Investigating and modelling the effect of light intensity on Rhodopseudomonas palustris growth

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Abstract

Photosynthetic bacteria can be useful biotechnological tools – they produce a variety of valuable products, including high purity hydrogen, and can simultaneously treat recalcitrant wastewaters. However, while photobioreactors have been designed and modelled for photosynthetic algae and cyanobacteria, there has been less work on understanding the effect of light in photosynthetic bacterial fermentations. In order to design photobioreactors, and processes using these organisms, robust models of light penetration, utilisation and conversion are needed. This article uses experimental data from a tubular photobioreactor designed to focus in on light intensity effects, to model the effect of light intensity on the growth of Rhodopseudomonas palustris, a model photosynthetic bacterium. The work demonstrates that growth is controlled by light intensity, and that this organism does experience photoinhibition above 600 W/m2, which has implications for outdoor applications. Further, the work presents a model for light penetration in circular photobioreactors, which tends to be the most common geometry. The work extends the modelling tools for these organisms, and will allow for better photobioreactor design, and the integration of modelling tools in designing processes which use photosynthetic bacteria.

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