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THE INVISIBLE PLASTICS PROBLEM: THE CASE OF POLYVINYLPIRROLIDONE



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Beyond microplastics: Water soluble synthetic polymers exert sublethal adverse effects in the freshwater cladoceran *Daphnia magna*

Simona Mondellini ^{a b}✉, Matthias Schott ^{a b}✉, Martin G.J. Löder ^{a b}✉,
Seema Agarwal ^c✉, Andreas Greiner ^c✉, Christian Laforsch ^{a b}✉

Unveiling the multilevel impact of four water-soluble polymers on *Daphnia magna*: From proteome to behaviour (a case study)

Lara Nigro ^a, Stefano Magni ^a✉, Marco Aldo Ortenzi ^b,
Stefano Gazzotti ^b, Camilla Della Torre ^a, Silvia Giorgia Signorini ^a,
Riccardo Sbarberi ^a, Andrea Binelli ^a



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Detection of polyvinylpyrrolidone in *Daphnia magna*: Development of a refractive index quantification method for water-soluble polymers in aquatic organisms

Eve C. Tarring ^a, Charlotte Robison-Smith ^b, Jo Cable ^b, Isabelle Durance ^b,
Michael Harbottle ^c, Benjamin D. Ward ^a✉

PVP toxicity and detection: What do we know?



Daphnia magna OECD 211 reproductive toxicity test

- ▶ Two different molecular weights tested; 40 kDa (**PVP40**) and 360 kDa (**PVP360**)
- ▶ **0.1 mg/L** (low level contamination detected polluting European rivers) – **21-day exposure**
- ▶ Serves as a model for the long-term effects of polyvinylpyrrolidone on reproductive health and population dynamics



Daphnia OECD 211

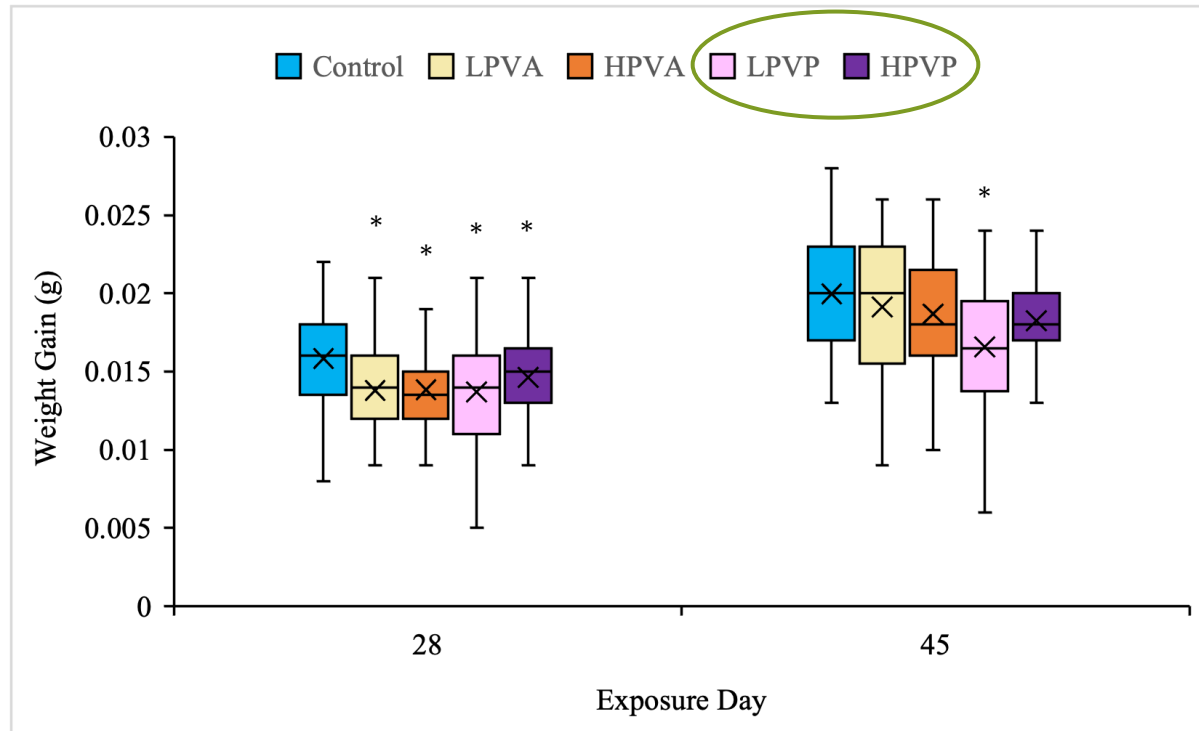
- ▶ No significant differences in the number of offspring produced between treatments – surviving adults
- ▶ PVP significantly increased mortality of *Daphnia magna*
- ▶ The first week of exposure saw 100% survival in controls, 47% in PVP40 and 87% in PVP360

A class of their own? Water-soluble polymer pollution impacting a freshwater host-pathogen system

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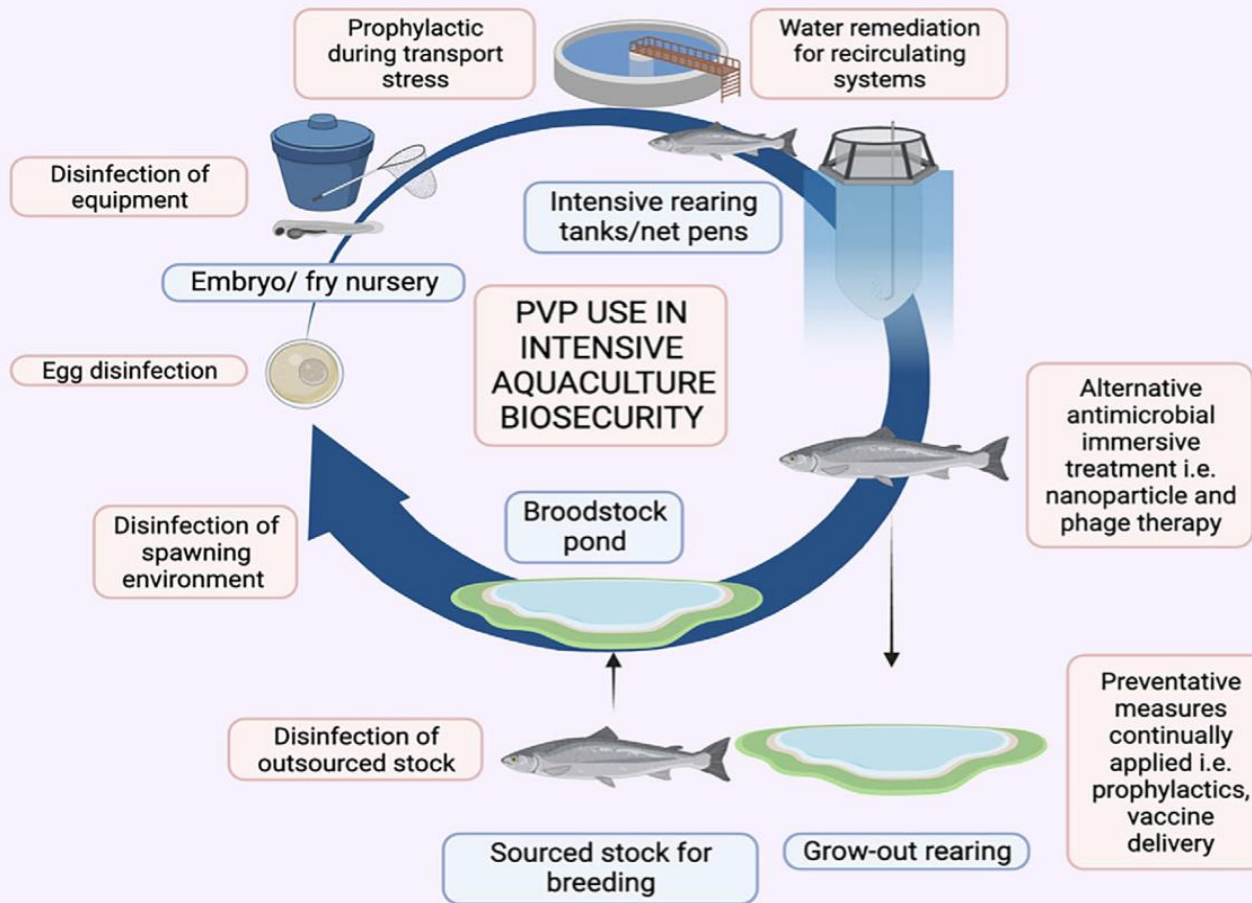


- PVP significantly reduced growth, altered metabolic function in guppies
- Increased mortality of *Gyrodactylus* (parasitic worm)



POLYVINYLPIRROLIDONE (PVP) USE IN AQUACULTURE

Polyvinylpyrrolidone (PVP) is a non-biodegradable soluble synthetic polymer heavily used within aquacultural biosecurity products



PVP is an emerging contaminant of freshwater ecosystems, has toxic effects on commercially important aquatic organisms and may be significantly inhibiting global aquaculture productivity

Robison-Smith, Charlotte and Cable, Jo 2024. *Reviews in Aquaculture*





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Summary: Low molecular weight PVP pollution may have significant impacts on freshwater invertebrate populations, future research to focus on the mode of toxicity

Thanks 😊



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