# Superbug Pseudomonas aeruginosa found to digest medical plastics, complicating infection control



Emerging research reveals a troubling development in the battle against hospital-associated infections. A strain of the notorious bacterium Pseudomonas aeruginosa, commonly identified as a "superbug," has shown the unexpected ability to digest certain medical plastics, specifically polycaprolactone (PCL). This biodegradable plastic is frequently used in sutures, stents, and surgical mesh due to its advantageous properties, such as flexibility and gradual dissolution within the body. Researchers from Brunel University London have shown that this microbe can not only degrade PCL but also utilise it as a nutrient source, thus complicating infection control in hospital environments.

This discovery challenges previously held assumptions surrounding the durability and inertness of clinical polymers against microbial attack. The researchers traced the plastic-digesting capability to a specific enzyme they named Pap1, which can significantly reduce PCL films in laboratory conditions. In effect, this microorganism transforms what was considered a passive material into a potential source of sustenance, allowing bacteria to thrive in settings where they might otherwise struggle.

Professor Ronan McCarthy, who spearheaded the research, stated, "It means we need to reconsider how pathogens exist in the hospital environment. Plastics, including plastic surfaces, could potentially be food for these bacteria." This indicates that the presence of such microorganisms could enhance their persistence in hospital settings, potentially leading to more severe and harder-to-treat infections.

The implications of this discovery extend well beyond plastic's decomposition; P. aeruginosa, once nourished by PCL particles, is likely to develop more resilient biofilms. These biofilms create a protective barrier that complicates treatment attempts, rendering conventional disinfectants and antibiotics less effective. Catheter-related urinary tract infections and ventilator-associated pneumonia, known for their challenging nature, could be exacerbated by such bacterial adaptations.

Furthermore, the examination of genetic databases allows the researchers to surmise that other types of plastics—such as polyurethane and polyethylene terephthalate, found in various medical devices—might also be candidates for microbial consumption. This hints at a larger scope of potential threats where medical equipment could not only become trappings for infection but also actively contribute to a pathogen's survival and proliferation.

In addressing these concerns, experts suggest rethinking the materials used in medical devices. Strategies may include designing polymers resistant to enzymatic breakdown or applying antibacterial coatings to device surfaces. In a related study, the application of enzyme multilayer coatings was shown to significantly curb biofilm formation on urinary catheters, demonstrating a promising approach to enhancing patient safety.

Moreover, enhancing hospital surveillance protocols could involve actively screening for plastic-degrading enzymes in microbial isolates to help identify outbreak sources that standard practices may overlook. The urgency for these adaptations is underscored by the World Health Organization’s identification of Pseudomonas aeruginosa as a critical pathogen in need of new therapeutic options, evidencing the considerable public health risk posed by this superbug.

As researchers prepare for future studies to track the genetic mutations associated with this plastic-digesting ability, they will also investigate its impact on the integrity of implanted devices and the potential release of harmful inflammatory by-products during digestion. It is a stark reminder of how the very materials designed for healing may unwittingly be providing a feast for the pathogens we seek to defeat.

The study's findings urge a significant paradigm shift in how medical professionals view and manage infections related to plastic components in hospitals. As McCarthy aptly noted, “Plastic is everywhere in modern medicine, and it turns out some pathogens have adapted to degrade it, and we need to understand the impact this has on patient safety." This concept not only affects hospitals but also calls for a more comprehensive evaluation of how materials in medical devices are designed, constructed, and maintained, as the stakes in patient care continue to rise.

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## Bibliography

1. <https://www.earth.com/news/hospital-superbugs-devour-medical-plastics-boosting-infection-risks/> - Please view link - unable to able to access data
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10380251/> - This review discusses the formation of bacterial biofilms on medical devices, emphasizing the resistance mechanisms that make infections persistent. It introduces two main strategies for preventing and treating biofilm-related infections: antibacterial coatings and surface modification of biomaterials. Antibacterial coatings involve the immobilization of antimicrobial agents on device surfaces, while surface modification alters the physical and chemical properties of the material to prevent bacterial adhesion. The article analyzes the advantages, biocompatibility, limitations, and application prospects of each strategy, providing insights for developing novel biofilm infection treatments related to therapeutic materials.
3. <https://link.springer.com/article/10.1007/s00253-015-6378-7> - This study investigates the use of enzyme multilayer coatings to inhibit biofilm formation by Pseudomonas aeruginosa on urinary catheters. The researchers applied Psl-specific glycoside hydrolase (PslG\_h) to the catheter surfaces, demonstrating a significant reduction in bacterial colonization and biofilm formation in vitro and in vivo. The findings suggest that surface-bound enzymes can effectively prevent biofilm-related infections, offering a promising approach to enhance the longevity and safety of medical devices.
4. <https://bmcmicrobiol.biomedcentral.com/articles/10.1186/s12866-018-1224-6> - This research presents a real-time monitoring system for observing biofilm formation by Pseudomonas aeruginosa on endotracheal tubes in vitro. Utilizing a bioluminescent strain of P. aeruginosa, the study provides dynamic information on the development of microbial communities on medical devices. The model offers valuable insights for evaluating the effectiveness of new antimicrobial agents and novel biomaterials, potentially aiding in the design and manufacturing of innovative medical devices to combat biofilm-associated infections.
5. <https://www.mdpi.com/1422-0067/21/22/8671> - This article explores the biofilm formation of Pseudomonas aeruginosa, a model organism for studying bacterial biofilms. It discusses the composition and structure of the biofilm, highlighting the role of exopolysaccharides (alginate, Psl, and Pel) and extracellular DNA (eDNA) in biofilm architecture. The study emphasizes the significance of biofilm formation in the pathogenicity of P. aeruginosa and its resistance to antimicrobial treatments, underscoring the need for effective strategies to manage, prevent, and eradicate biofilm-associated infections.
6. <https://journals.asm.org/doi/full/10.1128/aem.00637-11> - This research investigates the role of exopolysaccharides in the biofilm formation and architecture of Pseudomonas aeruginosa. By generating mutants deficient in the production of alginate, Psl, and Pel, the study examines how these polysaccharides interactively contribute to biofilm formation. The findings reveal that each exopolysaccharide plays a distinct role in biofilm development, with alginate being crucial for cell viability within the biofilm, Psl influencing attachment, and Pel affecting biofilm cell density and compactness. The study provides insights into the complex mechanisms underlying biofilm formation in P. aeruginosa.
7. <https://www.mdpi.com/2673-8449/1/3/19> - This article discusses the significance of biofilm formation by Pseudomonas aeruginosa on medical devices and its implications for pathogenicity. It highlights the resistance mechanisms of biofilm-encapsulated bacteria, which make them approximately 1000 times more resistant to antibiotics compared to planktonic cells. The study underscores the challenges posed by biofilm-associated infections in medical and industrial settings and emphasizes the need for effective strategies to control biofilm formation to prevent complications and improve patient outcomes.