Supplemental Document

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Single-wavelength water muted photoacoustic system for detecting physiological concentrations of endogenous molecules: supplement

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Single-wavelength water muted photoacoustic system for detecting physiological concentrations of endogenous molecules: supplemental document

(a) (b)

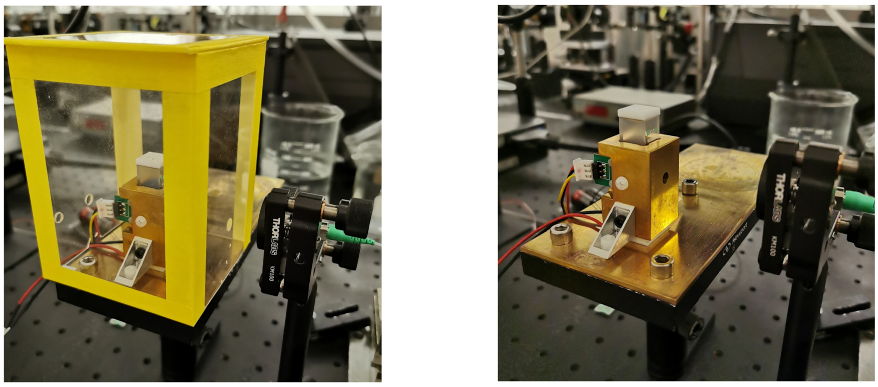

Fig. S1. Picture of single wavelength water muted photoacoustic system with (left)/ without (right) purging box for dry air flow. The purging box is made to prevent water condensation on cell and metal unit in experiment at low temperature. The optical component (black) on the right side in both pictures is the collimator and SWIR diode laser.

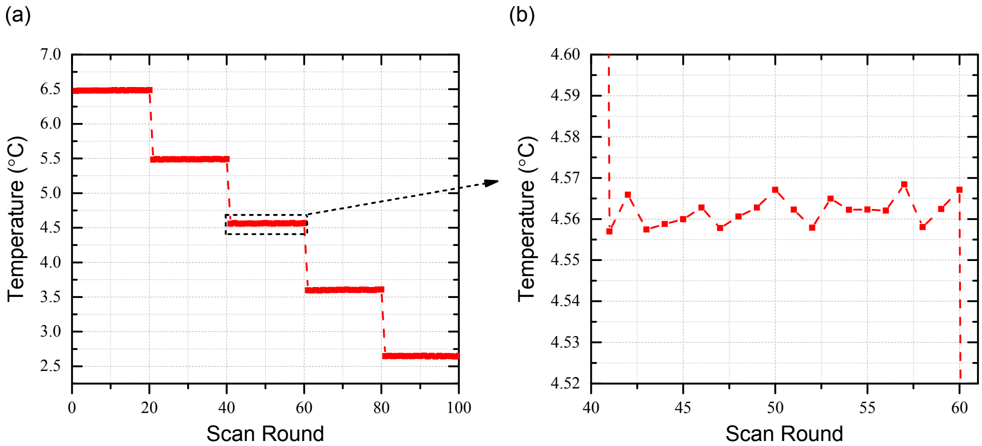

Fig. S2. Test of temperature stabilization for the system. The target temperatures are set to be 6.5, 5.5, 4.5, 3.5, and 2.5 □. At each temperature, the system waited 5 min for stabilization at the target temperature and then read the temperature for 20 times. The right figure shows the enlarged area of temperature reading at 4.5 □ in left figure. The slight off-set of reading temperature from target temperature (e.g. 4.56 □ to 4.5 □) is due to the residuals of feedback loop in temperature control. A small temperature variation of less than 0.02 □ can be achieved, as shown in the right figure.

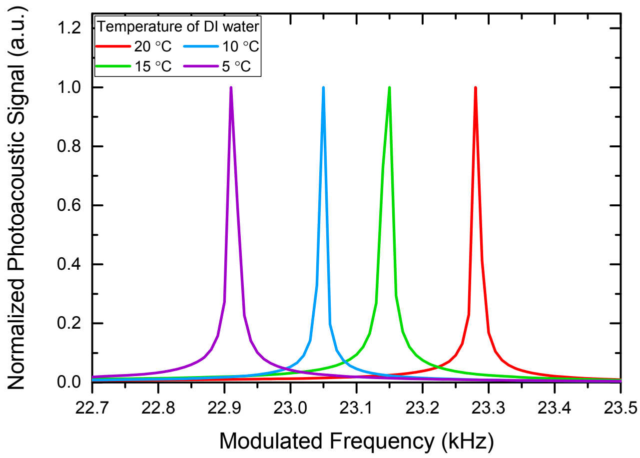

Fig. S3. Simulated photoacoustic spectrum of DI water at temperatures of 20, 10, 5, and 0 °C by COMSOL. The shift of resonant peaks is due to the change of sound velocity in DI water at different temperatures: 1481, 1447, 1427, and 1403 m/s for temperatures of 20, 10, 5, and 0 °C, respectively. The simulated peak frequencies are shifted from 23.28 kHz at 20 °C to 22.91 kHz at 0 °C, which shows a good agreement with the experimental result: 23.4 kHz at 20.06 °C to 22.9 kHz at 0.72 °C. The result proves the shift of peak frequency in temperature dependent measurements is mainly caused by the change of sound velocity in DI water.

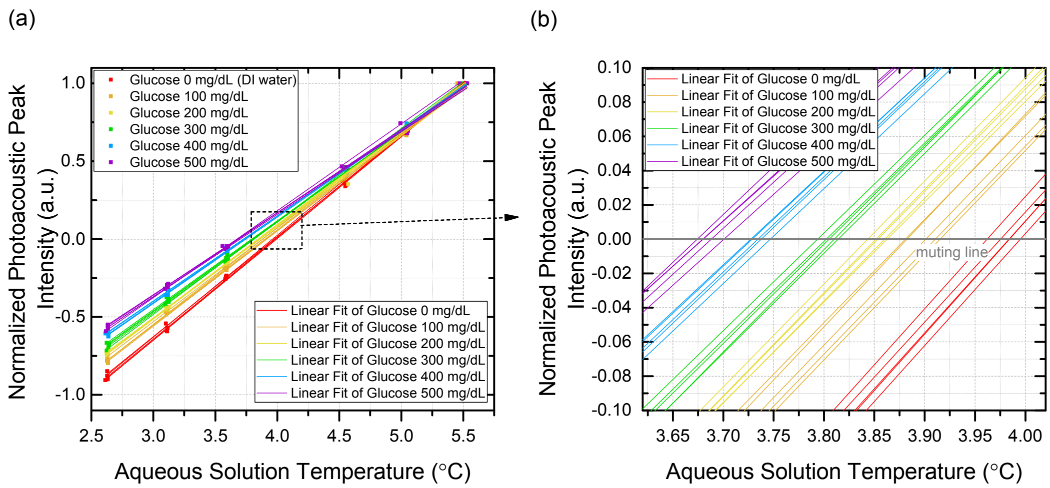

Fig. S4. (Left) Measured peak intensities of photoacoustic spectrums of glucose aqueous solutions (with low glucose solute concentration of 500 (purple), 400 (blue), 300 (green), 200 (yellow), and 100 (orange) mg/dL) and DI water (red) as a function of temperature. Linear fitting is used on each curve for reading muting temperature (intercept with muting line). For each solution, 5 independent measurements were deployed. (Right) Enlarged area of muting temperature reading for all measurements. The muting temperatures were read by the intercepts of fitted curves on muting line (zero photoacoustic signal axis).