**Introduction**

This study analyzes the accumulation pattern and potential transfer of toxic substances on zebrafish (Danio rerio) gills and embryos via microplastic exposure. Until now, the main focus in microplastic research was set on microplastic abundance, behavior and ingestion by a wide range of aquatic organisms, as well as the absorbance and potential transfer of associated persistent organic pollutants (POPs) along with microplastic ingestion. Only very few studies included the accumulation and effects of microplastics other than by ingestion (Lu et al. 2016, Watts et al. 2014). In this study, two different sizes of fluorescently labelled polymers (1-5 and 10-20 µm) and the model substance benzo[a]pyrene (BaP) as representative for POPs were used to analyze the behavior, accumulation and POP transfer of microplastics on zebrafish (Danio rerio) gills and embryos with histological analyses, a Gill EROD assay (Jönsson et al. 2009) and fluorescence tracking (Batel et al. 2016).

**Microplastic accumulation and POP transfer on zebrafish gills**

Fluorescent 1.5 µm or 10-20 µm MPs

![Image](image1)

**Accumulation**

- MPs attached to gill filaments and mucus, not in surrounding tissues.
- Mucus and particles were excrated permanently.
- No difference between particles size and incubation time.

**POP transfer via MPs**

- There was a tendency in Gill EROD induction compared to negative control groups for BaP coated MPs.
- The fluorescence tracking of BaP also revealed a transfer of BaP from MPs to gills.

![Image](image2)

**Microplastic attachment and POP transfer on zebrafish eggs**

Fish embryo toxicity test (OECD 236)

![Image](image3)

**Fish Embryo Toxicity Test (OECD TG 236)**

- There were no morphological effects visible in embryos exposed to MPs coated with BaP from 0-96 hpf (semistatic).
- The 1-5 µm particles (proprietary polymer, 1.3 g/cc) adhered more in number to the chorion compared to the 10-20 µm (polyethylene, 0.99 g/cc).
- When embryos hatched, no particles were visible on outer epithelia.
- Waterborne BaP positive exposure groups showed severe effects, such as edema and tail deformations.

![Image](image4)

**Conclusion**

In this study, we analyzed the potential of microplastics to interfere with aquatic organisms other than by ingestion. We showed that microplastics are filtered in adult zebrafish gills and accumulate on zebrafish eggs. Furthermore, microplastics transferred associated benzo[a]pyrene (BaP) to zebrafish gills and eggs via simple attachment. BaP accumulated in gill arches and fatty tissues of zebrafish embryos upon exposure with BaP coated microplastics. Both Gill EROD assay in adult zebrafish and fluorescence tracking in zebrafish embryos revealed a higher signal in groups exposed to BaP coated microplastics compared to control groups, but always lower compared to waterborne BaP exposures. Further research should be conducted on exact MP and substance concentrations.

However, this study shows potential ‘modes of action’ and useful methods to detect effects of microplastics and associated POPs on fish gills and embryos.

**References and Literature**

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