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Innovation Infosheet

Triboelectric Nanogenerators Derived from Natural Materials as Sustainable Power Sources

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- Biomedical Engineering
- Electrical Engineering

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- Biomechanical Engineering
- Biomedical Engineering
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- Implants

Emerging implantable devices demand appropriate power sources that can sustainably operate with minimal intervention. Currently, powering electronics relies on batteries; however, replacing batteries is difficult and expensive, especially for implantable devices. Moreover, materials used for batteries impose health and environmental hazards. Self-powered devices that can harvest energy from its environment, i.e., human body, holds promise for addressing this issue. Mechanical energy is ubiquitous and abundant for powering the sustainable operation of implanted medical devices. Triboelectric nanogenerators (TENGs) have emerged as a promising technology for converting biomechanical energy into electricity. However, materials synthesis in TENG often involves expensive and elaborate processing and the materials are usually not biocompatible or degradable, presenting challenges for successful implementation of TENG in low-cost medical relevant applications.

Researchers at Purdue University have developed novel lower-cost, biodegradable, and flexible triboelectric generators (TEGs) based on chitosan derived from crab shells or shrimp, which are currently disposed of in a landfill or the sea by the food processing industry, but could become a byproduct. Tunable electrical outputs were achieved by either mixing the chitosan with other natural materials, such as starch and lignin, or through laser processing. Laser treatment of biopolymer films with increased surface roughness offers a new way for surface engineering. The chitosan-based TEGs present efficient energy conversion performance and tunable degradation rate. The new class of TEGs derived from natural materials may pave the way towards the economically viable production of flexible TEGs for self-powered nanosystems in biomedical and environmental applications.

Advantages:
-Lower cost
-Biodegradable

-Self-powered

Potential Applications:
-Self-powered nanosystems in biomedical and environment applications
-Implantable devices
-Wearable electronics

People:

- Wu, Wenzhuo (Project leader)
- Wang, Ruoxing

Intellectual Property:

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Contact OTC:

Purdue Office of Technology Commercialization
The Convergence Center
101 Foundry Drive, Suite 2500
West Lafayette, IN 47906

Phone: (765) 588-3475
Fax: (765) 463-3486
Email: otcip@prf.org