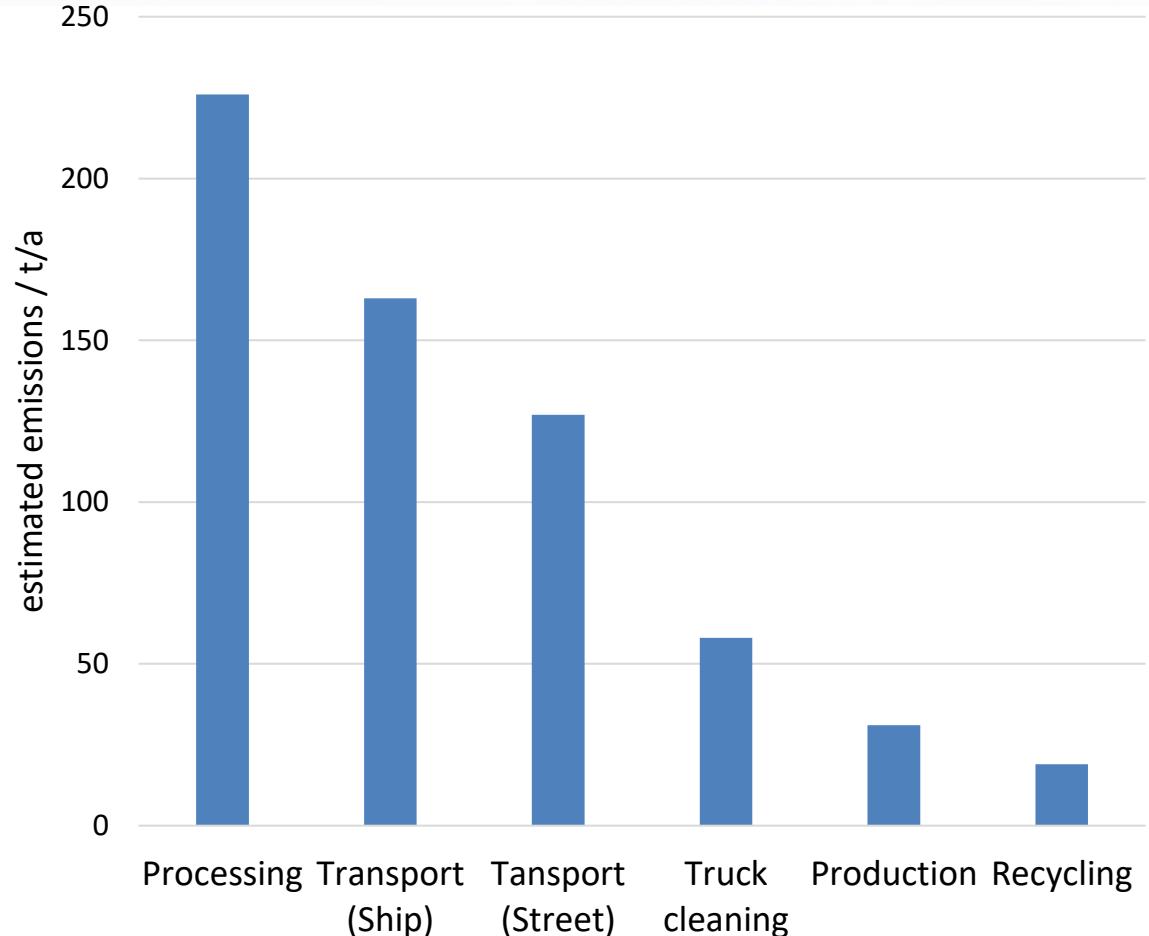
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Status quo: Industrial microplastic emissions

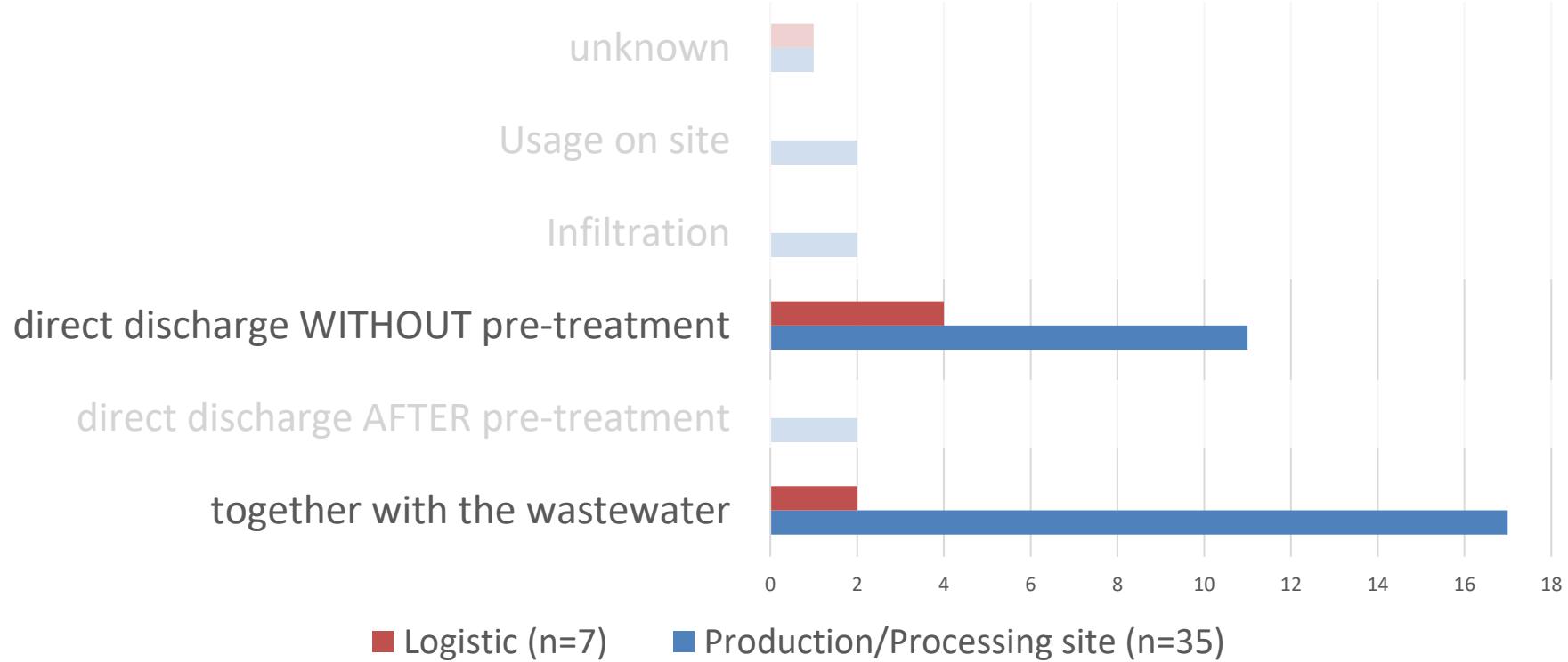


Data from: Conversio Sonderbetrachtung Pelletverluste. Endbericht. 2022

- **Estimation for Germany: 624 t/a**
 - 265 t/a (aquatic environment)
 - 359 t/a (terrestrial environment)
 - **0.001 % total loss.**
- **Transportation has the highest emission potential.**
- Most processing emissions occur during **loading activities.**
- **Drainage systems** for stormwater are the major emission pathways!

Pathways into the environment

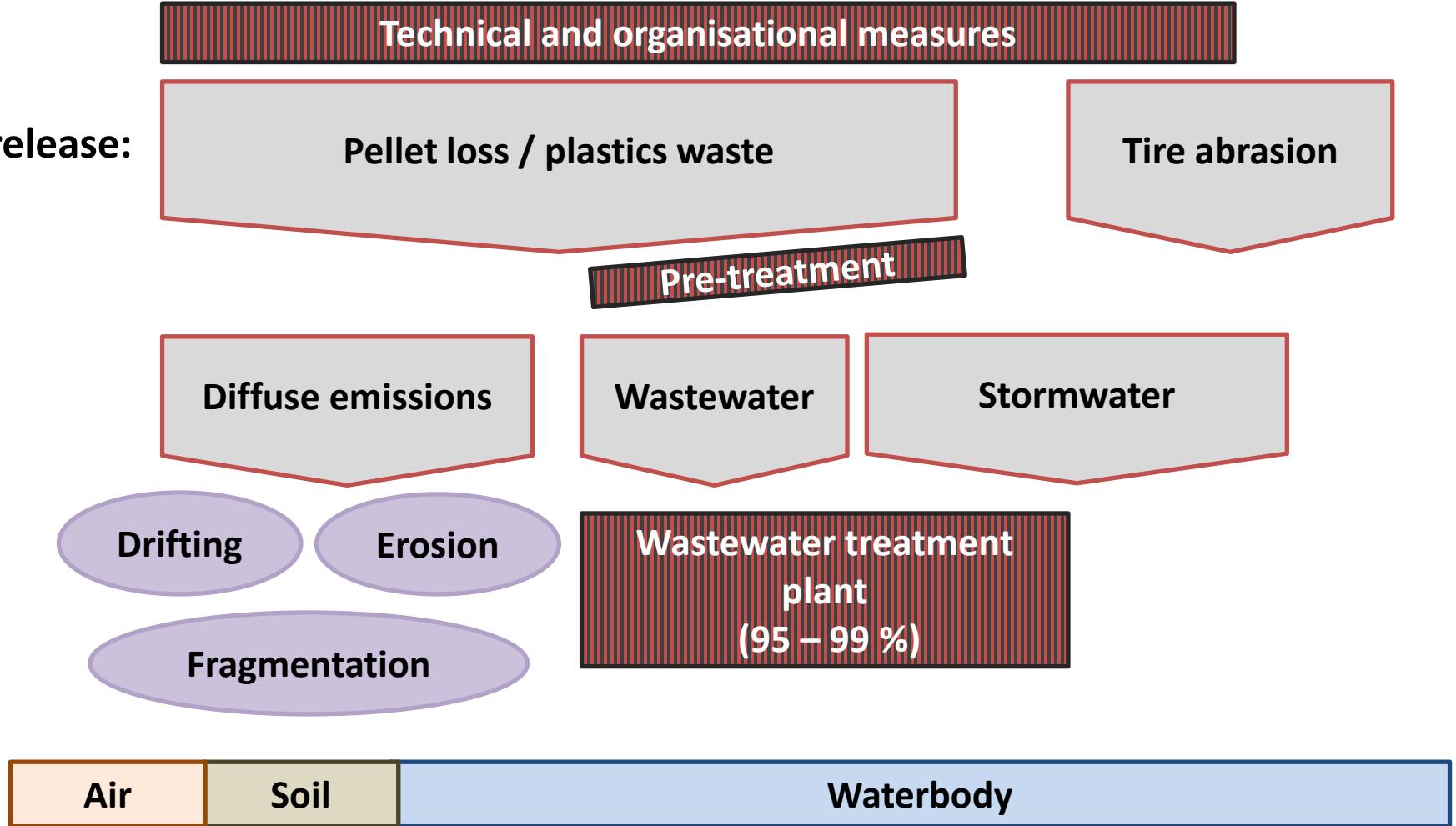
Representatives of industrial sites in the plastics industry on the type of stormwater disposal:



Mod. Barkmann et al. 2021: EmiStop final report (<https://bmbf-plastik.de/de/publikation/emistop-schlussbericht>)

Pathways into the environment

Unintentional release:



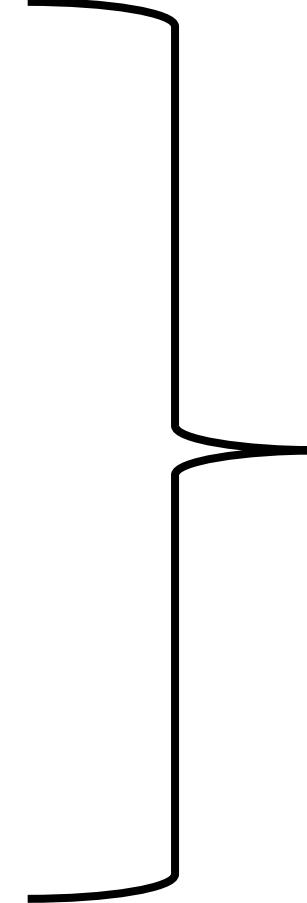
Reduction measures

Technical measures:

- **Approved and available technologies**
- Likely most effective
- Can be combined with wastewater treatment

Organisational measures:

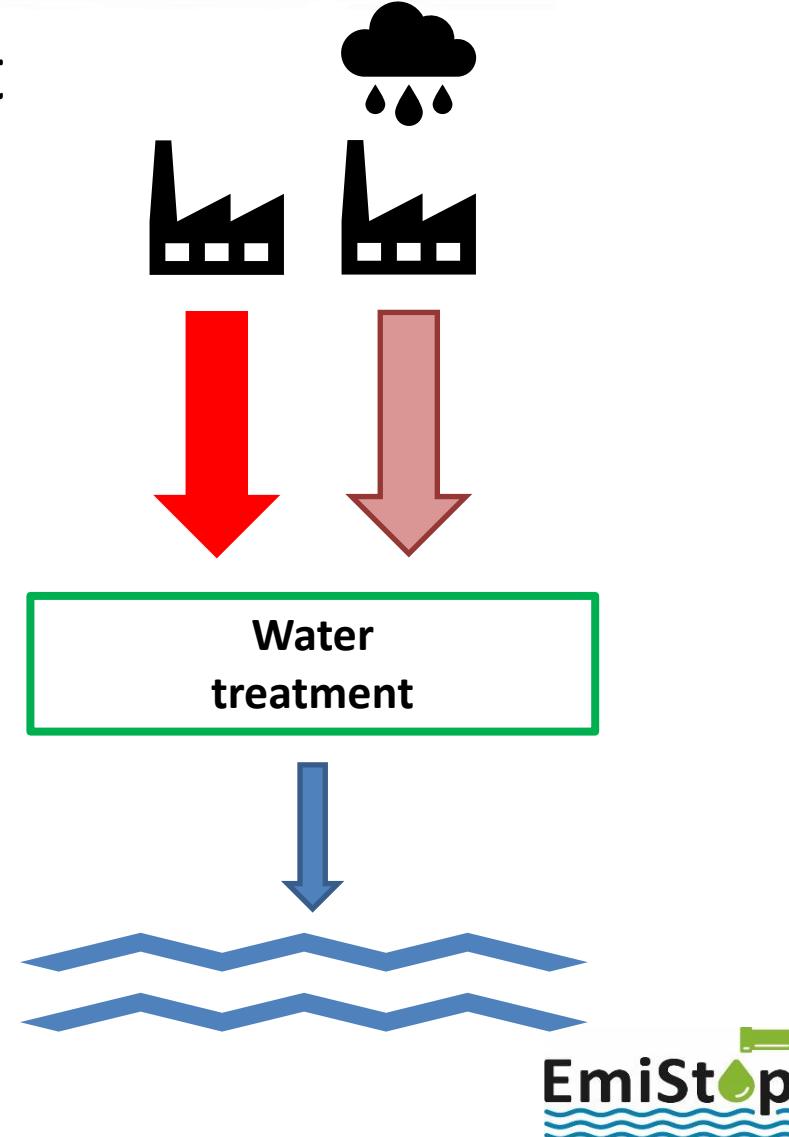
- Dependend on employee acceptance
- Monitoring
- Likely less effective
- Often single purpose solution



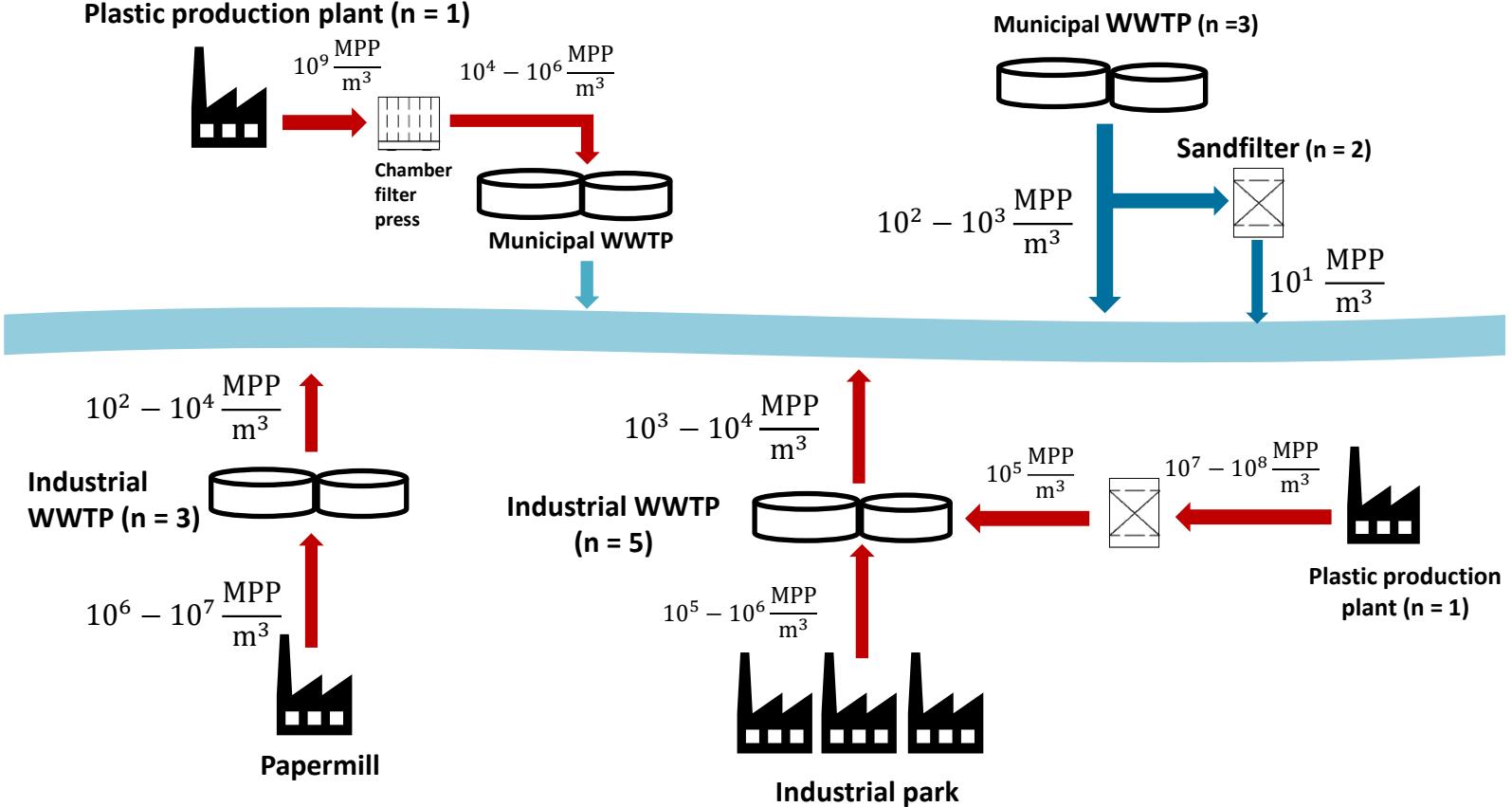
Best: combination of both

Reduction measures – examples

- Technical measures for wastewater treatment
 - Waste water pre-treatment (indirect discharge)
 - Sandfilter
 - Flotation
 - Chamber filter press
 - **Stormwater treatment**
 - **Stormwater discharge in industrial or municipal WWTPs**
 - Drain filters
 - Etc.



Status quo: Industrial microplastic emissions



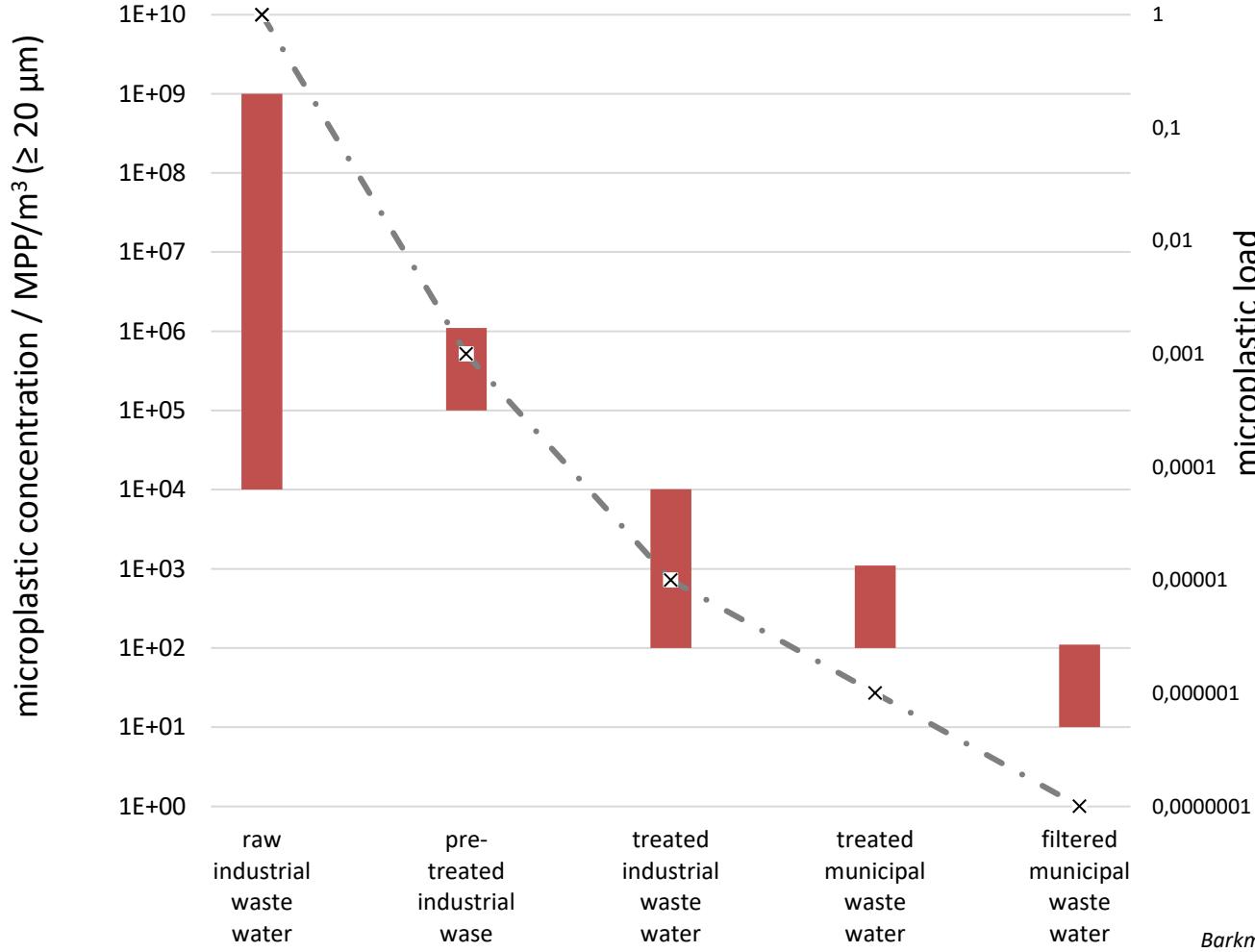
The only input pathway for industrial microplastic emissions that has been studied is via wastewater.

Barkmann et al. 2023 (Preprint DOI: 10.2139/ssrn.4348375)

Wolff et al. 2021 (DOI: 10.3390/w13010033)

Wolff et al. 2018 (10.1016/j.wroa.2018.100014)

Status quo: Industrial microplastic emissions



- Effluent concentration from industrial WWTP are **slightly higher** than from municipal WWTP.
 - Industrial WWTP eliminate up to **99.9 %**.
 - Industrial WWTP are **not** assumed to be „hot spots“ for microplastic emissions.
 - ~ 90 % of the microplastic particles in effluents are **< 50 μm** .
- **Industrial WWTP effluents do not contain pellets.**
- (small data base, further research is neccessary)

Reduction measures – examples

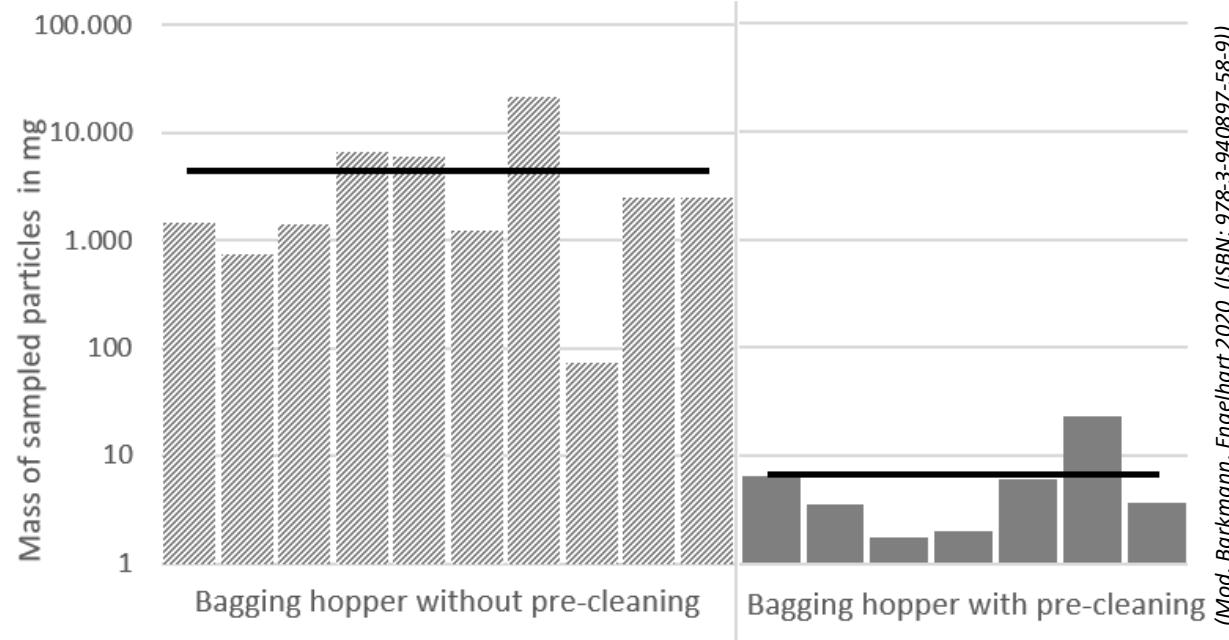
- Technical measures for emission reduction
 - Roofing of loading areas
 - Housing of storage areas
 - Improvement of packaging and storage



(Mod. Barkmann et al. 2021 (URN: urn:nbn:de:tuda-tuprints-202304))

Reduction measures

- Organisational measures
 - Employee training
 - Change of SOPs
 - Cleaning of vehicles (e.g. truck tires) and production equipment
 - Cleaning of production, storage and filling stations
 - Etc.



Conclusion

- **Stormwater** must be considered as the main emission pathway.
- In addition to **organisational** measures, **technical** measures should be implemented.
→ Especially wastewater treatment and **rainwater treatment**.
- There is a need for **further research** to obtain more reliable data on industrial microplastic emissions and pellet losses.



Further Literature

Bildquelle: AMB ENTERPRISE KARACHI

EmiStop

Industrielle Mikroplastikemissionen Handlungsempfehlungen

EmiStop • Projekt der BMBF Initiative: Mikroplastik in der Umwelt – Quellen, Serien, Lösungssätze

GEFÖRDERT VON:

- Bundesministerium für Bildung und Forschung
- FONA Förderung für nachhaltige Entwicklung BMF
- Plastik in der Umwelt

[DOI: 10.26083/tuprints-00020230](https://emistop.de/conferecereview.html)

Webkonferenz zum Nachhören

nächten wir Ihnen die Inhalte der Webkonferenz zur Verfügung stellen. Damit Sie genau das finden, was Ihnen interessiert, haben wir die Beiträge in Webinare von ca. 10–20 Minuten unterteilt, die sich den einzelnen Themenbereichen der Webkonferenz widmen:

Das EmiStop Projekt (9 Minuten):

- Wer sind die Referent:innen?
- Was ist das EmiStop-Projekt?
- Wer hat an der Webkonferenz teilgenommen?

Eintragspfade in die Umwelt (8 Minuten):

- In welcher Form und über welche Austragspfade gelangt Mikroplastik an Industriestandorten in die Umwelt?
- Was sind relevante Emissionsquellen?
- Für wie relevant schätzt die Kunststoffindustrie selbst die Problematik ein?

Probenahme und Analytik – Standards im Labor (7 Minuten):

- Welche Analyseansätze eignen sich für die Mikroplastik-Bestimmung?
- Was ist bei der Probenahme zu beachten?
- Wie unterscheiden sich Messmethoden?

Probenahme und Analytik – Einsatz im Unternehmen (18 Minuten):

<https://emistop.de/conferecereview.html>

SCHLUSSBERICHT | 02WPL1444A-E

Identifikation von industriellen Plastik-Emissionen mittels innovativer Nachweisverfahren und Technologieentwicklung zur Verhinderung des Umwelteintrags über den Abwasserpfad

EmiStop

The diagram shows industrial facilities at the top. Wastewater flows from these facilities through pipes into a central collection point. From there, it enters a 'water' treatment facility. A question mark above the pipe indicates the detection point for microplastics. Arrows show the flow from the industrial sites to the collection point, and from the collection point to the treatment facility.

gefördert von:

- Bundesministerium für Bildung und Forschung
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- Plastik in der Umwelt

<https://bmbf-plastik.de/de/publikation/emistop-schlussbericht>

water

Article

Elimination of Microplastics by Downstream Sand Filters in Wastewater Treatment

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DOI: 10.3390/w13010033

1 Quantification of Microplastics in Wastewater Systems of German Industrial Parks

3

4 Luisa Barkmann-Metaj^{1*}; Felix Weber²; Hajo Bitter³; Sebastian Wolff²; Susanne Lackner³; Jutta Kerpen²; Markus Engelhart¹

DOI: 10.2139/ssrn.4348375 (Pre-Print)