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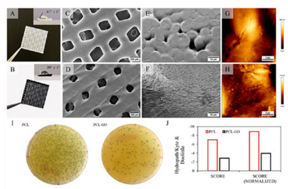
Polycaprolactone graphene oxide composite enables time-controlled hydrophobicity and can be sterilized with infrared radiation.



With the advent of 3D printing, it is easier than ever to build products with customizable features and materials. For instance, 3D printing can improve applications in medical scaffolding such as aiding wound closures, facilitating bone repair, and augmenting drug delivery systems. However, biomacromolecules can accumulate and grow on these devices in a process called biofouling, which can deteriorate the scaffold and harm the patient.

Friggeri et al. developed a 3D printed bioscaffold from a polycaprolactone graphene oxide composite (PCL-GO) that reduces bacteria growth, enables control over cell distribution, and exhibits time-controlled hydrophilicity.

The PCL, a biodegradable polyester, provides the base due to its low toxicity, biocompatibility, and easy printing capabilities.

Initially, the added GO limits biofouling due to its initial hydrophobic properties. Once implanted, repeated exposure to biological fluids increases hydrophilicity, enabling increased cell adhesion and facilitating tissue regeneration. The GO also absorbs infrared radiation, which can also be exploited to sterilize the scaffold after implantation.

In cell culture tests, the team demonstrated the 3D-printed device's efficacy and customizability through altered scaffold parameters.

"The scaffold demonstrated significant reductions in bacterial adhesion (~81% for E. coli and ~69% for S. aureus) and showed improved mechanical properties due to GO," said author Massimiliano Papi.

With minimized inflection risk and ability to support tissue regeneration, this 3D printed bioscaffold is a promising candidate for surgical implants.

"The scaffold can be used in various medical applications, including tissue engineering, wound healing, and potentially in microfluidics," said Papi. "We want to highlight the scaffold's potential in creating confined cell areas for experiments."

Source: "Multifunctional scaffolds for biomedical applications: Crafting versatile solutions with polycaprolactone enriched by graphene oxide," by G. Friggeri, I. Moretti, F. Amato, A. G. Marrani, F. Sciandra, S. G. Colombarolli, A. Vitali, S. Viscuso, A. Augello, L. Cui, G. Perini, M. De Spirito, M. Papi, and V. Palmieri, *APL Bioengineering* (2024). The article can be accessed at https://doi.org/10.1063/5.0184933.