High-throughput screening of microalgal cell *chlamydomonas reinhardtii* using phototaxis to enhance photosynthetic efficiency

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Photosynthetic organisms have evolved phototaxis to find optimal light condition for photosynthesis to survive. Here we report high-throughput screening system using phototaxis of *Chlamydomonas reinhardtii*, for rapid isolation of strains with enhanced photosynthetic efficiencies in microfluidic system. We proved the correlation between phototaxis and PSII efficiency by analysis of phototaxis. We enriched the strains with improved PSII efficiency by isolating cells showing fast phototactic response from 10,000 mutants. Among the mutants 147 strains were isolated after screening, and 94.6% showed enhanced growth over the parental strain. Two mutants showed much improved performances with up to 1.9- and 8.1-fold increases in growth and lipid production, respectively. Our approach provides a powerful tool for screening in improvement of microalgae to enhance photosynthetic efficiency.