Direct electrochemistry and electrocatalytic mechanism of evolved *Escherichia coli* cells in microbial fuel cells

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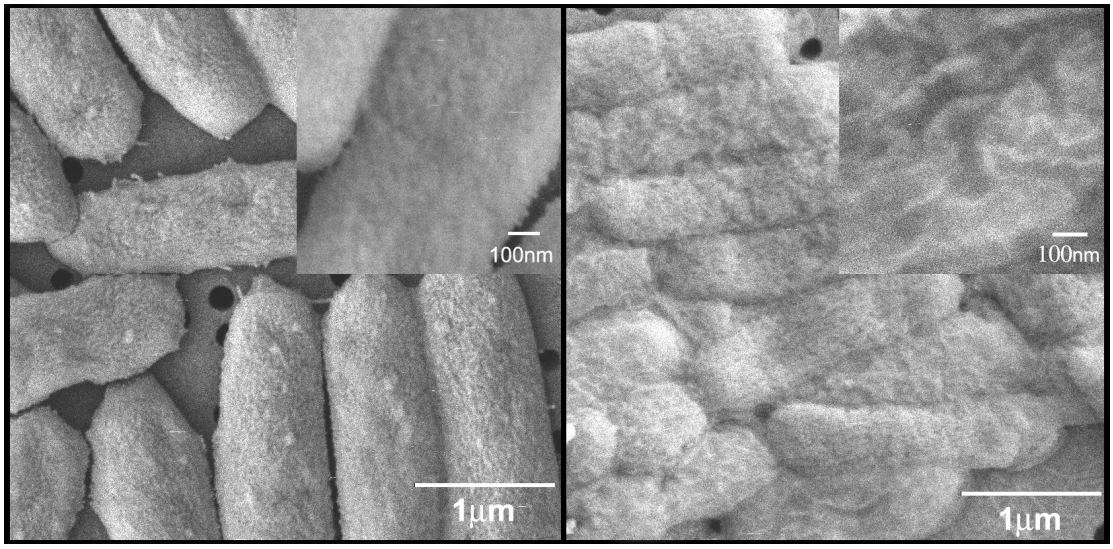
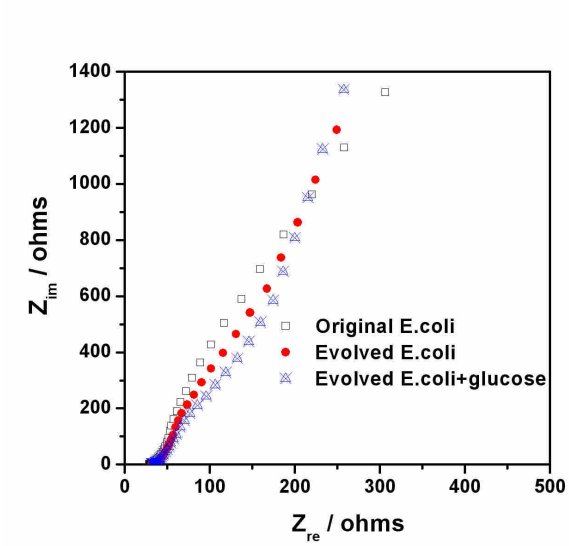
A. SEM micrograph of original and evolved *E. coli* cells



The morphologies of original (left) and evolved (right) E. coli cells were observed with FESEM (JEOL 6700, Japan). The insets are micrographs with high resolution. The evolved cells have much rougher surface than original cells. This phenomenon is in accordance with the result of AFM observation.

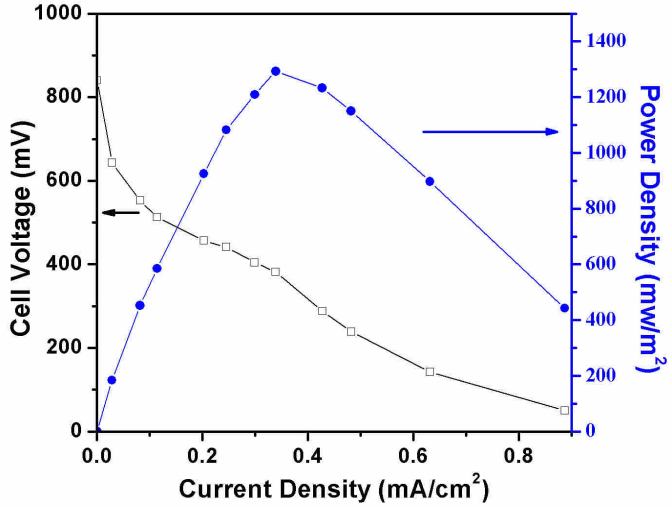
B. Electrochemical impedance spectra



Electrochemical impedance spectra measurements were performed over a frequency range of 0.5Hz to 100 kHz at open circuit potential with a perturbation signal of 10 mV. The Nyquist plots

of both E. coli cells represent frequency-dependent semicircle impedance curves. The charge transfer rate at the electrode/electrolyte interface is equal to the diameter of semicircle thus the evolved cells have faster charge transfer rate than original cells. The reason is that the exerted mediators of evolved cells facilitate the electron transfer between cells and electrodes. Addition of glucose increases the charge transfer rate suggests that hydroquinone derivates would have more rapid redox reaction with high concentration of electron donors.

C. Power output of mediator-less MFC



The power output of the mediator-less MFC with evolved E .coli cells as biocatalyst were examined with various resistances. The open-circuit potential is 830 mV and the maximum power density is 1300 mW/m^2, corresponding to a current density of 3390 mA/m^2 at a cell potential of 340 mV.