



## Measuring optical density of microbial culture (*E. coli*) with PiCOEXPLORER

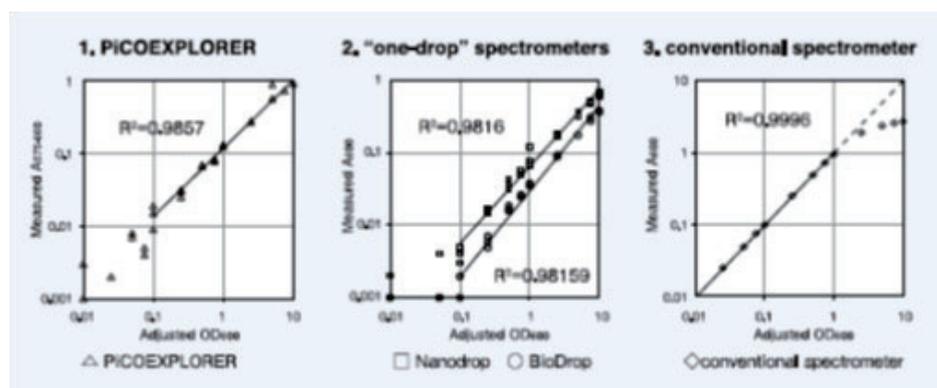
### Overview

Optical density of microbial culture (*Escherichia coli*, *E. coli*) is measured using PDMS-based portable spectrometer (PiCOEXPLORER), "one-drop" spectrometers (ThermoScientific, Nano Drop 1000 / BERTHOLD TECHNOLOGIES, BioDrop Lite,) and conventional spectrometer (SHIMADZU, UV-2450).

### Procedure

1. Grow *E. coli* SCS1 (Agilent Technologies#200231) in LB medium (10 g/l of tryptone, 5 g/l of yeast extract, 10 g/l of NaCl, pH 7.0) for overnight, then harvest and resuspend in 1 x PBS(-) (140 mM NaCl, 2.7 mM KCl, 8.1 mM Na<sub>2</sub>HPO<sub>4</sub>, 1.5 mM KH<sub>2</sub>PO<sub>4</sub>).
2. Adjust the density of the cells as OD<sub>600</sub> = 10 by using a conventional spectrometer (UV-2450, SHIMADZU; with the length of light path as 1 cm) and then dilute to make OD<sub>600</sub> = 0.01, 0.025, 0.5, 0.75, 0.1, 0.25, 0.5, 0.75, 1, 2.5, 5, 7.5, 10.
3. From each suspension, transfer 30, 50 and 100 μl into single PCR tube (RS-PCR-1 F, RIKAKEN), respectively, and by PiCOEXPLORER with the following parameters: LED output, 20%; sensor integration time, 100 ms; color sensor, Red (575–660 nm, maximum sensitivity at 615 nm).

### Calibration Curves



### Result

PiCOEXPLORER (Fig.1) and "one-drop" spectrometers (Fig.2) were able to measure with the same linearity up to the high concentration part of  $0.1 \leq OD_{600} \leq 10$  (for turbidity measurement of the bacterial culture solution). The conventional spectrometer (Fig.3) needs to be diluted when  $OD_{600} > 1$ , but good measurement was possible even in the low concentration part of  $OD_{600} < 0.1$ . Combining the data described above, it is shown that PiCOEXPLORER is superior to "one-drop" spectrometers in accuracy, and has an advantage over conventional spectrometer in measuring dense suspension without dilution.

### Measured by

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Measuring optical density (OD) is routine work for life science in general. Because conventional spectrometer require relatively large volume (~1 ml) for one measurement, researchers often use flasks, instead of daily used test tubes, to secure enough volume for monitoring growth of culture. Also, it cannot be moved where researchers wish to do the measurements (e.g. inside of clean bench). I was interested in PiCOEXPLORER because of its portability and its small sample volume, and thought this would provide to a comfortable and convenient routine work. Since PCR tube has short light path, I inferred that it would be able to measure dense suspension. This hypothesis has been proven. PiCOEXPLORER had an advantage over conventional spectrometer in measuring dense suspension, and it was superior to "one-drop" spectrometers in the accuracy. This motivated me to write a paper.