Electricity Generation from Heavy Metal-Containing Wheat Grain Hydrolysate Using Single-Chamber Microbial Fuel Cells: Performance and Long-Term Stability

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In this study, heavy metal-containing wheat grain (HMWG) hydrolysate was explored as a potential fuel in membrane-less single chamber microbial fuel cells (MFCs) for electricity production. The maximum coulombic efficiency got up to 15.7%, and the corresponding removal rate of chemical oxygen demand was 83.4%. A maximum power density of 381 mW/m² was achieved with relatively low concentration of the HMWG hydrolysate, but high concentration of the HMWG hydrolysate restrained the electricity production in a MFC, especially after long-terms of operation. The results of electrochemical analysis and scanning electron microscope proved that the decreased performance in electricity generation was mainly ascribed to the declined electrocatalytic activities of the MFC anode and the attenuated microorganisms on its surface. The present work demonstrates that attention should be paid to the toxicity of heavy metals in energy recovery from heavy metal-containing organic wastes by MFCs.

Keywords: Microbial fuel cell; Heavy metal; Organic waste; Electricity generation; Long-term stability

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