Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Materials

Dispersive phase microscopy incorporated with droplet-based microfluidics for biofactory-on-a-chip

Yingdong Luo,[a] Yuanyuan Huang,[a] Yani Li[a], Xiudong Duan[a], Yongguang Jiang[b], Cong Wang[a], Jiakun Fang[*c], Lei Xi[*d], Nam-Trung Nguyen[e], Chaolong Song[*a]

[a] School of Mechanical Engineering and Electronic Information, China University of Geosciences, Wuhan, 430074, China, email: songcl@cug.edu.cn
[b] School of Environmental Studies, China University of Geosciences, Wuhan 430074, China.
[c] State Key Laboratory of Advanced Electromagnetic Engineering and Technology, School of Electrical and Electronic Engineering, Huazhong University of Science and Technology, Wuhan, China, email: jfa@hust.edu.cn.
[d] Department of Biomedical Engineering, Southern University of Science and Technology, Shenzhen, China, email: xilei@sustech.edu.cn
[e] Queensland Micro, and Nanotechnology Centre, Griffith University, 170 Kessels Road QLD 4111, Nathan, Australia

This PDF file includes:

Figs. S1 to S6

Supplementary Figures

Figure. S1. The dimensions of the microfluidic chip used in the study.

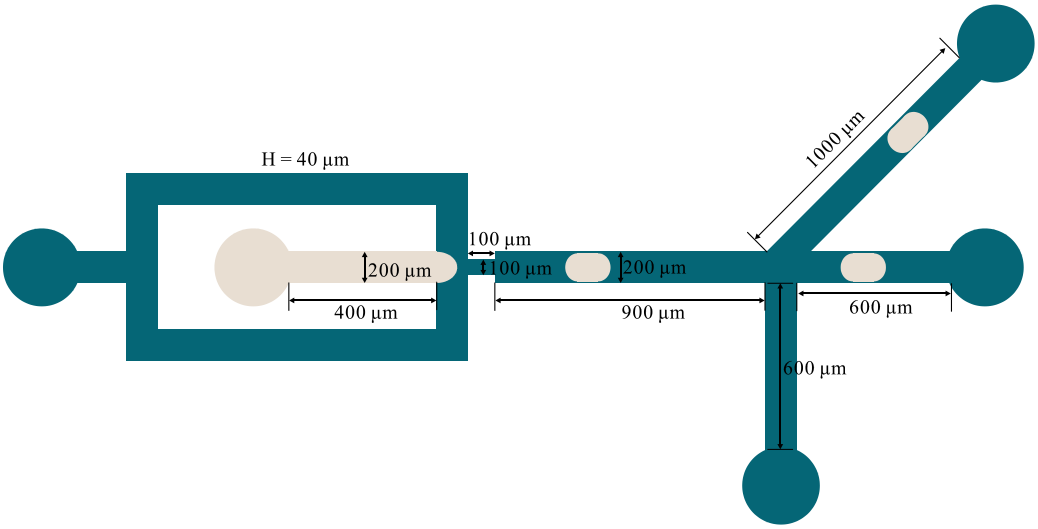

Figure S1. The microchip diagram used in this work.

Figure. S2.

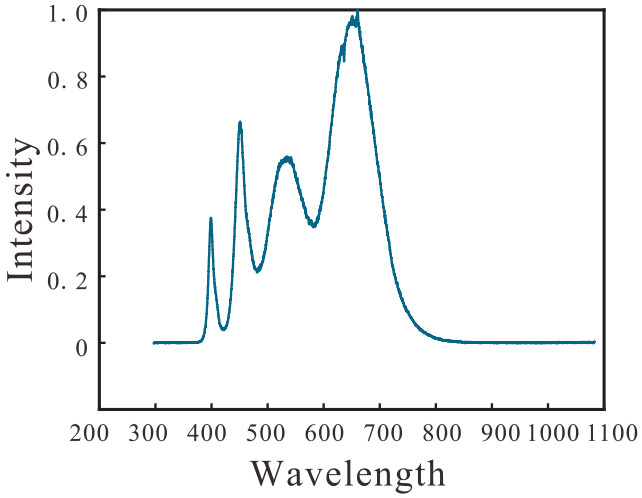

Figure S2. The light spectrum for algal cell illumination.

Figure.S3

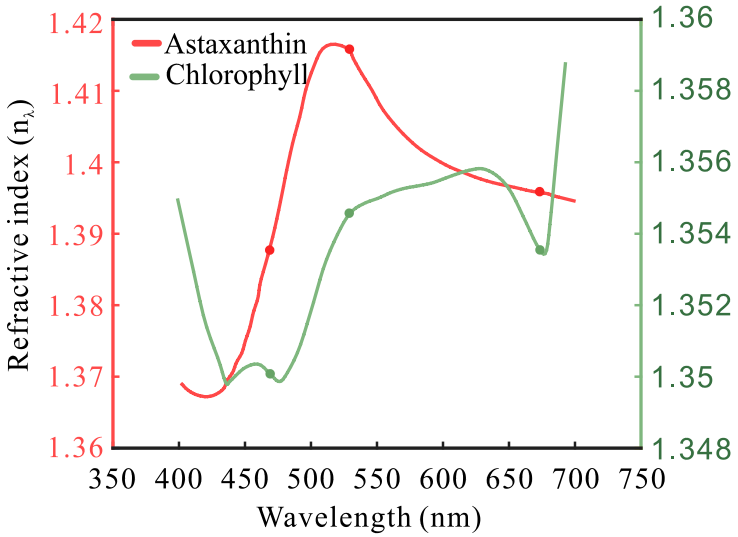

Fig.S3 Dispersive spectrum of the Astaxanthin and Chlorophy ll and the points indicate the wavelength used in DPM.

Figure.S4

A MANOVA test was utilized to assess the different exposure time influence in different group cells. The p-value obtained from the analysis are p=0 and 0.0000524, indicating that there are significant differences between the groups. The canonical variable value map, which provideds the differences between the groups is shown in Fig.S4. The canonical variable valve1 is the phase difference $P_{\lambda 3}$ - $P_{\lambda 1}$ and the canonical variable valve2 is $P_{\lambda 3}$ - $P_{\lambda 1}$ shown in Fig.3(f).

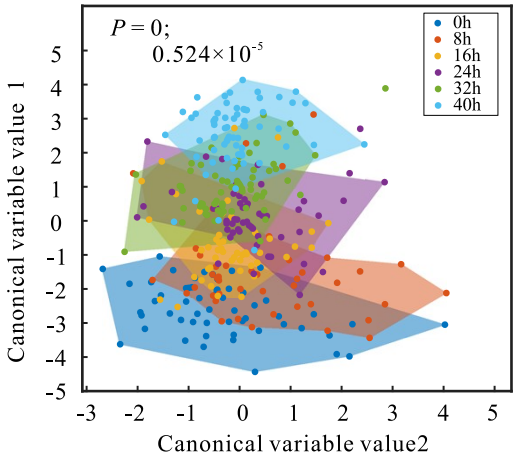

Fig.S4. The canonical variable map of the differences between the groups of cells exposure to various duration of intense light in Fig.3(f).

Figure.S5

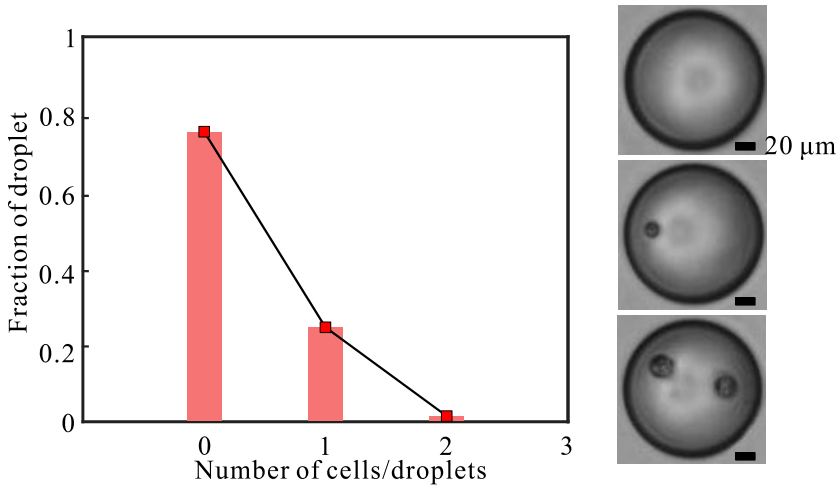

Fig.S5 (b) The fraction of the number of cells encapsulated in droplets in a volume fraction ratio of 0.3 between cells and pre-encapsulation solution, the scale bar is 20 μm;

Figure.S6

We also performed a control experiment to assess the dispersive phase of cells after 40 hours of culture without intense light exposure. In our study, *H.pluvialis* cells in vegetative states were encapsulated in 1nL droplets to provide homogeneous environments. After precluding empty droplets and droplets containing multiple cells, the droplets flowed through the DPM inspection spot to test the dispersive phase map of cell in the S9 state. To assess the impact of intense light exposure on the cells, future culturing the cells for 40 hour without exposure to intense light (S10) and detection thee dispersive phase of the cells. The centroid of the S10 is close to S9, compared with the centroid distance in S2 and S3 in Fig.5(b).

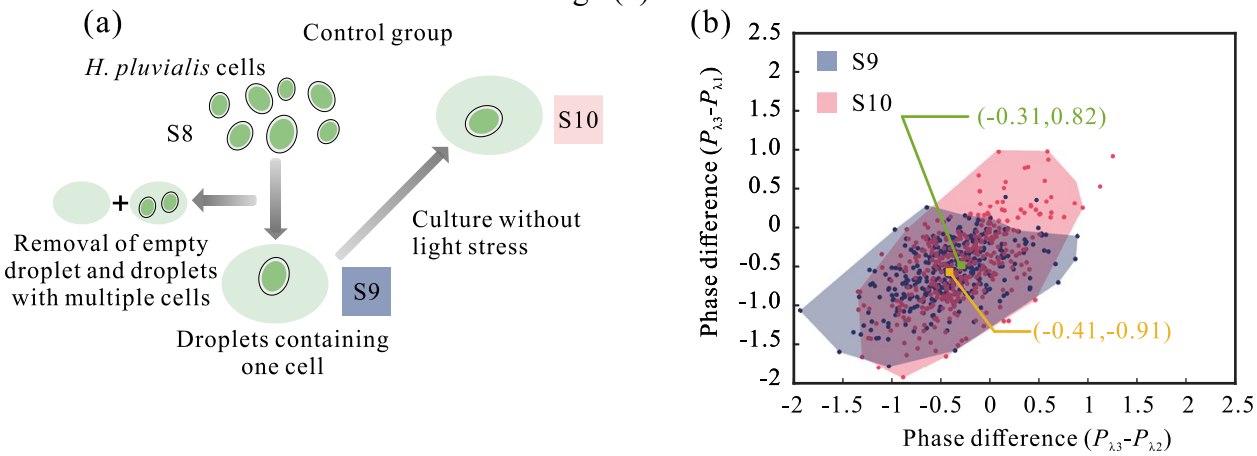

Fig.S6. Quantitative analysis of *H. pluvialis* cells culturing without intense light exposure. (a) The procedures of the control group; (b) The dispersive phase scatter plot of the cells in S9 and S10;