A completely anoxic microbial fuel cell using a photo-biocathode for cathodic carbon dioxide reduction

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Supplementary Material (ESI)

1 Experimental

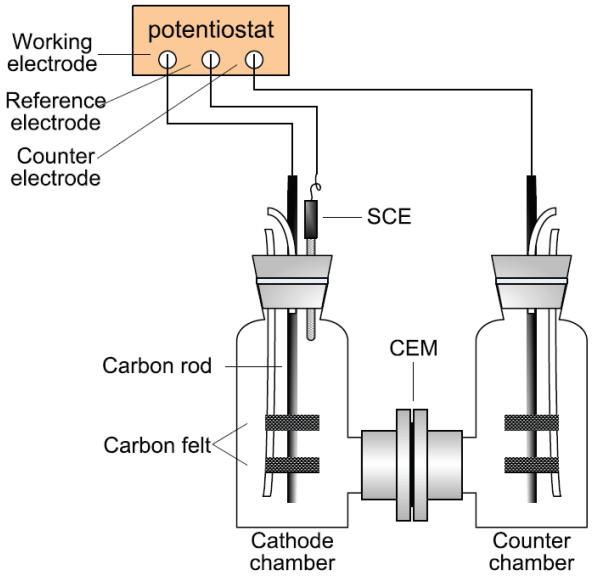

Fig. S1. Illustration of the MFC during poised potential mode

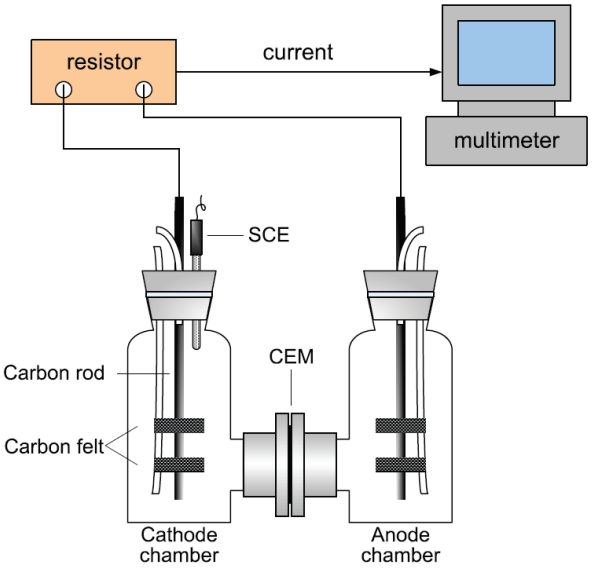

Fig. S2. Illustration of the MFC during fuel-cell mode

2 Proposed electron transfer pathway

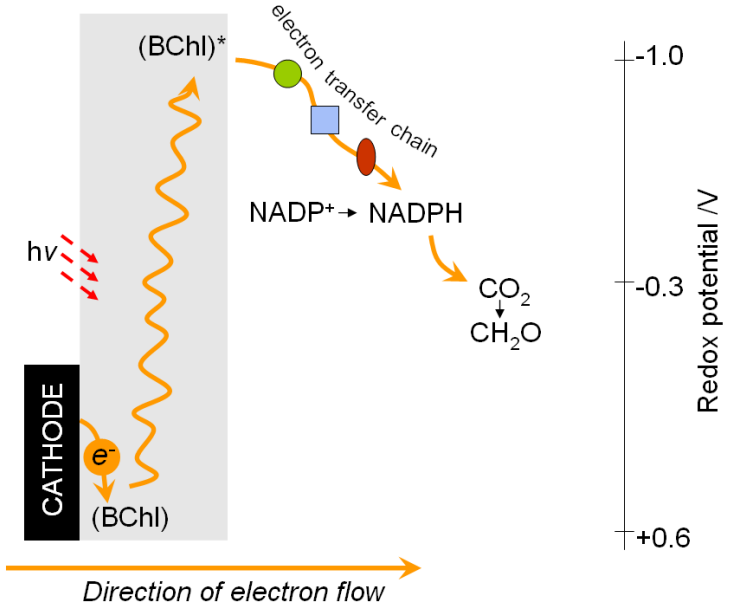

Fig. S3 Proposed mechanism of electron transfer from cathode to CO_2 via photoautotrophic organisms (simplified)

The midpoint of photo system reaction center in its nonexcited state (indicated as BChl in Fig.S3) was high, which can accept electrons from electricity generating cathode. By absorbing solar energy, the BChl was excited to BChl*, which has a very negative potential. Then the electrons flowed along the electron transfer chain to the final electron acceptor. In the whole process, CO_2 was utilized as carbon source and acceptor of reducing equivalents for cell synthesis [1, 2]. The detailed electron transfer mechanism is not clear right now, simplified half reaction maybe like this[3]:

$HCO_3^- + 4e^- + 5H^+ \rightarrow (CH_2O) + 2H_2O$

where (CH_2O) represent the approximate formula of cell mass.

1. J. M. Olson, *Science*, 1970, **168**, 438-446.
2. A. Ehrenreich and F. Widdel, *Appl Environ Microb*, 1994, **60**, 4517-4526.
3. F. Widdel, S. Schnell, S. Heising, A. Ehrenreich, B. Assmus and B. Schink, *Nature*, 1993, **362**, 834-836.