# University of Stirling pioneers microplastic bead method to monitor wastewater pathogens in UK rivers



Scientists at the University of Stirling have unveiled an innovative method for monitoring pathogens in rivers contaminated by wastewater treatment plants (WWTPs). As the number of sewage discharges into UK water bodies is on the rise, studies indicate that effluent from these plants harbours harmful pathogens that pose significant risks to public health. The urgency for effective monitoring has grown, particularly as traditional methods, which largely involve random water sampling, may miss crucial pathogen detections due to their unpredictable release and the ever-changing nature of water systems.

In a departure from conventional water sampling techniques, researchers at Stirling have employed microplastic beads to create a more reliable pathogen surveillance system. These beads are submerged downstream from sewage discharge points, allowing them to capture pathogens like E. coli through biofilm formation on their surfaces. This method not only improves detection rates but is also an affordable and straightforward technique to implement.

According to Professor Richard Quilliam from Stirling’s Faculty of Natural Sciences, the rising rates of sewage discharge are leading to significant environmental contamination, thereby escalating risks to public health. He explained that conventional sampling techniques can leave gaps in pathogen detection, remarking, “As water sampling is a transient process, bacteria may be missed using this process.” By using microplastic beads, the researchers were able to gather more consistent data, measuring which bacterial pathogens adhered to the beads over prolonged periods.

Field studies conducted in Scotland revealed markedly higher concentrations of harmful bacteria downstream from WWTPs. Dr Luke Woodford, who led the study and reported findings in the journal Water Research, noted that this new technique functions effectively as a surveillance system, proving capable of detecting bacterial pathogens within a mere day of installation. Furthermore, genome sequencing of the bacteria collected from the microplastics indicated the presence of genes associated with antimicrobial resistance and heightened virulence, underscoring potential public health threats.

Research highlights that microplastics, while often viewed as waste, can serve as vectors for harmful bacteria, an issue prevalent in many wastewater treatment systems. A study found that while WWTPs successfully removed over 99% of microplastics from influent wastewater, the microbial communities that proliferated on these microplastic surfaces retained a substantial number of potentially pathogenic bacteria. This poses a dual problem: the persistence of microplastics in rivers and their ability to transport harmful pathogens through aquatic ecosystems.

Additionally, evidence suggests that WWTPs contribute significantly to microplastic pollution in rivers, with findings indicating that 80% of the rivers studied showed signs of contamination. Microplastics found in effluent often harbour more dangerous bacterial communities than those found in the natural river environment, which exacerbates the risks posed to both human health and ecological stability.

With sewage releases increasing in frequency and volume across the UK, innovative solutions for monitoring and reducing the impact of these discharges have become essential. The microplastic bead method developed at the University of Stirling offers an advanced, lower-cost alternative to existing monitoring strategies. As Dr Woodford concluded, such methodologies can enhance our understanding of water quality changes, a critical step towards addressing the pressing public health issues associated with wastewater pollution.

In sum, as the interplay between wastewater treatment practices and environmental health becomes more complex, there is an urgent need for improved management of both microplastics and pathogens. The research highlights an important avenue for future studies and potentially transformative practices within the field of environmental monitoring.

## Reference Map:

* Paragraph 1 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[6]](https://www.eurekalert.org/news-releases/577590)
* Paragraph 2 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[2]](https://www.sciencedirect.com/science/article/pii/S0043135420304260), [[3]](https://www.technologynetworks.com/applied-sciences/news/wastewater-treatment-fails-to-remove-pathogens-stuck-on-microplastics-393210)
* Paragraph 3 – [[4]](https://pubmed.ncbi.nlm.nih.gov/33406095/), [[5]](https://ehp.niehs.nih.gov/doi/10.1289/isee.2022.P-1257), [[7]](https://pubmed.ncbi.nlm.nih.gov/27508863/)
* Paragraph 4 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[3]](https://www.technologynetworks.com/applied-sciences/news/wastewater-treatment-fails-to-remove-pathogens-stuck-on-microplastics-393210), [[6]](https://www.eurekalert.org/news-releases/577590)
* Paragraph 5 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[2]](https://www.sciencedirect.com/science/article/pii/S0043135420304260), [[5]](https://ehp.niehs.nih.gov/doi/10.1289/isee.2022.P-1257)
* Paragraph 6 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[6]](https://www.eurekalert.org/news-releases/577590)
* Paragraph 7 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[7]](https://pubmed.ncbi.nlm.nih.gov/27508863/)

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## Bibliography

1. <https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers> - Please view link - unable to able to access data
2. <https://www.sciencedirect.com/science/article/pii/S0043135420304260> - This study investigates the presence of total coliform and Escherichia coli in microplastic biofilms grown in wastewater and their inactivation by peracetic acid. The research highlights the role of microplastics in harboring harmful bacteria, which can pose significant risks to human health and the environment. The findings suggest that microplastics can act as vectors for bacterial pathogens, emphasizing the need for effective wastewater treatment methods to address this issue.
3. <https://www.technologynetworks.com/applied-sciences/news/wastewater-treatment-fails-to-remove-pathogens-stuck-on-microplastics-393210> - Emerging research indicates that microplastics in wastewater can harbor harmful pathogens, including E. coli, Listeria monocytogenes, and Salmonella. These biofilm-covered microplastics, termed 'plastispheres,' can transport these pathogens through ecosystems, potentially entering the human food chain. The study underscores the limitations of current wastewater treatment processes in removing microplastics and associated pathogens, highlighting the need for improved management and innovative treatment technologies.
4. <https://pubmed.ncbi.nlm.nih.gov/33406095/> - This research examines how wastewater treatment plants (WWTPs) influence microbial colonization of microplastics. The study found that while WWTPs retained over 99% of influent microplastics in sludge, the microbial communities on these microplastics differed from those in the influent. Some potentially pathogenic bacteria remained abundant on effluent microplastics, suggesting that WWTPs can modify microplastic-associated bacterial assemblages, affecting their fate in the environment.
5. <https://ehp.niehs.nih.gov/doi/10.1289/isee.2022.P-1257> - This study investigates the abundance and occurrence of microplastics in a wastewater treatment plant in Bangladesh. The findings reveal that microplastics are present in both influent and effluent samples, with a decrease in concentration from influent to effluent. Despite the reduction, the study suggests that WWTPs may still contribute to the load of microplastics in receiving water bodies, emphasizing the need for effective treatment technologies to mitigate this issue.
6. <https://www.eurekalert.org/news-releases/577590> - Research indicates that wastewater treatment plants (WWTPs) are a significant source of microplastics in rivers, with 80% of the rivers studied showing contamination. The study also found that microplastics in effluent harbor bacterial communities more likely to be potentially harmful than those in the rivers. This highlights the need for improved wastewater treatment processes to address microplastic pollution and its associated risks to environmental and human health.
7. <https://pubmed.ncbi.nlm.nih.gov/27508863/> - This study examines the impact of wastewater treatment plant discharges on microplastic concentrations in surface water. The research found that microplastic concentrations significantly increased downstream of WWTPs, with smaller size classes being abundant across sampling sites. The study suggests that WWTPs may not effectively remove microplastics, allowing their release into freshwater environments and potentially affecting the fate and transport of microplastics in these ecosystems.