Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Cell-free biology using remote-controlled digital microfluidics for individual droplet control

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Movie S1. Digital microfluidics droplet control overview. The use of abundant consumables and time-consuming experimental operation has contributed to a huge waste of labor and finance. The digital microfluidics method can be helpful for cell-free biology. Some of demo scenarios were presented, such as mouse-like droplet control on the touchpad, droplets mixing, and oscillating process.

Movie S2. Proof-of-concept verification of colored pigments. Four different colorful dyes were driven on the OpenDrop board as a conceptual verification of droplet control. The fluent move of individual aqueous droplet was showed.

Movie S3. Cell-free glucose detection. Three detective droplets, GOx, HRP, ABTS, and a concentrated glucose droplet were controlled on the OpenDrop board. These 3 detective droplets were mixed and shaken, then the tested glucose droplet was added, and then the green color was presented, indicating that the glucose detection reaction has taken place.

Movie S4. Cell-free protein synthesis reaction. The cell-free synthesis sytem was divided into 4 droplets. Droplet 1 includes E. coli extract and T7 RNA polymerase. Droplet 2 includes PEG8000, NTPs mixture, and phosphoenolpyruvic acid (PEP). Droplet 3 includes Mg^{2+}, other salts, and amino acid mixtures. Droplet 4 includes aqueous plasmid solution as the trigger of the cell-free reaction. The four droplets were mixed in turn. After incubation of 5 hours under anti-evaporation treatment, the mixed droplet turned into yellow brown, indicating that the cell-free synthesis reaction has taken place.

Movie S5. Real-time droplet control by PC touchpad. Mouse-like movement control of droplets was presented. Through the movements of fingers on the PC touchpad, the droplet moved to the corresponding position of the electrodes array on the OpenDrop board, which can be visualized on the control interface.