MICROBIAL FUEL CELLS

Effects of scale-up

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Microbial fuel cells (MFCs) offer a sustainable means of producing electricity by using microbes to oxidize biodegradable organic molecules. As with many other emerging energy technologies, scaling up MFCs is a major challenge, which is rooted in gaps between laboratory-scale setups and those in real applications. In general, smaller electrodes and more idealized test conditions lead to better MFC performance. For example, laboratory studies are often conducted with highly concentrated acetate as a fuel rather than actual dilute organic complexes in real wastewater. Many studies also focus on static conditions instead of continuous flow of fuels. Now, Bruce Logan and colleagues in the United States investigate the effect on MFC performance of some key design and operational parameters, including the size of the anodes and the flow mode over them.

The researchers use fresh wastewater as the fuel in their MFCs, which have a volume of 85 l and consist of cathodes with a large exposed area of 0.62 m^2. Two different brush-type anodes, with diameters of 2.5 or 5.1 cm, are used. They also test two different fuel flow paths, along either a diagonal or a parallel direction in the anodic chamber. The researchers find that compared with that under static conditions, flow along the diagonal path increases the device power density by 5–17% depending on the hydraulic residence time, which they attribute to the reduced anodic overpotentials. In contrast, downsizing the diameter of anodes from 5.1 to 2.5 cm decreases the power density by 18%. This lowered power output is, however, probably due to cathode fouling, as there is no noticeable change in the anode performance.

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