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Photomixing of chlamydomonas rheinhardtii suspensions JULIEN DERVAUX, LIED, University Paris Diderot, MARINA CAPELLAZZI RESTA, BÉRENGÈRE ABOU, PHILIPPE BRUNET, MSC, University Paris Diderot —
Chlamydomonas rheinhardtii is a fast swimming unicellular alga able to bias its swimming direction in gradients of light intensity, an ability know as phototaxis. We have investigated experimentally both the swimming behavior of individual cells and the macroscopic response of shallow suspensions of these micro-organisms in response to a localized light source. At low light intensity, algae exhibit positive phototaxis and accumulate beneath the excitation light. In weakly concentrated thin layers, the balance between phototaxis and cell motility results in steady symmetrical patterns compatible with a purely diffusive model using effective diffusion coefficients extracted from the analysis of individual cell trajectories. However, at higher cell density and layer depth, collective effects induce convective flows around the light source. These flows disturb the cell concentration patterns which spread and may then becomes unstable. Using large passive tracer particles, we have characterized the velocity fields associated with this forced bioconvection and their dependence on the cell density and layer depth. By tuning the light distribution, this mechanism of photo-bioconvection allows a fine control over the local fluid flows, and thus the mixing efficiency, in algal suspensions.

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