



A functional environmentally safe plastic, designed for the circular economy

Aquapak's Hydropol™ is a specially engineered material that can create a range of packaging products that are designed to eliminate plastic pollution at source

Hydropol & Pathogens

Plastics & Pathogens

The relatively recent public concern over plastics in the oceans, catalysed by David Attenborough's Blue Planet 2 programme, has triggered both a review of previous work and new research into the behaviour of plastics in the environment.

The fate of plastics in the environment is now a major concern with all the commonly used plastics, like polyethylene, now known to be persistent pollutants in their own right but are also a vector for the concentration of toxins.

All the plastics we are familiar with are hydrophobic (water-hating) materials. It is this property which greatly reduces their ability to biodegrade and enhances toxin accumulation.

Research has now identified another issue with these hydrophobic plastics. The method by which many microbes and pathogens adhere to surfaces, and their resistance to removal from the surface, is in many cases, enhanced if the plastic is hydrophobic.

There is an increasing body of evidence, some of which is listed below, which not only identifies pathogens on common plastics but indicates that their dwell time is much greater on hydrophobic surfaces in comparison to hydrophilic surfaces like Hydropol™.

The implications of these findings are arguably even more important given the situation which has arisen because of the Covid-19 pandemic, and the increased use of plastic-containing PPE. The potential impact of PPE, predominantly manufactured using common hydrophobic plastics, acting as a carrier for pathogens is a concern. Clearly whilst the adoption of enhanced cleaning of surfaces etc., or even in some cases the incorporation of anti-microbial systems in the matrix of the material is known to be helpful, there is a strong case to ensure the base materials do not add to the problem.



Testing of Hydropol Films

Testing of Hydropol 30164P (hydrophilic) and polyethylene (hydrophobic) film was carried out by Wickham Laboratories according to ISO 22196/00. Samples of each film were inoculated with E.Coli and S.Aureus before being placed in a sterile container. Inoculum counts were carried out at time 0 and 24hrs.

After 24hrs the inoculum counts on the Hydropol films were essentially the same as at the start of the test. On polyethylene film however, the average count was approximately doubled after 24hrs. This supports the differences suggested in the literature between pathogen dwell time on hydrophilic and hydrophobic plastics.

This small study is only intended to give an indication of the expected behaviour of Hydropol vs polyethylene.

References:

- Keswani, A & Quilliam, R.S. 2016. *Microbial Hitchhikers on marine plastic debris: Human exposure risks at bathing waters and beach environments*. Marine Environmental Research. **118** 10-19
- Kirstein, I.V et al. 2019. *The Plastisphere – Uncovering tightly attached plastic “specific” microorganisms*. <https://doi.org/10.1371/journal.pone.0215859>
- Krasowska, A & Sigler, K. 2014. *How microorganisms use hydrophobicity and what does this mean for human needs?* Frontiers in Cellular and Infection Microbiology. **4** 112
- Rummel, C.D. 2017. *Impacts of biofilm formation on the fate and potential effects of microplastic in the aquatic environment*. Environmental Science & Technology Letters. **4**. 258-267
- Yue Yuan et al. 2017. *Surface Characteristics influencing bacterial adhesion to polymeric substrates*. RSC Adv. **7** 14254-14261
- Peilin, J; Shiye, Z; Lixin, Z; Daoji, Li. 2018. *Microplastic-associated bacterial assemblages in the intertidal zone of the Yangtze Estuary*. Science of the Total Environment. **624**. 48-54
- Jacquin, J et al. 2019. *Microbial Ecotoxicology of Marine Plastic Debris: A review on colonisation and biodegradation by the “Plastisphere”*. Frontiers in Microbiology.
- Netherlands News. March 2019. New research studies on health risks of microplastics: do plastics make us ill?
- Wu, Y et al. 2019. *Colonisation of plastic pellets (nurdles) by E. coli at public bathing beaches*. Marine Pollution Bulletin. **139** 376-380
- Puglisi, E; Romaniello, F; Cocconcelli, S. 2019. *Selective bacterial colonization processes on polyethylene waste samples in an abandoned landfill site*. Scientific Reports. **9** 14138