A microfluidic device for evaluating the dynamics of metabolism-dependent antioxidant activity of nutrients

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Supplementary Information

1. Performance of LED spectrometer

Transmission at varying wavelength from 300 nm to 1100 nm was measured using custom-built LED spectrometer. The result shows that the LED light source yields sufficient light near 517 nm. Also absorbance at various DPPH concentration was measured to check the linearity of the response.

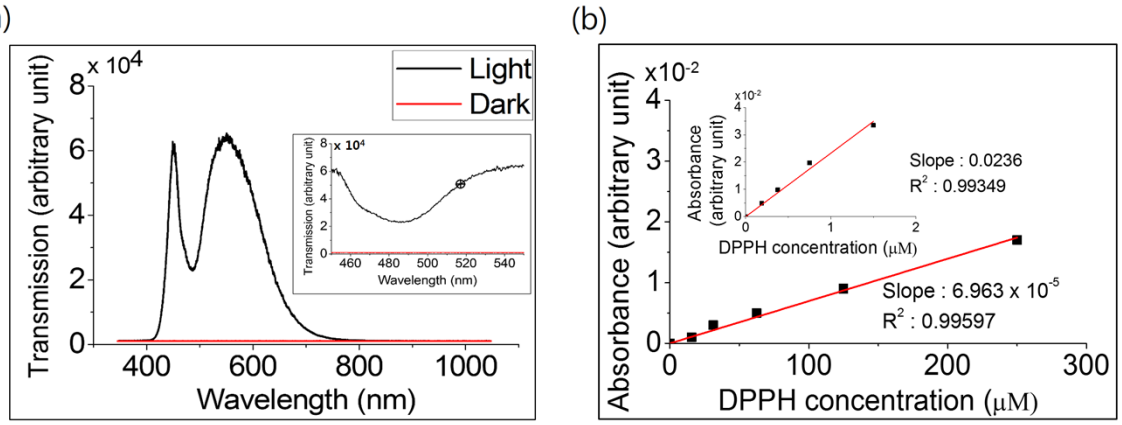

Figure S1. Performance of custom-built LED spectrometer at various wavelength and DPPH concentrations. (a) Transmission intensity of the spectrometer system at various wavelengths (d) Measured absorbance of various concentrations of DPPH on the chip

2. Effect of ethanol fraction on radical scavenging activity

The effect of ethanol fraction in the solvent on the measured radical scavenging activity was examined. 300 μM DPPH in ethanol was mixed with quercetin diluted in PBS in various ratios and the radical scavenging reaction was performed. The measured radical scavenging activity varied significantly depending on the ratio between ethanol and water (Figure S2).

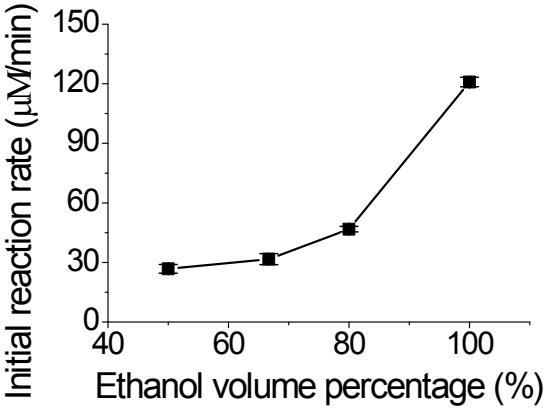

Figure S2. Initial reaction rate with various ethanol volume fraction in the solvent

3. Microsomal reaction in microfluidic setting

To compare with microfluidic setting the effect of microsomal enzymatic reaction on the antioxidant activity of quercetin was studied in a static, macroscale environment. 100 μM Quercetin was incubated with microsomal fraction encapsulated in hydrogel for 30 minutes and the supernatant was moved to a solution containing 200 μM DPPH. The radical scavenging activity was measured by the change in DPPH concentration, calculated from the change in the absorbance. To estimate the effect of diffusional limitation created by encapsulating the microsome in hydrogel, the same concentration of quercetin was also incubated with free microsome in solution. Consistent with experimental result using microfluidic chip, metabolism of quercetin with microsome caused enhancement of antioxidant activity.

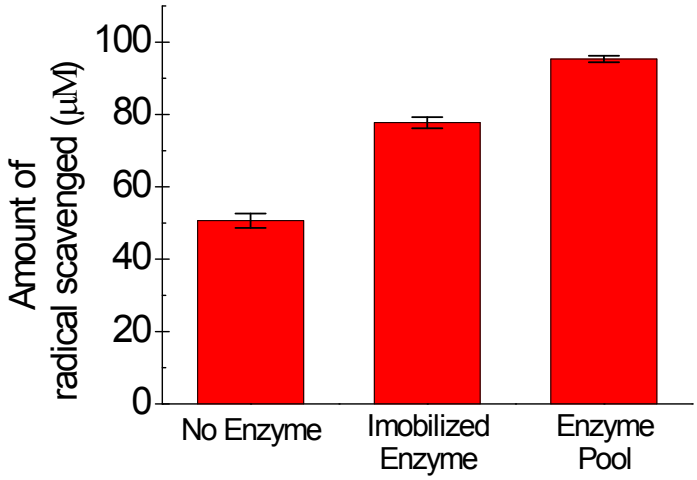

Figure S3. Amount of radical scavenged with or without metabolism with microsomes. Error bars represent standard deviations.

Trapping of quercetin inside PEGDA hydrogel

Due to diffusion limitation, some of the quercetin in the microfluidic channel was observed to remain trapped inside the PEGDA hydrogel pillars as shown in Figure S4.

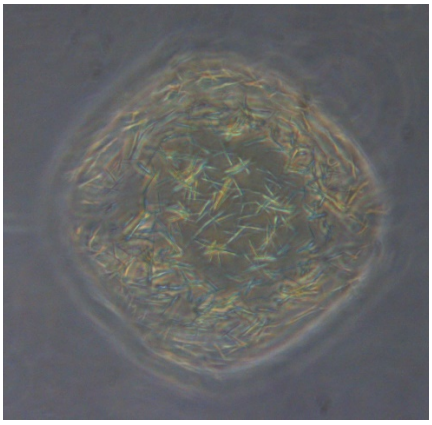

Figure S4. Quercetin trapped inside a PEGDA hydrogel pillar