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Competition Between Oxygen and Nitrate Respirations in Continuous Culture of *Pseudomonas aeruginosa* Performing Aerobic Denitrification

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Abstract:

Continuous culture of P. *aeruginosa* was conducted with nitrate-containing media under the dilution rates (D) of 0.026, 0.06, and 0.13/h and the dissolved oxygen concentrations (DO) of 0–2.2 mg/L. The bacterium performed simultaneous O_2 and nitrate respiration in all of the systems studied. For eachD, the (apparent) cell yield from glucose ($Y_{X/S}$) was lower at zero DO, but did not change substantially with non-zero DO. In non-zero DO systems, $Y_{X/S}$ increased with increasing D, and when fit with a model considering cell death, gave the following parameters: maximumcell yield $Y^{m}_{X/S}$ m ¼ 0.49, maintenance coefficient M_S = 0.029 (/h), and cell decay constant k_d = 0.014/h. The same model failed to describe the behaviors of zero-DO systems, where neither glucose nor nitrate was limiting and the limiting factor(s) remained unknown. The cell yield from accepted electron ($Y_{X/e}$) was however relatively constant in all systems, and the energy yield per electron accepted via denitrification was estimated at ~ 69% of that via O_2 respiration. A closer examination revealed that increasing DO enhanced O_2 respiration only at extremely low DO (<0.05 mg/L), beyond which the increasing DO only slightly increased its weak inhibition on denitrification. While O_2 was the preferred electron acceptor, the fraction of electrons accepted via denitrification increased with increasing D.

Key-words: *Pseudomonas aeruginosa*, respiration, denitrification, cell yield, energy yield