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IPN Researchers Develop Customized Dermal Patches for Hard-to-Treat Wounds

- Engineered at UPIITA, these innovative patches address injuries caused by natural disasters where hospital infrastructure is scarce, as well as chronic wounds in diabetic patients.
- On a societal level, the initiative seeks to bring low-cost, high-tech healthcare solutions to underserved populations through technology transfer and public health partnerships.

To address the urgent need for specialized wound care in remote communities and disaster zones—particularly for patients with diabetic foot ulcers—Instituto Politécnico Nacional (IPN) researcher Yunia Verónica García Tejeda is developing customized nanocomposite dermal patches engineered to adapt to the specific clinical needs of each patient.

Led by the scientist and professor from the Interdisciplinary Professional Unit of Engineering and Advanced Technologies (Unidad Profesional Interdisciplinaria de Ingeniería y Tecnologías Avanzadas, UPIITA), the initiative focuses on treating injuries in regions with limited hospital access and scarce medical supplies following landslides, floods, and hurricanes. It also serves individuals with diagnosed or undiagnosed diabetes living in isolated areas who face severe wound-healing complications.

With this development, the IPN reaffirms its commitment to placing science and technology at the service of society to enhance public well-being, aligning with national educational and scientific priorities championed by President Claudia Sheinbaum Pardo and supported by Education Secretary Mario Delgado Carrillo.

Dr. García Tejeda and her research team formulate the patches using tissue-regenerating biopolymers and targeted antimicrobial agents. Experimental trials demonstrated a 12-day full healing timeframe compared to 16 days with conventional antibiotic control treatments—a landmark result that strongly supports the project's progression toward clinical stages.

Beyond creating novel wound dressings, Dr. García Tejeda and her team aim to deliver this technology to underserved populations through technology transfer and strategic





healthcare partnerships. By utilizing low-cost, highly adaptable, and safe materials, the project seeks to prevent severe complications, lower amputation rates, and improve emergency wound care across isolated regions.

The project is conducted in collaboration with researchers from IPN's Center for Genomic Biotechnology (Centro de Biotecnología Genómica, CBG) and specialists affiliated with the Hebrew University of Jerusalem, as ongoing interdisciplinary studies evaluate its biosafety and clinical applications.

A Level I member of Mexico's National System of Researchers and Research Fellows (Sistema Nacional de Investigadoras e Investigadores, SNII), Dr. García Tejeda explained that one of the primary medical challenges is combating antibiotic-resistant bacterial infections. Consequently, the Polytechnic team is studying functionalized nanomaterials—such as metal oxides—that inhibit bacterial proliferation while reinforcing skin regeneration matrices.

The Polytechnic expert noted that the patches also incorporate predatory bacteria capable of selectively targeting and destroying common pathogens such as *Escherichia coli* and *Staphylococcus aureus*. A hallmark of the proposal is its capacity for point-of-care manufacturing via a compact, semi-automated nanocomposite fabrication system—engineered by UPIITA students—capable of producing bio-films with tailored thickness and chemical properties on demand.

This portable setup will allow emergency relief teams to transport compact equipment and raw materials directly to disaster areas to craft customized patches based on a wound's precise dimensions and clinical state. The system also enables the production of specialized hydrogels, which are ideal for open injuries requiring continuous exudate drainage while minimizing infection risks, she highlighted.

This level of personalization is critical for diabetic patients, who require thorough clinical evaluation prior to intervention. Identifying underlying conditions such as diabetes, hypertension, or known drug allergies allows medical personnel to select specific materials and active pharmaceutical ingredients tailored to each individual, replacing the traditional one-size-fits-all approach to wound care.

For more information, visit www.ipn.mx

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