RELATIONSHIP BETWEEN THE NUMBER OF AQUAPORINS AND HYDROGEN GAS PRODUCTION IN CYANOBACTERIA

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Abstract: Water and carbohydrate are the primary sources for hydrogen production in cyanobacteria. Water and carbon dioxide (CO₂) is transported in the interior of the cyanobacteria by aquaporins (AQP). In the daytime the transport of CO₂ via AQP is facilitated by AQP but is inhibitory for hydrogen gas production. This CO₂ is converted to HCO₃⁻ in the interior which is eventually converted to carbohydrates. During the night these carbohydrates are converted enzymatically to H₂ gas. It could be hypothesized that there could be a direct relationship between the number of AQPs present and the amount of hydrogen gas produced. Hydrogen production occurs within at least 14 Cyanobacteria genera, under a vast range of culture conditions. One possibility is that there is efficient transport of CO₂ via a single AQP and the other is that the cumulative transport of CO₂ via multiple AQPs leading to increased H₂ production. To this end we explored 20 annotated genomes of cyanobacteria comprising of about 62,262 genes. *Gloeobacter* PCC 7421 with 3 known AQPs shows increased H₂ gas production in comparison to *Synechocystis* sp. PCC 6803 which has only one AQP. There is a clear correlation of the number of AQPs and H₂ gas production in the AQPs examined in the study. We are currently examining the number of AQPs present in the unannotated bacteria *Anabaena variabilis* which produces 10-fold more hydrogen than *Gloeobacter*.

Keywords: Aquaporins, carbon dioxide, cyanobacteria, hydrogen gas, water transport

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