# University of Stirling pioneers microplastic beads to track sewage pathogens in UK rivers



Scientists at the University of Stirling have introduced an innovative method for monitoring pathogens in rivers contaminated by wastewater treatment plants (WWTPs). Amid increasing discharges from sewage networks across the UK, evidence indicates that effluent often contains harmful pathogens, which pose significant risks to public health. Traditional monitoring approaches, primarily reliant on sporadic water sampling, may overlook these pathogens due to the unpredictable nature of discharge events and the dynamic characteristics of receiving water bodies.

In response to these challenges, the team at Stirling has effectively harnessed microplastic beads as a monitoring tool. These beads are coated with biofilm, allowing bacteria to attach to their surfaces. By deploying these beads downstream of sewage effluent pipes, researchers can capture and assess the presence of various pathogens, including E. coli and Klebsiella spp. The methodology represents a significant advancement compared to existing sampling techniques, emphasising both cost-effectiveness and ease of application.

Professor Richard Quilliam from the Faculty of Natural Sciences at the University of Stirling has previously highlighted the alarming capacity of E. coli to latch onto microplastics, as noted in earlier studies discussing the transport of pathogens to coastal areas. He stated, “Wastewater treatment plants are releasing sewage effluent into the environment at an unprecedented rate in the UK, leading to environmental contamination and risks to public health.” Quilliam's work suggests that pathogens can endure and remain infectious as they transit through different environmental contexts, reinforcing the urgency of re-evaluating current environmental monitoring strategies.

Following this innovative approach, the research team deployed microplastic beads secured within small metal cages at multiple locations upstream and downstream of WWTP discharge points. Their analysis revealed a marked increase in pathogen concentrations downstream, establishing that the beads can act as a continuous surveillance system. Dr Luke Woodford, the lead author of the published study in the journal *Water Research*, noted that pathogens were detectable within merely 24 hours of placement. The microplastics persisted in revealing bacterial profiles for over three weeks, underscoring their effectiveness in monitoring environmental contamination.

Further genetic analysis of these pathogens uncovered concerning traits, such as antimicrobial resistance and virulence factors, elevating the public health risks associated with their presence in waterways. This study not only elucidates the pathogenic landscape downstream of sewage discharges but also advocates for the integration of more sophisticated surveillance techniques into environmental monitoring frameworks. As sewage discharges escalate in the UK, implementing systems like this could play a pivotal role in addressing these risks.

The fieldwork conducted between April and May 2024 marked a substantial step towards understanding the dynamics of pathogen release from wastewater systems, paving the way for enhanced strategies that can be adopted by environmental researchers and monitoring groups alike. As awareness increases around sewage pollution and its implications for public health, this research calls for a critical reassessment of regulatory frameworks governing wastewater management and microplastic pollutants.

The role of microplastics in pathogen transportation is gaining recognition, with prior studies from the University of Stirling revealing how these materials facilitate the survival of dangerous bacteria, including E. coli, during their journey from wastewater to recreational beaches. The implications of this research extend beyond immediate health concerns, shedding light on the necessity for legislative reforms aimed at minimising microplastic discharge into aquatic systems.

In conclusion, the University of Stirling's advancements in microplastic-based monitoring provide significant insights into the threats posed by wastewater contaminants. With the increasing severity of sewage-related pollution affecting waterways, the urgency for effective surveillance techniques has never been greater. As ongoing research continues to unravel the complexities of these interactions, a proactive approach will be essential in safeguarding public health against the oxidised realities of pollution.

## Reference Map:

* Paragraph 1 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[4]](https://www.stir.ac.uk/research/hub/publication/2116789)
* Paragraph 2 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[2]](https://www.stir.ac.uk/news/2023/april-2023-news/new-study-finds-that-microplastics-can-help-dangerous-bacteria-survive-on-scottish-beaches/), [[5]](https://www.stir.ac.uk/news/2022/june-2022-news/hitch-hiking-viruses-can-survive-on-microplastics-in-freshwater-new-study-finds/)
* Paragraph 3 – [[3]](https://www.stir.ac.uk/research/hub/publication/1869339), [[6]](https://www.stir.ac.uk/news/2024/february-2024-news/research-reveals-new-insights-into-marine-plastic-pollution/)
* Paragraph 4 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[5]](https://www.stir.ac.uk/news/2022/june-2022-news/hitch-hiking-viruses-can-survive-on-microplastics-in-freshwater-new-study-finds/)
* Paragraph 5 – [[2]](https://www.stir.ac.uk/news/2023/april-2023-news/new-study-finds-that-microplastics-can-help-dangerous-bacteria-survive-on-scottish-beaches/), [[3]](https://www.stir.ac.uk/research/hub/publication/1869339)
* Paragraph 6 – [[1]](https://smartwatermagazine.com/news/university-stirling/reserachers-develop-new-method-monitor-sewage-pollution-rivers), [[5]](https://www.stir.ac.uk/news/2022/june-2022-news/hitch-hiking-viruses-can-survive-on-microplastics-in-freshwater-new-study-finds/)

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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.stir.ac.uk/news/2023/april-2023-news/new-study-finds-that-microplastics-can-help-dangerous-bacteria-survive-on-scottish-beaches/> - In April 2023, researchers at the University of Stirling discovered that harmful bacteria, including E. coli, can survive the journey from sewage treatment plants to beaches by attaching to microplastics. This finding highlights the role of microplastics in transporting pathogens, increasing the risk of human exposure on beaches. The study emphasizes the need for increased public awareness and potential legislative changes regarding plastic discharge into the environment. The research was led by Rebecca Metcalf under the supervision of Professor Richard Quilliam. ([stir.ac.uk](https://www.stir.ac.uk/news/2023/april-2023-news/new-study-finds-that-microplastics-can-help-dangerous-bacteria-survive-on-scottish-beaches/?utm_source=openai))
3. <https://www.stir.ac.uk/research/hub/publication/1869339> - A 2023 study from the University of Stirling examined how human pathogens, such as E. coli, persist on microplastics during their transfer from wastewater discharge to beaches. The research found that these bacteria can survive and remain infectious on microplastics for extended periods, even after transitioning through various environmental matrices. This underscores the potential health risks associated with microplastic pollution and the necessity for updated regulations on wastewater discharge and microplastic management. ([stir.ac.uk](https://www.stir.ac.uk/research/hub/publication/1869339?utm_source=openai))
4. <https://www.stir.ac.uk/research/hub/publication/2116789> - In 2025, University of Stirling researchers developed a novel surveillance system using microplastic beads to monitor pathogenic bacteria in wastewater effluent. By deploying these beads upstream and downstream of wastewater treatment plant discharge points, the study detected viable E. coli, Klebsiella spp., Citrobacter spp., and Enterococcus spp. within 24 hours. The pathogens remained present as biofilm communities for over three weeks, with higher concentrations downstream, highlighting the effectiveness of this method in assessing environmental contamination. ([stir.ac.uk](https://www.stir.ac.uk/research/hub/publication/2116789?utm_source=openai))
5. <https://www.stir.ac.uk/news/2022/june-2022-news/hitch-hiking-viruses-can-survive-on-microplastics-in-freshwater-new-study-finds/> - A 2022 study led by the University of Stirling demonstrated that viruses, such as rotavirus, can survive and remain infectious by binding to microplastics in freshwater environments. The research found that rotavirus could persist for up to three days in lake water by attaching to microplastic surfaces. This discovery raises concerns about the potential impact of microplastic-associated viruses on human health, especially considering the widespread presence of microplastics in aquatic ecosystems. ([stir.ac.uk](https://www.stir.ac.uk/news/2022/june-2022-news/hitch-hiking-viruses-can-survive-on-microplastics-in-freshwater-new-study-finds/?utm_source=openai))
6. <https://www.stir.ac.uk/news/2024/february-2024-news/research-reveals-new-insights-into-marine-plastic-pollution/> - In February 2024, University of Stirling researchers uncovered new insights into marine plastic pollution by analysing the proteins in plastic samples from Gullane Beach, Scotland. The study identified enzymes actively involved in degrading plastic, highlighting the role of bacteria on plastic debris in the biodegradation process. This research offers valuable information for developing strategies to tackle plastic pollution and its environmental impact, particularly in colder climates. ([stir.ac.uk](https://www.stir.ac.uk/news/2024/february-2024-news/research-reveals-new-insights-into-marine-plastic-pollution/?utm_source=openai))
7. <https://plasticvectors.stir.ac.uk/publications/> - The Plastic Vectors project at the University of Stirling has published several peer-reviewed studies examining the role of microplastics in transporting human pathogens. Notable publications include research on the persistence of 'wet wipes' in beach sand as reservoirs for E. coli contamination, evidence of interspecific plasmid uptake by pathogenic strains of Klebsiella isolated from microplastic pollution on public beaches, and the survival of human pathogens bound to microplastics during transfer through the freshwater-marine continuum. These studies underscore the environmental and public health risks associated with microplastic pollution. ([plasticvectors.stir.ac.uk](https://plasticvectors.stir.ac.uk/publications/?utm_source=openai))