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Lignin Biopolymer based Triboelectric Nanogenerators

A new triboelectric nanogenerator utilizes abundant, low-cost lignin waste to create economically feasible, eco-friendly, self-powered electronic devices for energy and biomedical applications.

Lignin, despite being the second most abundant biopolymer on earth, has few practical applications and has a very small market value. Water insoluble Kraft lignin is the most abundant side product produced by the pulp and paper industry at 50 to 100 million tons per year, most of which is burned as cheap fuel. Current applications of lignin are scarce, using only 2 to 5 percent of all lignin produced. Characteristics of lignin, including antioxidant, naturally degradable, biocompatible, and lacking in cytotoxicity, offer its potential use as a constituent in biomedical devices. The disparity in structure and surface properties make it finely tunable for controlled degradation, which is desirable in implanted devices. There remains a need to develop new lignin biopolymers and explore the new utilities of such lignin biopolymers.

Researchers at Purdue University have developed a lignin biopolymer based triboelectric nanogenerator (TENG) for harvesting mechanical energy in the environment. Most TENG research focuses on increasing power generation, but economical and eco-friendly obstacles continue to prevail. Lignin offers a valuable opportunity for low-cost TENG applications in self-powered biomedical devices, benefitting from its biodegradability and biocompatibility. In addition to self-powered biomedical devices, this technology presents an opportunity for the development of new technologies that utilize otherwise wasted materials for economically feasible and ecologically friendly production of functional devices in energy, electronics, and sensor applications.

Advantages:

-Utilizes otherwise wasted material

-Economically feasible

Technology ID

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Category

Energy & Power Systems/Power Generation

Materials Science & Nanotechnology/Nanomaterials & Nanostructures

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-Ecologically friendly

-Relatively high power density

Potential Applications:

-Self-powered biomedical devices

-Wearable and implantable electronic devices

-Functional devices in energy, electronics and sensor applications

TRL: 5

Intellectual Property:

Provisional-Patent, 2017-05-31, United States | Utility Patent, 2018-05-08, United States

Keywords: Lignin biopolymer, triboelectric nanogenerator, TENG, self-powered biomedical devices, mechanical energy harvesting, biodegradable, biocompatible, low-cost electronics, waste material utilization, energy devices