Electrochemical Potential Influences Phenazine Production, Electron Transfer and Consequently Electric Current Generation by *Pseudomonas aeruginosa.*

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Abstract

Pseudomonas aeruginosa has gained interest as a redox mediator (phenazines) producer in bioelectrochemical systems. Several biotic and abiotic factors influence the production of phenazines in synergy with the central virulence factors production regulation. It is, however, not clear how the electrochemical environment may influence the production and usage of phenazines by P. aeruginosa. We here determined the influence of the electrochemical potential on phenazine production and phenazine electron transfer capacity at selected applied potentials from -0.4 to +0.4 V (vs. Ag/AgClsat) using P. aeruginosa strain PA14. Our study reveals a profound influence of the electrochemical potential on the amount of phenazine-1-carboxylate production, whereby applied potentials that were more positive than the formal potential of this dominating phenazine (E(° ')PCA = -0.24 V vs. Ag/AgClsat) stimulated more PCA production (94, 84, 128, and 140 µg mL(-1) for -0.1, 0.1, 0.2, and 0.3 V, respectively) compared to more reduced potentials (38, 75, and 7 µg mL(-1) for -0.4, -0.3, and -0.24 V, respectively). Interestingly, P. aeruginosa seems to

produce an additional redox mediator (with E(° ') ~ 0.052 V) at applied potentials below 0 V, which is most likely adsorbed to the electrode or present on the cells forming the biofilm around electrodes. At fairly negative applied electrode potentials, both PCA and the unknown redox compound mediate cathodic current generation. This study provides important insights applicable in optimizing the BES conditions and cultures for effective production and utilization of P. aeruginosa phenazines. It further stimulates investigations into the physiological impacts of the electrochemical environment, which might be decisive in the application of phenazines for electron transfer with P. aeruginosa pure- or microbial mixed cultures.

Involved units

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