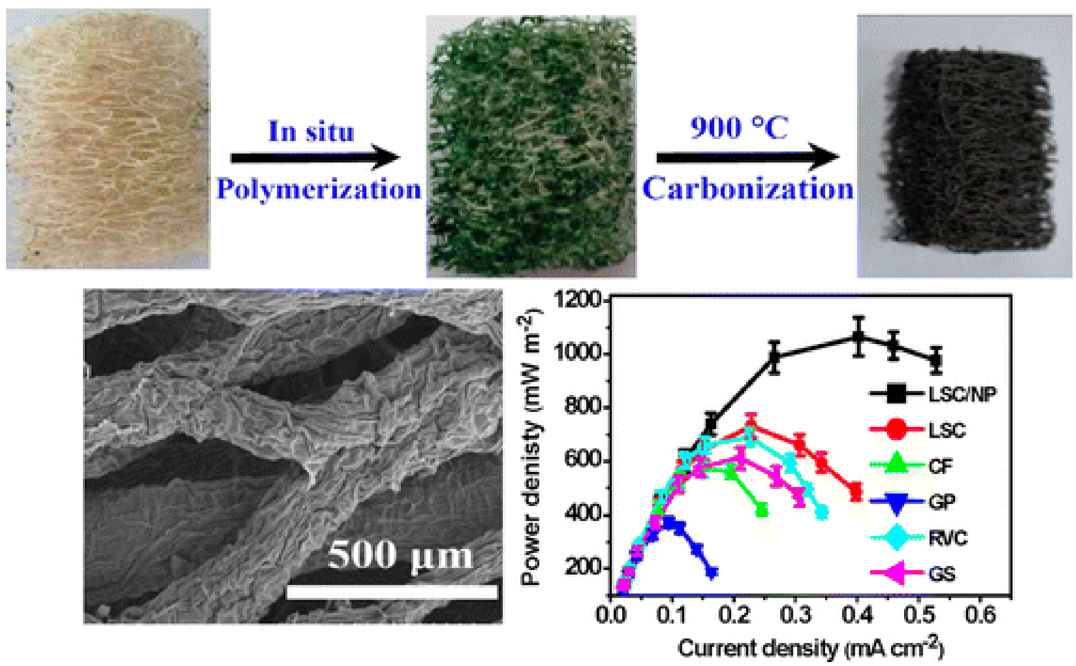
Turning waste into power with bacteria—and loofahs

December 4 2013



Loofahs, best known for their use in exfoliating skin to soft, radiant perfection, have emerged as a new potential tool to advance sustainability efforts on two fronts at the same time: energy and waste. The study describes the pairing of loofahs with bacteria to create a power-generating microbial fuel cell (MFC) and appears in the ACS journal *Environmental Science & Technology*.

Shungui Zhou and colleagues note that MFCs, which harness the ability of some bacteria to convert waste into electric power, could help address both the world's growing waste problem and its need for clean power. Current MFC devices can be expensive and complicated to make. In addition, the holes, or pores, in the cells' electrodes are often too small for bacteria to spread out in. Recently, researchers have turned to plant materials as a low-cost alternative, but pore size has still been an issue. Loofahs, which come from the fully ripened fruit of loofah plants, are commonly used as bathing sponges. They have very large pores, yet are still inexpensive. That's why Zhou's team decided to investigate their potential use in MFCs.

When the scientists put nitrogen-enriched carbon nanoparticles on loofahs and loaded them with bacteria, the resulting MFC performed better than traditional MFCs. "This study introduces a promising method for the fabrication of high-performance anodes from low-cost, sustainable natural materials," the researchers state.

More information: "Nanostructured Macroporous Bioanode Based on Polyaniline-Modified Natural Loofah Sponge for High-Performance Microbial Fuel Cells" *Environ. Sci. Technol.,* Article ASAP. DOI: 10.1021/es404163g

Abstract
Microbial fuel cells (MFCs) are a promising technology to recover electrical energy from different types of waste. However, the power density of MFCs for practical applications is limited by the anode performance, mainly resulting from low bacterial loading capacity and low extracellular electron transfer (EET) efficiency. In this study, an open three-dimensional (3D) structured electrode was fabricated using a natural loofah sponge as the precursor material. The loofah sponge was directly converted into a continuous 3D macroporous carbon material via a simple carbonization procedure. The loofah sponge carbon (LSC) was

decorated with nitrogen-enriched carbon nanoparticles by cocarbonizing polyaniline-hybridized loofah sponges to improve their microscopic structures. The macroscale porous structure of the LSCs greatly increased the bacterial loading capacity. The microscale coating of carbon nanoparticles favored EET due to the enhanced interaction between the bacteria and the anode. By using a single-chamber MFC equipped with the fabricated anode, a power density of 1090 ± 72 mW m–2 was achieved, which is much greater than that obtained by similarly sized traditional 3D anodes. This study introduces a promising method for the fabrication of high-performance anodes from low-cost, sustainable natural materials.

Provided by American Chemical Society

Citation: Turning waste into power with bacteria—and loofahs (2013, December 4) retrieved 10 April 2024 from https://phys.org/news/2013-12-power-bacteriaand-loofahs.html