Regulation of *Shewanella* biofilm formation by changes in the concentration of electron shuttle

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Electron shuttles, such as anthraquinone-2-sulfonate, participated extracellular electron transfer (EET) is well known to be a key process of microbial metal reduction. Here, the mechanism that the changing concentration of AQS affected biofilm formation was studied in bioelectrochemical systems (BESs) with *Shewanella oneidensis* MR-1. Results show that the maximum current (I_{max}) increased with the increasing of AQS concentration from 0 to 500 μM. Biofilm biomass also showed a similar changing tendency, which implied the importance of the biofilm formation for current generation. While I_{max} slightly decreased with the continue increasing of AQS concentration from 500 to 1000 μM, and biofilm biomass also decreased under the condition of high concentration. To clarify the reason why biofilm formation decreased, the density of planktonic cells was obtained. Contrary to biofilm formation, planktonic cells increased at the high concentration conditions. The higher the density of planktonic cells there is, the longer the lag phase of current generation it is, which implied that the beneficial of AQS for planktonic cell at high AQS concentration is a possible mechanism that AQS delayed the current generation and biofilm formation.

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